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ASSUMPTIONS AND CONVENTIONS

A number of assumptions have been adopted for the projections presented in the *World Economic Outlook* (WEO). It has been assumed that real effective exchange rates remained constant at their average levels during January 26 to February 23, 2018, except for those for the currencies participating in the European exchange rate mechanism II, which are assumed to have remained constant in nominal terms relative to the euro; that established policies of national authorities will be maintained (for specific assumptions about fiscal and monetary policies for selected economies, see Box A1 in the Statistical Appendix); that the average price of oil will be $62.31 a barrel in 2018 and $58.24 a barrel in 2019 and will remain unchanged in real terms over the medium term; that the six-month London interbank offered rate on US dollar deposits will average 2.4 percent in 2018 and 3.4 percent in 2019; that the three-month euro deposit rate will average –0.3 percent in 2018 and 0.0 in 2019; and that the six-month Japanese yen deposit rate will yield on average 0.0 percent in 2018 and 0.1 percent in 2019. These are, of course, working hypotheses rather than forecasts, and the uncertainties surrounding them add to the margin of error that would in any event be involved in the projections. The estimates and projections are based on statistical information available through April 2, 2018.

The following conventions are used throughout the WEO:

. . . to indicate that data are not available or not applicable;

– between years or months (for example, 2017–18 or January–June) to indicate the years or months covered, including the beginning and ending years or months; and

/ between years or months (for example, 2017/18) to indicate a fiscal or financial year.

"Billion" means a thousand million; "trillion" means a thousand billion.

"Basis points" refers to hundredths of 1 percentage point (for example, 25 basis points are equivalent to ¼ of 1 percentage point).

Data refer to calendar years, except in the case of a few countries that use fiscal years. Table F in the Statistical Appendix lists the economies with exceptional reporting periods for national accounts and government finance data for each country.

For some countries, the figures for 2017 and earlier are based on estimates rather than actual outturns. Table G in the Statistical Appendix lists the latest actual outturns for the indicators in the national accounts, prices, government finance, and balance of payments indicators for each country.

What is new in this publication:

- No changes have been introduced for the April 2018 WEO database.

In the tables and figures, the following conventions apply:

- If no source is listed on tables and figures, data are drawn from the WEO database.
- When countries are not listed alphabetically, they are ordered on the basis of economic size.
- Minor discrepancies between sums of constituent figures and totals shown reflect rounding.

As used in this report, the terms "country" and "economy" do not in all cases refer to a territorial entity that is a state as understood by international law and practice. As used here, the term also covers some territorial entities that are not states but for which statistical data are maintained on a separate and independent basis.

Composite data are provided for various groups of countries organized according to economic characteristics or region. Unless noted otherwise, country group composites represent calculations based on 90 percent or more of the weighted group data.

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PREFACE

The analysis and projections contained in the *World Economic Outlook* are integral elements of the IMF's surveillance of economic developments and policies in its member countries, of developments in international financial markets, and of the global economic system. The survey of prospects and policies is the product of a comprehensive interdepartmental review of world economic developments, which draws primarily on information the IMF staff gathers through its consultations with member countries. These consultations are carried out in particular by the IMF's area departments—namely, the African Department, Asia and Pacific Department, European Department, Middle East and Central Asia Department, and Western Hemisphere Department—together with the Strategy, Policy, and Review Department; the Monetary and Capital Markets Department; and the Fiscal Affairs Department.

The analysis in this report was coordinated in the Research Department under the general direction of Maurice Obstfeld, Economic Counsellor and Director of Research. The project was directed by Gian Maria Milesi-Ferretti, Deputy Director, Research Department; Oya Celasun, Division Chief, Research Department; and Helge Berger, Assistant Director, Research Department and Head of the IMF's Spillover Task Force.

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Joseph Procopio from the Communications Department led the editorial and production team for the report with support from Linda Kean, Christine Ebrahimzadeh, James Unwin, Lucy Scott Morales, Angela White, and Vector Talent Resources.

The analysis has benefited from comments and suggestions by staff members from other IMF departments, as well as by Executive Directors following their discussion of the report on April 2, 2018. However, both projections and policy considerations are those of the IMF staff and should not be attributed to Executive Directors or to their national authorities.

FOREWORD

The global economic upswing that began around mid-2016 has become broader and stronger. This new *World Economic Outlook* report projects that advanced economies as a group will continue to expand above their potential growth rates this year and next before decelerating, while growth in emerging market and developing economies will rise before leveling off. For most countries, current favorable growth rates will not last. Policymakers should seize this opportunity to bolster growth, make it more durable, and equip their governments better to counter the next downturn.

Global growth seems on track to reach 3.9 percent this year and next, substantially above our October forecast. Helping to drive this output acceleration is faster growth in the euro area, Japan, China, and the United States, all of which grew above expectations last year, along with some recovery in commodity exporters. Along with China, several other emerging market and developing economies will also do better this year than in our past projections—that group includes Brazil, Mexico, and emerging Europe. The aggregate gains for this country group are, however, weighed down by sharp downward revisions for a few countries in the grip of civil strife, notably Libya, Venezuela, and Yemen. Growing trade and investment continue as notable factors powering the global upswing.

Growth this broad based and strong has not been seen since the world's initial sharp 2010 bounce back from the financial crisis of 2008–09. The synchronized expansion will help to dispel some remaining legacies of the crisis by speeding the exit from unconventional monetary policies in advanced economies, encouraging investment, and healing labor market scars.

Other aftereffects of the crisis seem more durable, however, including higher debt levels worldwide and widespread public skepticism about policymakers' capacity and willingness to generate robust and inclusive growth. That skepticism will only be reinforced—with negative political consequences down the road—if economic policy does not rise to the challenge of enacting reforms and building fiscal buffers. Success in such efforts would strengthen medium-term growth, spread its benefits lower in the income distribution, and build resilience to the hazards that lie ahead.

Future growth prospects look challenging indeed for advanced economies and many commodity exporters. In advanced economies, aging populations and lower projected advances in total factor productivity will make it hard to return to the precrisis pace for the average household's income growth. Substantially raising middle and lower incomes looks even tougher. Moreover, growth rates will inevitably bend toward their weaker longer-term levels. Policy support will fade in the United States and China—a necessity in view of those countries' macroeconomic imbalances. And countries that currently can grow more quickly by putting underutilized labor and capital back to work will reach full capacity. The need for a forward-looking policy perspective is therefore urgent—to limit risks as well as enhance growth.

As usual, Chapter 1 of this report sets out the risks to the forecast. These are balanced over the next several quarters, with the possibility of more buoyant growth than forecast balancing out unfavorable contingencies. But as time passes, the likelihood of negative shifts in the forecast rises.

Monetary policy might tighten sooner than expected if excess demand emerges, a notable possibility in the United States, where fiscal policy has turned much more expansive even as the economy has neared full employment. Financial tightening, in turn, would stress highly indebted countries, firms, and households, including in emerging market economies.

An escalating cycle of trade restrictions and retaliation is another risk. The first shots in a potential trade war have now been fired. Conflict could intensify if fiscal policies in the United States drive its trade deficit higher without action in Europe and Asia to reduce surpluses. The multilateral rules-based trade system that evolved after World War II and that nurtured unprecedented growth in the world economy needs strengthening. Instead, it is in danger of being torn apart.

The renewed popularity of nationalistic policies is another aftereffect of the financial crisis and its prolonged aftermath. Diminished prospects for household income growth in advanced economies, coupled with trends of higher polarization in jobs and incomes, have fueled a widespread political backlash hostile to traditional political modalities. If policymakers are complacent and do not tackle the challenge of strengthening long-term growth, political risks could intensify, possibly reversing some of the progress that economic reforms and integration have achieved to date.

The three analytical chapters in this *World Economic Outlook* are unified by their focus on central determinants of long-term economic growth.

Population growth, age distribution, and other structural employment trends are critical for understanding growth, investment, and productivity. Chapter 2 focuses on labor force participation in advanced economies, where population aging and, for many countries, declining overall participation rates are substantial headwinds to growth. Especially worrisome is the widespread decline in participation of young and prime-age men. The chapter shows how a range of policies—for example, educational investments and tax policies—can mitigate these effects. But participation will continue to decline even under best-practice approaches.

Chapter 3 focuses on the declining share of manufacturing employment globally and, most dramatically, in advanced economies. This structural transformation, driven by technology advances as well as globalization, has sparked popular concern about greater earnings inequality as "good jobs" disappear. Another worry is that currently poor countries may be trapped far from the global income frontier if they never pass through a developmental stage of substantial manufacturing employment. The chapter, however, suggests that services can offer considerable scope for productivity gain. Therefore, the best policy response is not to overrule market forces and subsidize manufacturing—possibly a zero-sum game globally—but instead to aim to raise productivity across the economy. The latter effort requires structural reforms, including lower barriers to services trade, along with many of the same investments in people that will enhance labor force attachment, as described in Chapter 2.

Finally, Chapter 4 studies the process through which innovative activity and technological know-how spread across national borders. Cross-border knowledge flows from technological leaders to poorer countries have historically been significant drivers of income convergence. Now, the emergence of China and Korea as leaders in some sectors offers the promise of positive repercussions for others, including the long-established high-income countries. International trade and competition, this chapter suggests, promote global knowledge diffusion and thus provide an important channel through which all countries can benefit from globalization. From this perspective, policies that restrict trade to prop up politically favored sectors of the economy will ultimately harm productivity growth.

Global growth is on an upswing, but favorable conditions will not last forever, and now is the moment to get ready for leaner times. Readiness requires not only cautious and forward-looking management of monetary and fiscal policies, but also careful attention to financial stability. Also necessary are structural and tax policies that raise potential output, including by investing in people and ensuring that the fruits of growth are widely shared. While there is much each country can do on its own, multilateral cooperation on a range of issues—stretching from trade to reducing global imbalances to cybersecurity to climate—remains essential.

Maurice Obstfeld
Economic Counsellor

EXECUTIVE SUMMARY

The upswing in global investment and trade continued in the second half of 2017. At 3.8 percent, global growth in 2017 was the fastest since 2011. With financial conditions still supportive, global growth is expected to tick up to a 3.9 percent rate in both 2018 and 2019. Advanced economies will grow faster than potential this year and next; euro area economies are set to narrow excess capacity with support from accommodative monetary policy, and expansionary fiscal policy will drive the US economy above full employment. Aggregate growth in emerging market and developing economies is projected to firm further, with continued strong growth in emerging Asia and Europe and a modest upswing in commodity exporters after three years of weak performance.

Global growth is projected to soften beyond the next couple of years. Once their output gaps close, most advanced economies are poised to return to potential growth rates well below precrisis averages, held back by aging populations and lackluster productivity. US growth will slow below potential as the expansionary impact of recent fiscal policy changes goes into reverse. Growth is projected to remain subpar in several emerging market and developing economies, including in some commodity exporters that continue to face substantial fiscal consolidation needs.

While upside and downside risks to the short-term outlook are broadly balanced, risks beyond the next several quarters clearly lean to the downside. Downside concerns include a possibly sharp tightening of financial conditions, waning popular support for global economic integration, growing trade tensions and risks of a shift toward protectionist policies, and geopolitical strains.

The current recovery offers a window of opportunity to advance policies and reforms that secure the current upswing and raise medium-term growth to the benefit of all. Such policies should focus on strengthening the potential for higher and more inclusive growth, building buffers to deal more effectively with the next downturn, improving financial resilience to contain market risks and stability concerns, and fostering international cooperation.

Economic activity in 2017 ended on a high note—growth in the second half of the year was above 4 percent, the strongest since the second half of 2010, supported by a recovery in investment. Outcomes exceeded the October 2017 *World Economic Outlook* forecasts in the euro area, Japan, the United States, and China, and continued to improve gradually in commodity exporters. Financial conditions remain supportive, despite the recent volatility in equity markets and increases in bond yields following signs of firming inflation in advanced economies. With broad-based momentum and expectations of a sizable fiscal expansion in the United States over this year and the next, global growth is now projected at 3.9 percent for 2018–19, a 0.2 percentage point upgrade for both years relative to the October 2017 forecast.

This positive momentum will eventually slow, however, leaving many countries with a challenging medium-term outlook. Some cyclical forces will wane: financial conditions are expected to tighten naturally with the closing of output gaps and monetary policy normalization; US tax reform will subtract momentum starting in 2020, and then more strongly as full investment expensing is phased out starting in 2023; and China's transition to lower growth is expected to resume as credit growth and fiscal stimulus diminish. At the same time, while the expected recovery in investment will help raise potential output, weak productivity trends and reduced labor force growth due to population aging constrain medium-term prospects in advanced economies. (Chapter 2 examines the drivers of labor force participation in advanced economies.) The outlook is mixed across emerging market and developing economies. Prospects remain favorable in emerging Asia and Europe, but are challenging in Latin America, the Middle East and sub-Saharan Africa, where—despite some recovery—the medium-term outlook for commodity exporters remains generally subdued, with a need for further economic diversification and adjustment to lower commodity prices. More than one-quarter of emerging market and developing economies are projected to grow by less than advanced economies in per capita terms over the next five years, and hence fall further behind in terms of living standards.

Risks around the short-term outlook are broadly balanced, but risks beyond the next several quarters are clearly to the downside. On the upside, the growth spurt in advanced economies may turn out to be stronger and more durable than in the baseline, as slack in labor markets can be larger than currently assessed (Chapter 2 of the October 2017 WEO). Furthermore, the ongoing recovery in investment could foster a rebound in productivity, implying higher potential growth going forward. On the downside, financial conditions—which remain easy despite the onset of monetary policy normalization—could tighten sharply and expose vulnerabilities that have accumulated over the years, with adverse repercussions for growth. Indeed, as discussed in the April 2018 *Global Financial Stability Report*, Growth-at-Risk analysis suggests that risks to medium-term growth, stemming from easy financial conditions, remain well above historical norms. In the United States, financial conditions could tighten faster than expected, triggered, for example, by an adjustment in market pricing of the future path of monetary policy, higher realized or expected wage and price inflation, and/or a sudden decompression of term premiums. Tighter financial conditions in the United States would have spillovers to other economies, including through a reduction in capital flows to emerging markets. Very expansionary fiscal policy in the United States, at a time when the current account deficit is already larger than justified by fundamentals, combined with persistent excess current account surpluses in other countries, is projected to widen global imbalances. Anxiety about technological change and globalization is on the rise and, when combined with wider trade imbalances, could foster a shift toward inward-looking policies, disrupting trade and investment. Recent import restrictions announced by the United States, announced retaliatory actions by China, and potential retaliation by other countries raise concerns in this regard and threaten to damage global and domestic activity and sentiment. Similarly, changes in US tax policies are expected to exacerbate income polarization, which could affect the political climate for policy choices in the future. Climate change, geopolitical tensions, and cybersecurity breaches pose additional threats to the subdued medium-term global outlook.

The current juncture offers a window of opportunity to advance policies and reforms that safeguard the upswing and raise medium-term growth to the benefit of all.

- *Strengthen the potential for higher and more inclusive growth.* All countries have room for structural reforms and fiscal policies that raise productivity and enhance inclusiveness—for instance, by encouraging experimentation and diffusion of new technologies, increasing labor force participation, supporting those displaced by structural change, and investing in the young to enhance their job opportunities. The analysis, in Chapter 3, of one aspect of structural change—the decline in the share of manufacturing jobs in overall employment and its implications for productivity growth and inequality—highlights the importance of facilitating the reallocation of labor to the most dynamic sectors through workforce skills development, lowering job search costs, and reducing barriers to entry and trade in services.
- *Complete the recovery and build buffers*. Monetary accommodation needs to continue where inflation is weak, but a well-communicated, data-dependent normalization should follow in countries where inflation looks set to return to the central bank's target. Fiscal policies should start rebuilding buffers where needed, incorporate supply-side measures to bolster potential output, and promote inclusiveness. In countries at or close to full employment, with an excess current account deficit and an unsustainable fiscal position (notably the United States), there is a need to stabilize and eventually reduce the debt and reverse the procyclical stimulus that is already in place. This will require ensuring higher future revenues and gradually containing the growth of public spending, while changing its composition toward improving infrastructure, boosting labor force participation, and reducing poverty. Countries with both excess current account surpluses and fiscal space (for example, Germany) should increase public investment that boosts potential growth and demand.
- *Improve financial resilience.* Macro- and microprudential policies can curb rising leverage and contain financial market risks. In some advanced economies, balance sheet repair needs to continue. Emerging market economies should keep monitoring exposures

to foreign currency debt. Building on recent efforts, China should continue to rein in credit growth and address financial risks.

- *Improve convergence prospects for low-income developing countries.* Continued progress toward the 2030 United Nations Sustainable Development Goals will require low-income developing countries to implement policies that strengthen their fiscal positions, boost financial resilience, reduce poverty, and make growth more inclusive. Investment in workforce skills, improving access to credit, and reducing infrastructure gaps can promote economic diversification and improve the capacity to cope with climate shocks where needed.
- *Foster cooperation.* Maintaining financial and regulatory reform momentum and preserving an open, multilateral trade system should take priority. As Chapter 4 documents, global integration has helped increase cross-border knowledge flows, the diffusion of innovation, and productivity growth across countries—a key driver of improvements in living standards and welfare over time. It is also crucial that countries collaborate to address shared problems, such as excess external imbalances, cybersecurity, and climate change.

CHAPTER 1

GLOBAL PROSPECTS AND POLICIES

World growth strengthened in 2017 to 3.8 percent, with a notable rebound in global trade. It was driven by an investment recovery in advanced economies, continued strong growth in emerging Asia, a notable upswing in emerging Europe, and signs of recovery in several commodity exporters. Global growth is expected to tick up to 3.9 percent this year and next, supported by strong momentum, favorable market sentiment, accommodative financial conditions, and the domestic and international repercussions of expansionary fiscal policy in the United States. The partial recovery in commodity prices should allow conditions in commodity exporters to gradually improve.

Over the medium term, global growth is projected to decline to about 3.7 percent. Once the cyclical upswing and US fiscal stimulus have run their course, prospects for advanced economies remain subdued, given their slow potential growth. In emerging market and developing economies, in contrast, growth will remain close to its 2018–19 level as the gradual recovery in commodity exporters and a projected increase in India's growth provide some offset to China's gradual slowdown and emerging Europe's return to its lower-trend growth rate. Nevertheless, 40 emerging market and developing economies are projected to grow more slowly in per capita terms than advanced economies, failing to narrow income gaps vis-à-vis the group of more prosperous countries.

Despite strong aggregate figures in the baseline forecast and buoyant market sentiment, the current momentum is not assured. Upside and downside risks are broadly balanced over the next several quarters, but risks farther down the road are skewed to the downside. With still-easy financial conditions and persistently low inflation that has required protracted monetary policy accommodation, a potential further buildup of financial vulnerabilities could give way to rapid tightening of global financial conditions, denting confidence and growth. The support to growth that comes from procyclical policies, including in the United States, will eventually need to be reversed. Other risks include a shift toward inward-looking policies that harm international trade and a worsening of geopolitical tensions and strife.

The current favorable juncture offers a window to enact policies and reforms that protect the upswing and raise medium-term growth to the benefit of all—strengthening the potential for higher and more inclusive growth, building buffers that will help deal more effectively with the next downturn, improving financial resilience to contain financial market risks, and fostering international cooperation.

Recent Developments and Prospects

An Investment-Led Pickup in Growth

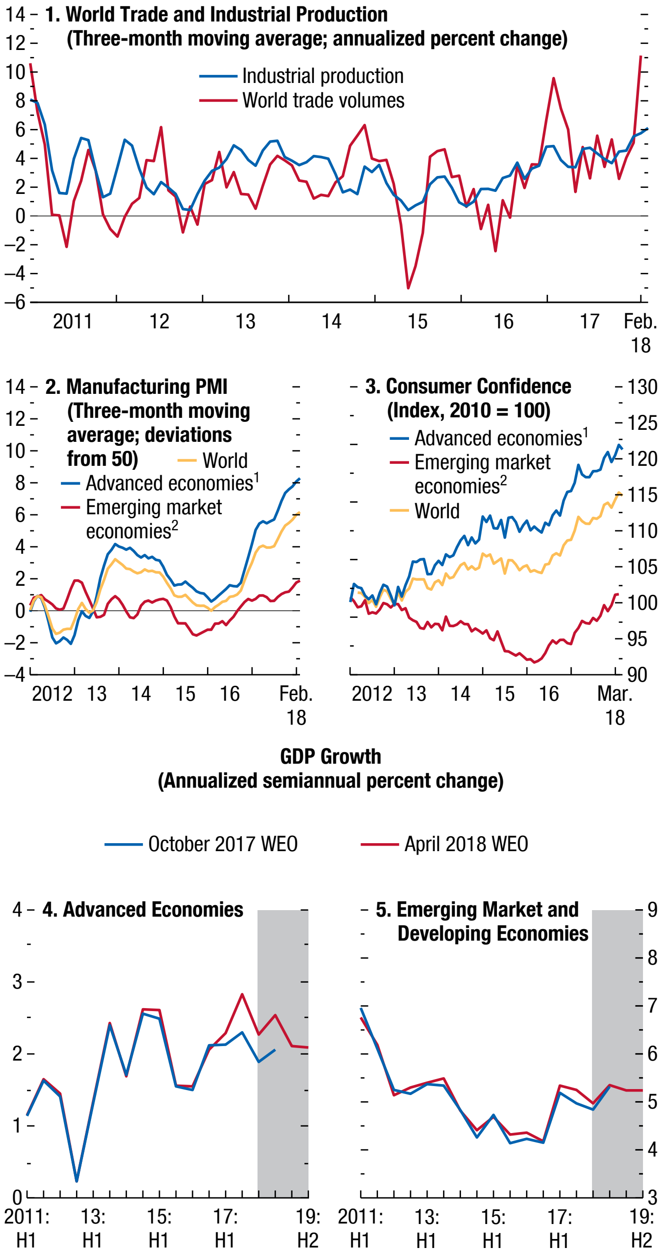
At 3.8 percent, global growth last year was ½ percentage point faster than in 2016 and the strongest since 2011. Two-thirds of countries accounting for about three-fourths of global output experienced faster growth in 2017 than in the previous year (the highest share of countries experiencing a year-over-year growth pickup since 2010). The preliminary outcome for global growth in 2017 was 0.2 percentage point stronger than forecast in the October 2017 *World Economic Outlook* (WEO), with upside surprises in the second half of 2017 in advanced as well as emerging market and developing economies.

Resurgent investment spending in advanced economies and an end to the investment decline in some commodity-exporting emerging market and developing economies were important drivers of the uptick in global GDP growth and manufacturing activity (Figures 1.1–1.3).

- Across advanced economies, the 0.6 percentage point pickup in 2017 growth relative to 2016 is explained almost entirely by investment spending, which remained weak since the 2008–09 global financial crisis and was particularly subdued in 2016 (Figure 1.2, left column). Both stronger gross fixed capital formation and an acceleration in stock building contributed to the pickup in investment, with accommodative monetary policy, stronger balance sheets, and an improved outlook helping release pent-up demand for capital goods.

Figure 1.1. Global Activity Indicators

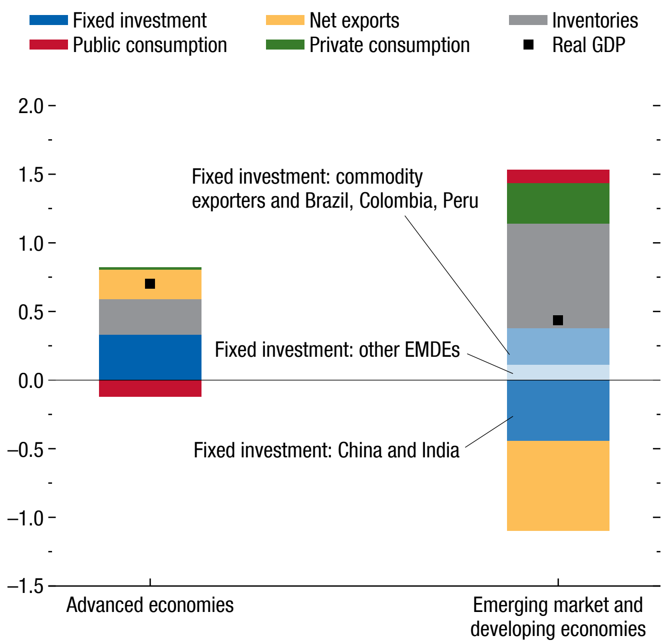
Global growth surprised on the upside in the second half of 2017 amid strengthening industrial production and trade.



Sources: CPB Netherlands Bureau for Economic Policy Analysis; Haver Analytics; Markit Economics; and IMF staff estimates.
Note: CC = consumer confidence; PMI = purchasing managers' index; WEO = *World Economic Outlook.*
[1]Australia, Canada (PMI only), Czech Republic, Denmark, euro area, Hong Kong SAR (CC only), Israel, Japan, Korea, New Zealand (PMI only), Norway (CC only), Singapore (PMI only), Sweden (CC only), Switzerland, Taiwan Province of China, United Kingdom, United States.
[2]Argentina (CC only), Brazil, China, Colombia (CC only), Hungary, India (PMI only), Indonesia, Latvia (CC only), Malaysia (PMI only), Mexico (PMI only), Philippines (CC only), Poland, Russia, South Africa, Thailand (CC only), Turkey, Ukraine (CC only).

Figure 1.2. Contributions to the Change in Real GDP Growth, 2016–17
(Percentage points)

Stronger investment spending in advanced economies and an end to fixed investment contractions in commodity exporters were important contributors to the pickup in global growth.



Source: IMF staff calculations.
Note: EMDEs = emerging market and developing economies.

- Across emerging market and developing economies, the 0.4 percentage point pickup in 2017 growth came primarily from an acceleration in private consumption (Figure 1.2, right column). But the picture is mixed within the group. Growth in China and India last year was supported by resurgent net exports and strong private consumption, respectively, while investment growth slowed. An end to fixed investment contractions in commodity-exporting countries that were severely affected by the commodity price downturn during 2015–16 (notably Brazil and Russia, but also Angola, Ecuador, and Nigeria) instead played an important role in their growth pickup in 2017. Higher fixed investment growth (2.3 percentage points above its 2016 level) also supported the growth performance of other emerging market and developing economies, alongside stronger private consumption.

A Cyclical Rebound in Global Trade

Global trade—which tends to be highly correlated with global investment (see Figure 1.3 and Chapter 2 of the October 2016 WEO)—recovered strongly in 2017 after two years of weakness, to an estimated real growth rate of 4.9 percent. The upsurge was more pronounced in emerging market and developing economies (with trade growth rising from 2.2 percent in 2016 to 6.4 percent in 2017), reflecting improved investment growth rates in formerly stressed commodity exporters as well as the recovery in advanced economy investment and domestic demand more generally.

Among advanced economies, large exporters, such as Germany, Japan, the United Kingdom, and the United States, contributed strongly to the recovery in exports (Figure 1.4, panel 1), while the recovery in imports was broad based, except in the United Kingdom (Figure 1.4, panel 2).

Among emerging market and developing economies, as shown in Figure 1.4, panel 3, the rebound in export growth was particularly strong in emerging Asia, especially China.[1] In contrast, the rebound in imports largely reflects an import recovery among commodity exporters—countries that had earlier experienced sharp investment and import contractions during the 2015–16 commodity price downturn. This is shown in Figure 1.4, panel 4: the blue bars represent commodity exporters that had a particularly pronounced cycle in imports (Angola, Brazil, Ecuador, Nigeria, Russia); the green bars represent remaining commodity exporters, which account for an important part of the import demand cycle among other emerging market and developing economies.

Rising Commodity Prices

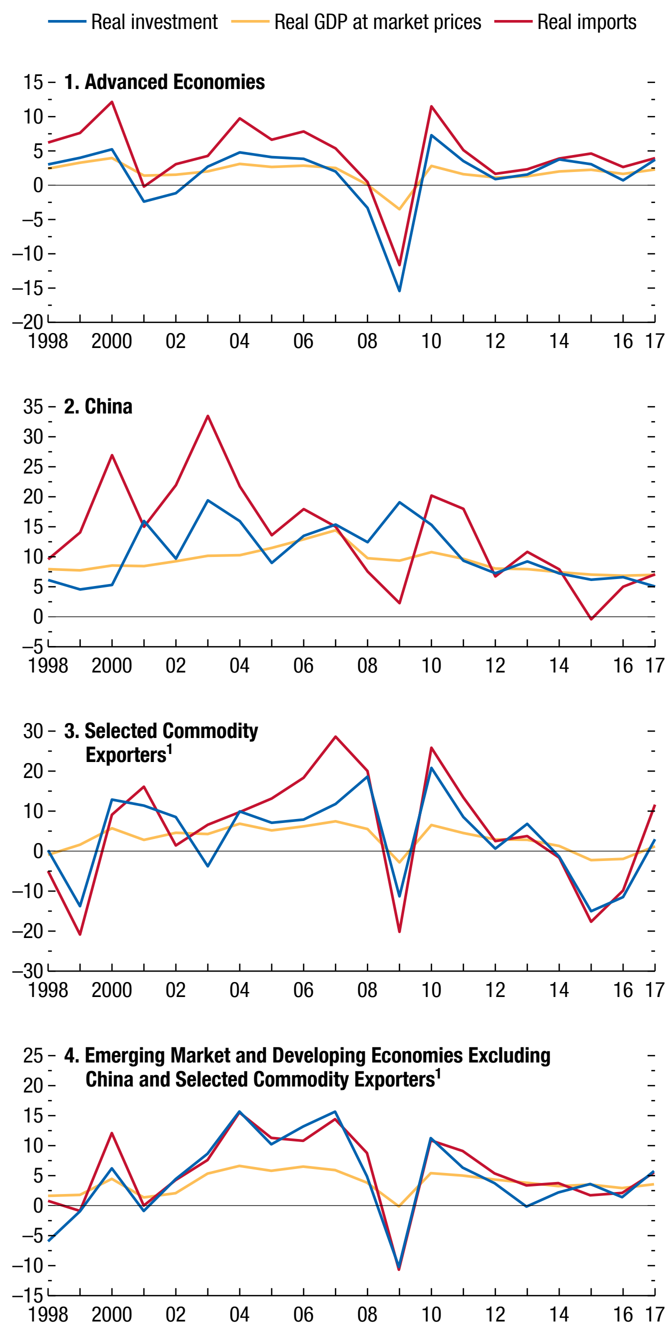
The IMF's Primary Commodities Price Index rose 16.9 percent between August 2017 and February 2018—that is, between the reference periods for the October 2017 WEO and the current report (Figure 1.5). As described in the Commodities Special Feature, the increase was driven primarily by rising oil and natural gas prices. Among the other subindices, metals and agricultural commodity prices also rose, although less rapidly than energy prices.

- Oil prices increased to more than $65 a barrel in January, the highest level since 2015, following

[1]Box 1.1 discusses the role of the so-called tech cycle in explaining the rebound in trade in Asian economies and elsewhere.

Figure 1.3. Global Investment and Trade
(Percent change)

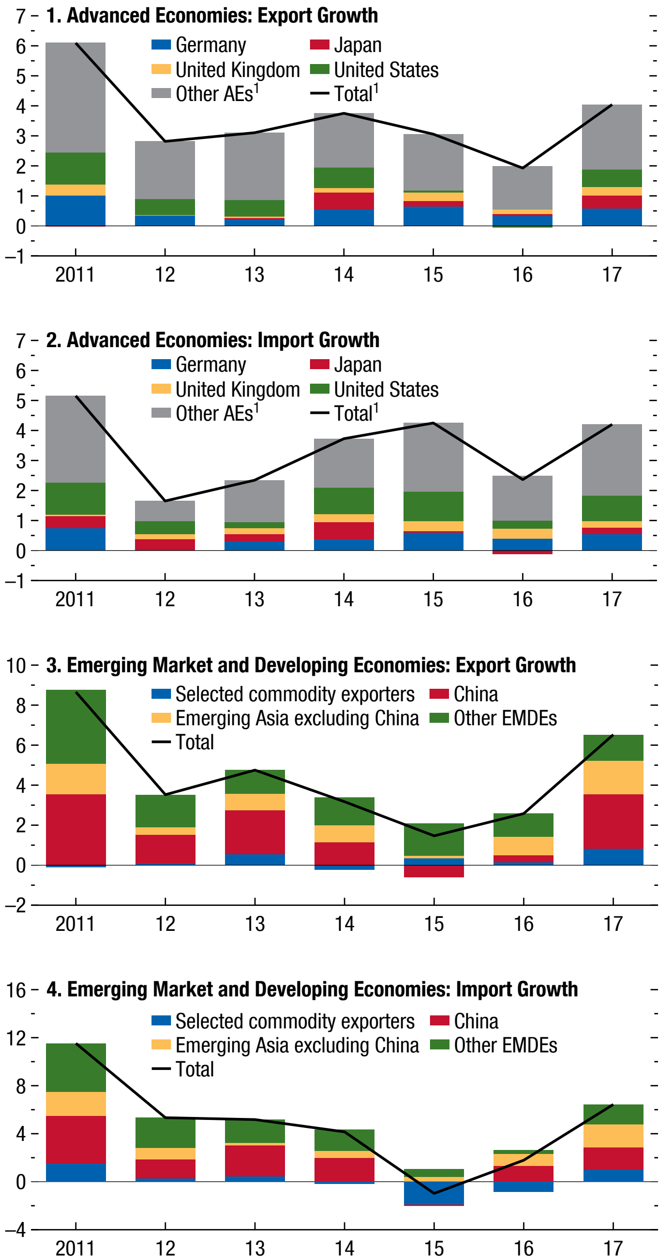
Global trade recovered strongly in 2017 after two years of weakness as investment spending picked up.



Source: IMF staff calculations.
[1]Selected commodity exporters = Angola, Brazil, Ecuador, Nigeria, Russia.

Figure 1.4. Contributions to Trade Growth
(Percent)

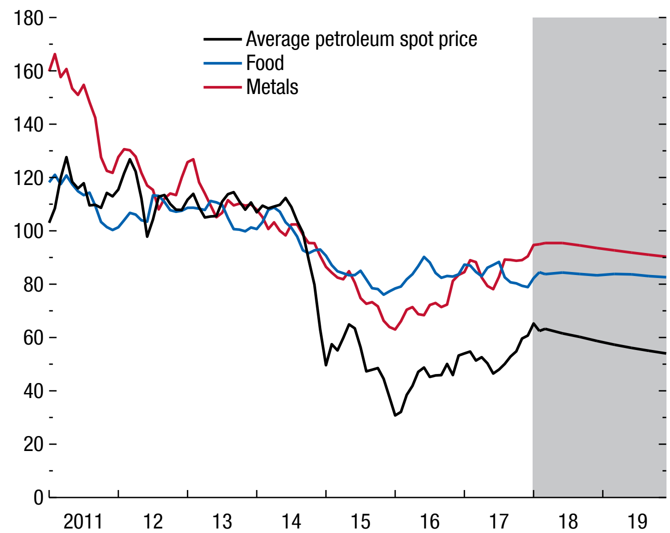
The trade recovery was particularly pronounced in emerging market and developing economies.



Source: IMF staff calculations.
Note: Trade growth reflects export and import volumes from external sector data. AEs = advanced economies; EMDEs = emerging market and developing economies; selected commodity exporters = Angola, Brazil, Ecuador, Nigeria, Russia.
[1]Excludes Ireland.

Figure 1.5. Commodity and Oil Prices
(Deflated using US consumer price index; index, 2014 = 100)

Commodity prices, notably of oil and natural gas, have risen since the fall, but the medium-term outlook remains subdued.



Sources: IMF, Primary Commodity Price System; and IMF staff estimates.

unplanned outages on the US Gulf Coast and in Libya, the North Sea, and Venezuela; an extension to the end of 2018 of the Organization of the Petroleum Exporting Countries agreement on production targets; and stronger global economic growth. Prices moderated to $63 a barrel in February, 27 percent above their August level.

- The natural gas price index—an average for Europe, Japan, and the United States—rose sharply, by 45 percent from August 2017 to February 2018, reflecting seasonal factors. Strong demand for liquefied natural gas (LNG) in China, where the government has restricted the use of coal to mitigate air pollution, helped drive the spot LNG price to its highest level in three years. Higher oil prices also added upward pressure in countries where oil-linked pricing is more common.
- Metal prices increased 8.3 percent from August to February, in line with stronger growth in all major economies. Demand for base metals—especially aluminum—was strong, while supply was limited in part due to China's production capacity cuts. Iron ore prices rose 4.1 percent from August to February, rallying recently thanks to strong steel prices and rising coal costs.

- The IMF's agricultural price index rose 4.1 percent from August 2017 to February 2018, as unfavorable weather conditions in recent months are expected to reduce this year's harvests of many grains and oilseeds. The subindices of food and agricultural raw materials rose 4.1 percent and 6.0 percent, respectively.

Headline Inflation Has Picked up, but Core Inflation Remains Sluggish

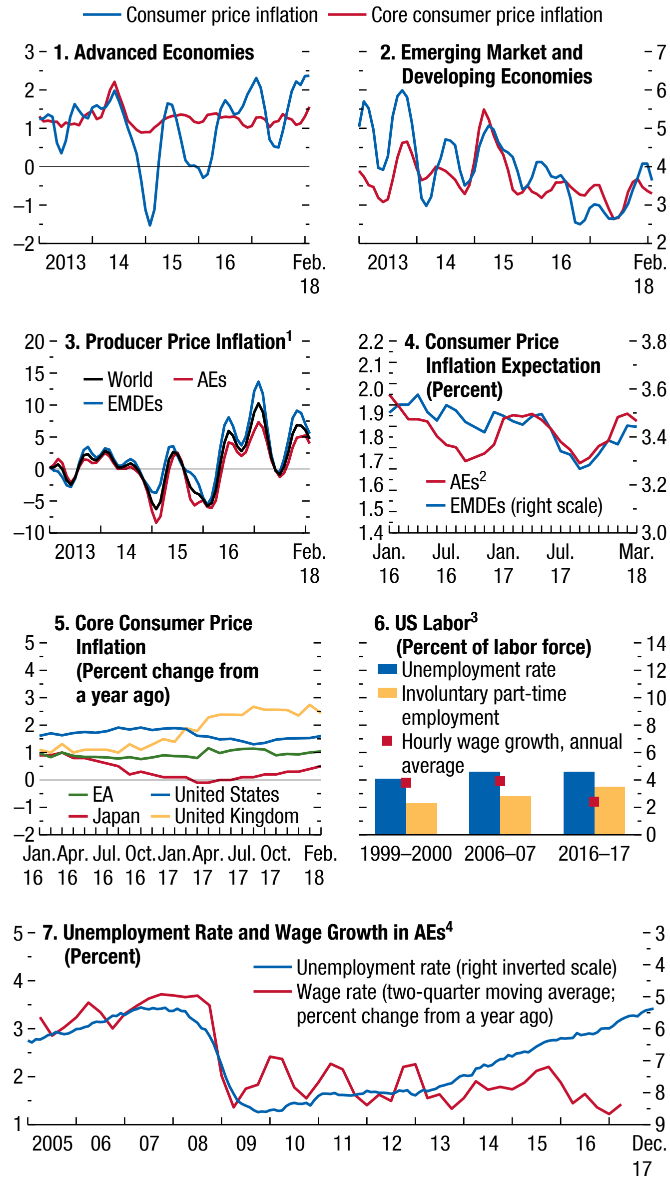
With the upturn in oil prices since September, headline consumer price inflation has picked up again (Figure 1.6). Core inflation—inflation rates when fuel and food prices are excluded—generally remains soft. It has begun to show signs of recovery in advanced economies and appears to have bottomed out in emerging market and developing economies. As illustrated in Box 1.2, the continued weakness of inflation in advanced economies relative to precrisis years reflects primarily nontraded consumer services, such as medical services and education. Traded goods inflation has remained low but has not declined.

- In most advanced economies, core inflation remains below target but appears to be edging up in response to stronger demand. In the United States, where unemployment is close to its lowest level since the late 1960s, core personal consumer expenditure inflation (the Federal Reserve's preferred measure) has begun to firm. In February, it stood at about 1.6 percent when measured on a 12-month basis, but slightly above 2 percent (the Federal Reserve's medium-term target), measured on a three-month (annualized) basis. Twelve-month core inflation notched up to 1.1 percent in the euro area in February (just above its average for the past couple of years), while in Japan it has remained on a gentle upward trajectory in recent months, reaching 0.4 percent in January. The United Kingdom is an exception to the pattern of below-target inflation. At 2.4 percent in February, UK core inflation is below the peak it reached in 2017 in the aftermath of the June 2016 Brexit referendum pound depreciation, but remains above the Bank of England's target of 2 percent.
- Wage growth also remains tepid in most advanced economies, moving broadly in line with labor productivity when measured in real terms (hence implying a limited increase in unit labor costs). As documented in Chapter 2 of the October 2017

Figure 1.6. Global Inflation

(Three-month moving average; annualized percent change, unless noted otherwise)

Headline inflation has picked up, reflecting stronger fuel prices, but core inflation remains soft.



Sources: Consensus Economics; Haver Analytics; Organisation for Economic Co-operation and Development; US Bureau of Labor Statistics; and IMF staff calculations.

Note: AEs = advanced economies (AUT, BEL, CAN, CHE, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HKG, IRL, ISR, ITA, JPN, KOR, LTU, LUX, LVA, NLD, NOR, PRT, SGP, SVK, SVN, SWE, TWN, USA); EA = euro area; EMDEs = emerging market and developing economies (BGR, BRA, CHL, CHN, COL, HUN, IDN, IND, MEX, MYS, PER, PHL, POL, ROU, RUS, THA, TUR, ZAF). Panel 6 is equalized to 100 in 2007 by shifting the level. Country list uses International Organization for Standardization (ISO) country codes.

[1]AEs excludes HKG, ISR, and TWN. EMDEs includes UKR; excludes IDN, IND, PER, and PHL.

[2]AEs includes AUS; excludes LUX.

[3]Hourly wage growth refers to the growth of production and nonsupervisory workers in private industries.

[4]Blue line includes AUS and NZL; excludes BEL. Red line includes AUS and MLT; excludes HKG, SGP, and TWN.

WEO, the sluggishness in wages partly reflects continued slack in labor markets, especially a still-elevated share of workers involuntarily working part-time. Changes in the composition of the workforce—new entrants earning relatively lower wages than retiring workers—may also have played a role. The January uptick in US hourly earnings growth was a welcome sign of a firming labor market after a period of strong payroll gains. A sustained acceleration of labor earnings will be needed to push real wage growth above labor productivity gains, raise cost pressures for firms, and support the return of core inflation toward the medium-term target.

- In many emerging market and developing economies, recent currency stability or appreciations against the US dollar have helped keep a lid on core inflation. Core inflation is around historical lows in Brazil and Russia, where demand has been recovering from the deep contractions of 2015–16, while it has picked up in India after falling sharply in the second quarter of 2017 due to one-off factors. In China, core inflation remains broadly stable at about 2 percent. In contrast, other countries—in sub-Saharan Africa; the Commonwealth of Independent States; and the Middle East, North Africa, Afghanistan, and Pakistan region—continue to grapple with high inflation stemming from the pass-through of earlier exchange rate depreciations.

Financial Conditions—Still Loose

Despite equity market turbulence in early February, equity market declines in March, and some increases in bond yields in response to firmer growth and inflation, market sentiment generally appears stronger than in August. Confidence in the strength of the global outlook has gained ground, and financial conditions remain accommodative and supportive of the recovery, as discussed in the April 2018 *Global Financial Stability Report* (GFSR).

Central bank monetary policy moves have been well telegraphed and absorbed smoothly by markets. Withdrawal of monetary support in the United States has continued, with increases in short-term interest rates in December and March amid a firmer labor market and emerging signs of strengthening inflation. Markets are currently pricing in two additional interest rate increases in 2018—a more rapid pace of normalization than expected a few months ago (Figure 1.7). In January 2018, the European Central Bank reduced the monthly pace of its asset purchase program from €60 billion to €30 billion, with purchases intended to continue until the end of September 2018, or beyond if necessary. Among other advanced economies, the United Kingdom raised its bank rate to 50 basis points in November and Canada raised its policy rate to 1.25 percent in January.

With strengthening economic activity and expectations of more rapid increases in the policy rate in the United States, nominal yields on 10-year US Treasury bonds have risen by over 50 basis points since August (as of end March 2018). This increase reflects primarily a steeper expected path for short-term interest rates. Over the same period, long-term bond yields have risen by some 10 basis points in Germany and 25 basis points in the United Kingdom, while they have remained around zero in Japan. Long term bond yields have remained broadly unchanged in Italy and Spain, as their spreads over German bunds have compressed with the increase in German yields.

Despite the early February turbulence and declines in March following the announcements of intended US tariff actions on steel and aluminum and a range of Chinese products, as well as the announcement by China of retaliatory tariffs on imports from the US, equity market valuations remain stronger than in August (Figure 1.7, panel 5). Volatility has subsided but remains higher than the pre-February episode lows, with spillovers beyond equity markets generally contained. Corporate credit spreads are tighter or little changed relative to August (Figure 1.7 panel 6).

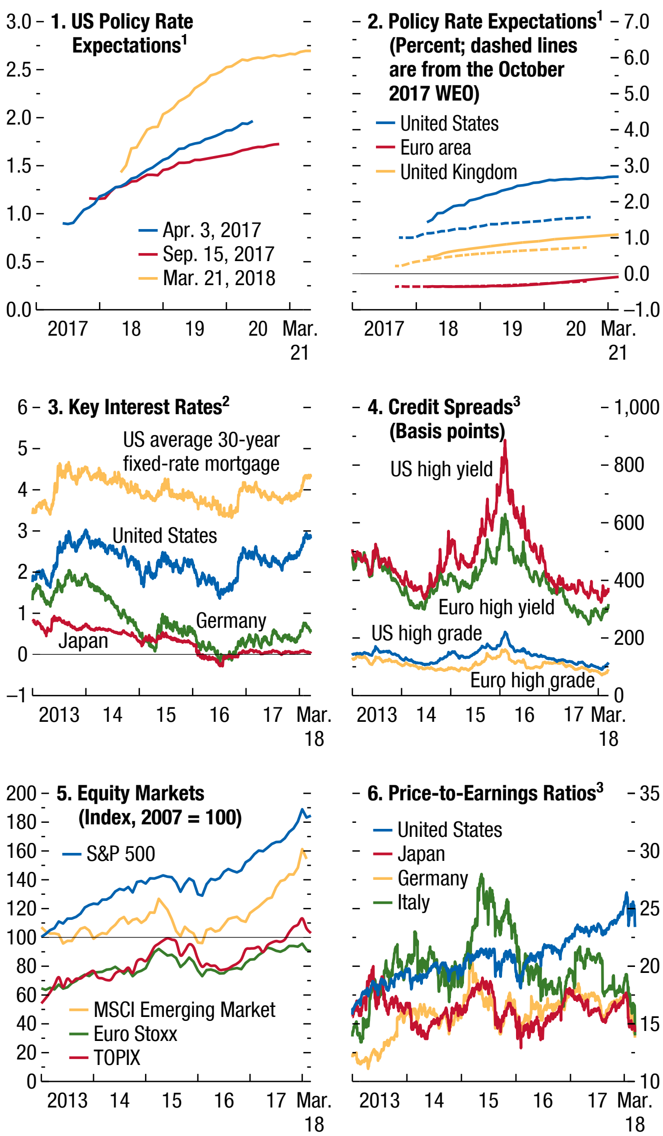
Despite widening interest rate differentials, the US dollar weakened modestly in real effective terms, by about 1½ percent between August 2017 and end-March 2018, and is about 4 ½ percent weaker than its 2017 average (Figure 1.8). The euro has appreciated by around 1 percent and stands about 4 percent stronger than its 2017 average. Among other currencies, the Japanese yen has remained broadly stable, while the British pound appreciated 5 ½ percent after the Bank of England raised interest rates in November and as expectations of a Brexit deal rose.

In emerging market economies, financial conditions since August have generally remained supportive of a pickup in economic activity. Monetary policy was eased further in Brazil and Russia, while it was tightened in Mexico. Equity markets have strengthened (Figure 1.9) and spreads on the J.P. Morgan Global Emerging Markets Bond Index have declined (Figure 1.10). Long-term interest rates on local currency bonds have increased modestly in countries growing rapidly, such as in emerg-

Figure 1.7. Advanced Economies: Monetary and Financial Market Conditions

(Percent, unless noted otherwise)

With stronger domestic demand, a steeper path of expected policy rates has lifted US long-term yields since the fall. Yields have risen to a lesser extent among other advanced economies.

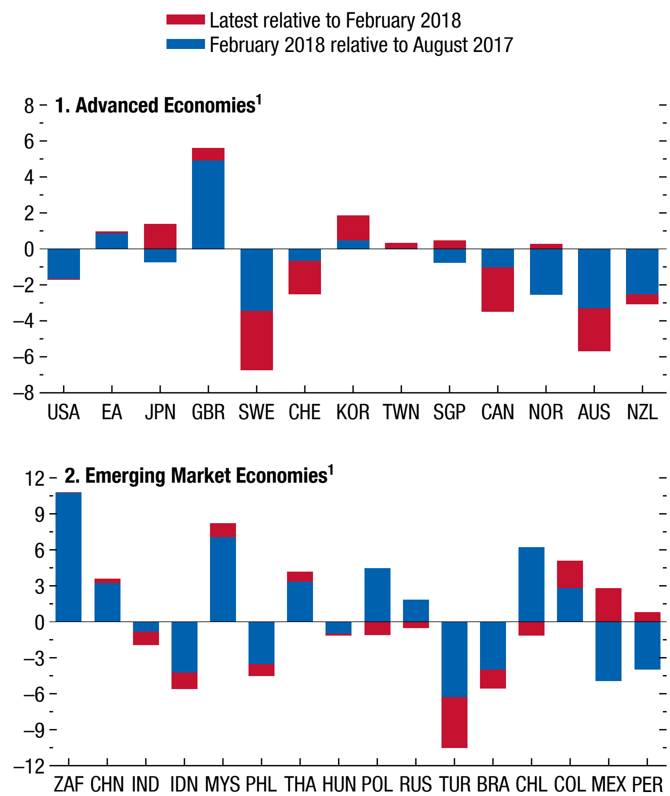


Sources: Bloomberg Finance L.P.; Thomson Reuters Datastream; and IMF staff calculations.
Note: MSCI = Morgan Stanley Capital International; S&P = Standard & Poor's; TOPIX = Tokyo Stock Price Index.
[1]Expectations are based on the federal funds rate futures for the United States, the sterling overnight interbank average rate for the United Kingdom, and the euro interbank offered forward rate for the euro area; updated March 21, 2018.
[2]Interest rates are 10-year government bond yields, unless noted otherwise. Data are through March 23, 2018.
[3]Data are through March 23, 2018.

Figure 1.8. Real Effective Exchange Rate Changes, August 2017–March 2018

(Percent)

Exchange rate movements since the fall have been modest across advanced economies and for most emerging market and developing economies.



Source: IMF staff calculations.
Note: EA = euro area. Data labels use International Organization for Standardization (ISO) country codes.
[1]Latest data available are for March 30, 2018.

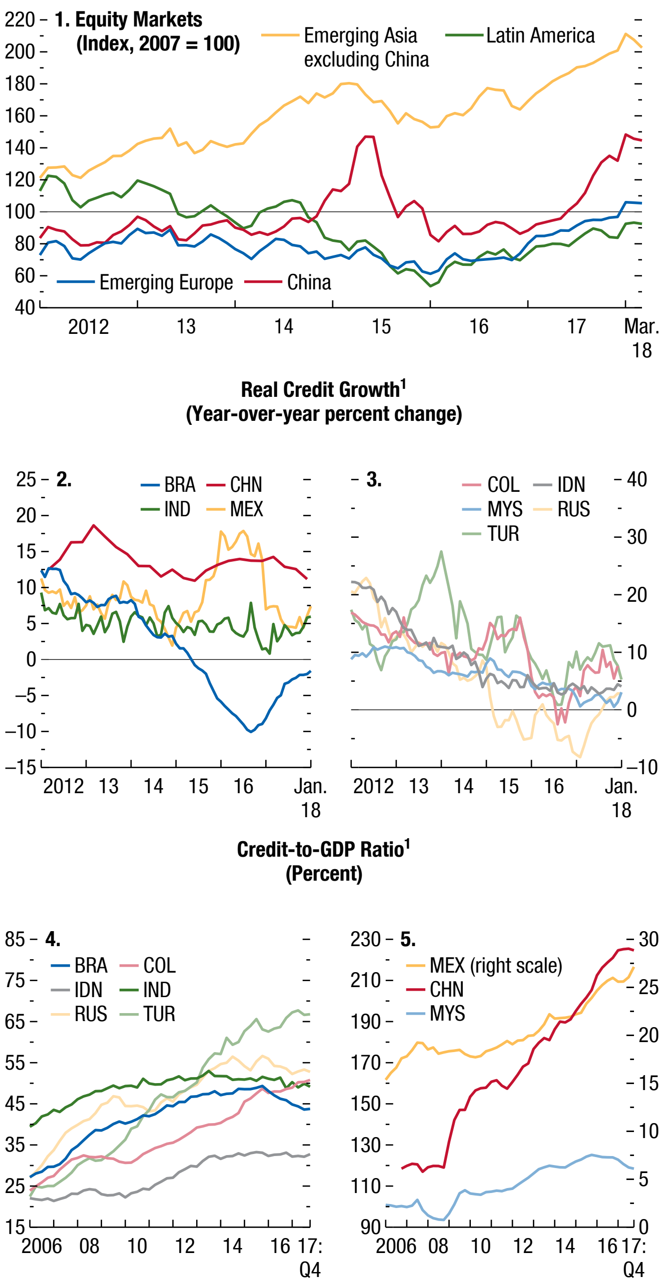
ing Asia and emerging Europe, while they eased further in Latin America and in Russia.

Among emerging market currencies, the Chinese renminbi appreciated 3½ percent in real effective terms between August 2017 and end-March 2018 and by a similar amount relative to its average value in 2017. The South African rand rebounded by 10 percent on reduced political uncertainty and the Malaysian ringgit by over 8 percent on an improved growth outlook and stronger commodity prices. In contrast, the Turkish lira depreciated by more than 10 percent on higher inflation readings.

Financial flows to emerging market economies moderated in the second half of 2017 after surging in the

Figure 1.9. Emerging Market Economies: Equity Markets and Credit

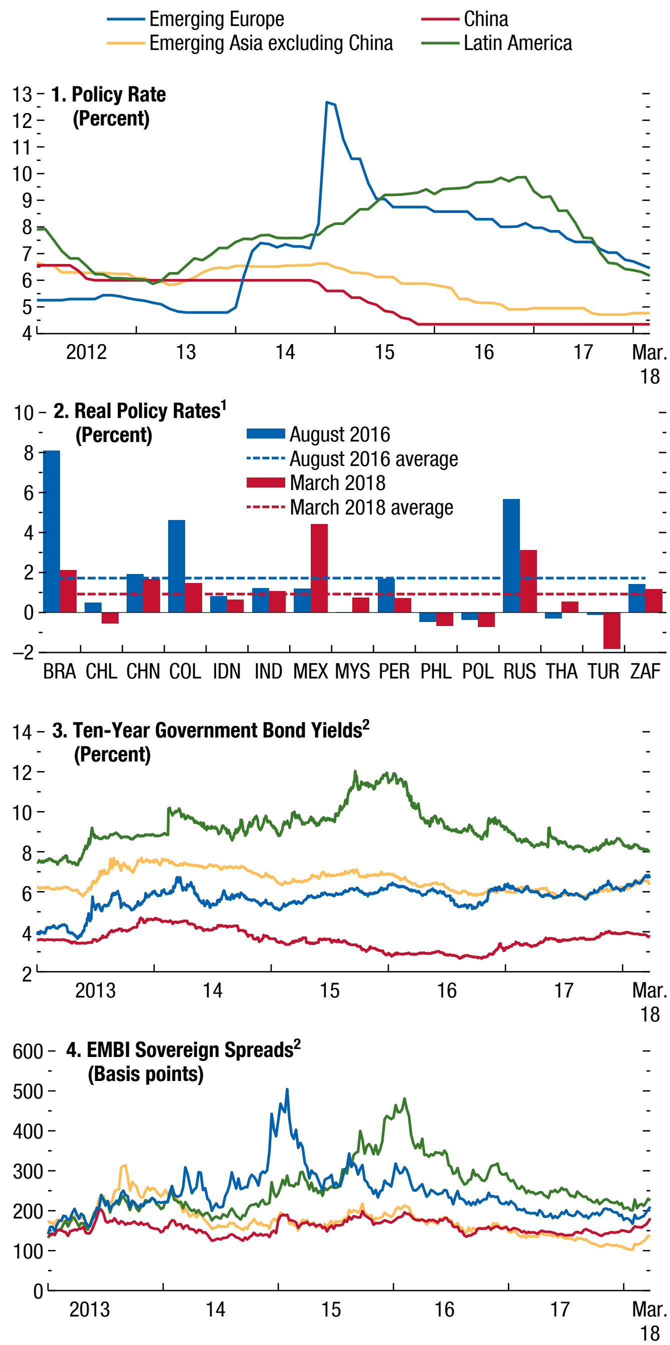
Financial conditions in emerging market economies generally remain supportive of a pickup in economic activity.



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, International Financial Statistics (IFS) database; and IMF staff calculations.
Note: Data labels use International Organization for Standardization (ISO) country codes.
[1]Credit is other depository corporations' claims on the private sector (from IFS), except in the case of Brazil, for which private sector credit is from the Monetary Policy and Financial System Credit Operations published by Banco Central do Brasil, and China, for which credit is total social financing after adjusting for local government debt swaps.

Figure 1.10. Emerging Market Economies: Interest Rates

Emerging market bond spreads have declined, while yields on local-currency long-term bonds have increased modestly in some fast-growing economies.



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, *International Financial Statistics*; and IMF staff calculations.
Note: Emerging Asia excluding China comprises India, Indonesia, Malaysia, the Philippines, and Thailand; emerging Europe comprises Poland, Romania, Russia, and Turkey; Latin America comprises Brazil, Chile, Colombia, Mexico, and Peru. EMBI = J.P. Morgan Emerging Markets Bond Index. Data labels use International Organization for Standardization (ISO) country codes.
[1]Deflated by two-year-ahead *World Economic Outlook* inflation projections.
[2]Data are through March 30, 2018.

first half of the year but remained robust. Following a strong start to 2018, portfolio flows to emerging market economies softened in the immediate aftermath of the global equity market turbulence of early February but have recovered since (Figure 1.11).

Key Forces Shaping the Outlook

Advanced Economies: Output Gaps Closing amid Structurally Stronger Growth

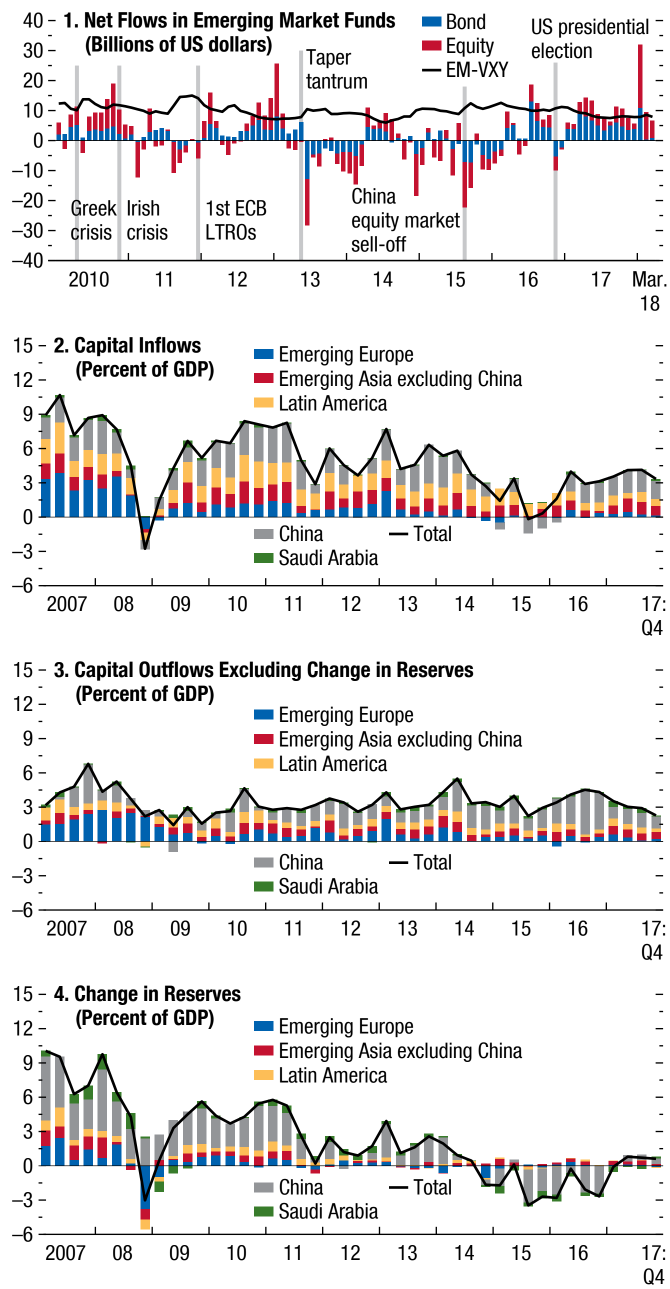
Since 2014 advanced economies have experienced a continued, if at times halting, recovery from the recessions in the aftermath of the 2008–09 global financial crisis and the 2011–12 euro area sovereign debt crisis. Accommodative monetary policy and the gradual fading of crisis-related drags have been pivotal in helping advanced economies attain above-potential growth and reduce unemployment. Measures of potential growth and output gaps are inherently very uncertain, especially in the aftermath of a deep crisis with lasting macroeconomic legacies. Nonetheless, potential growth for advanced economies is also estimated to have recovered in recent years.[2]

The faster-than-expected pace of activity in advanced economies since mid-2016 has not only sped up the closing of output gaps, it has also led to a reassessment of medium-term output.

- Some 40 percent of the 0.6 percentage point cumulative growth surprise for 2016–17 relative to the October 2016 WEO projections is attributed to a faster-than-expected closing of output gaps (a cyclical recovery in demand), while the rest has been matched by an upward revision to estimated potential growth (implying a structurally stronger recovery).
- Likewise, about 40 percent of the 1.7 percentage point revision to cumulative growth in advanced economies during 2016–21 (relative to the October 2016 WEO projections) is attributed to faster closing of output gaps; the rest is attributed to faster potential growth. Higher potential output relative to earlier projections implies that employment is

Figure 1.11. Emerging Market Economies: Capital Flows

Portfolio flows to emerging market economies softened immediately after the global equity market turbulence of early February, but have recovered since.

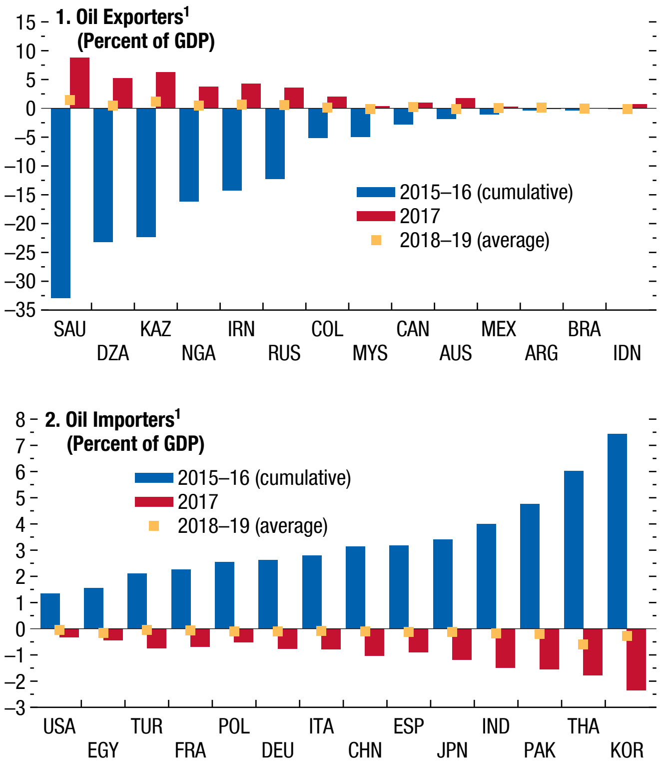


Sources: Bloomberg Finance L.P.; EPFR Global; Haver Analytics; IMF, *International Financial Statistics*; and IMF staff calculations.
Note: Capital inflows are net purchases of domestic assets by nonresidents. Capital outflows are net purchases of foreign assets by domestic residents. Emerging Asia excluding China comprises India, Indonesia, Malaysia, the Philippines, and Thailand; emerging Europe comprises Poland, Romania, Russia, and Turkey; Latin America comprises Brazil, Chile, Colombia, Mexico, and Peru. ECB = European Central Bank; EM-VXY = J.P. Morgan Emerging Market Volatility Index; LTROs = longer-term refinancing operations.

[2]Box 1.3 updates the potential growth projections in Chapter 3 of the April 2015 WEO. The analysis—based on multivariate filtering techniques—suggests a pickup in potential growth of about 0.4 percentage point between 2011 and 2017 in a selected group of advanced economies. The estimated change in potential growth is almost identical to the pickup for the aggregated group of advanced economies over the same period in the current WEO projections, which also incorporate country-specific factors.

Figure 1.12. Terms-of-Trade Windfall Gains and Losses

Despite the projected short-term increase in commodity prices, terms-of-trade windfall gains and losses are expected to be modest over 2018–19 compared with 2015–17.



Source: IMF staff estimates.
Note: Data labels use International Organization for Standardization (ISO) country codes.
[1]Gains (losses) for 2018–19 are simple averages of annual incremental gains (losses) for 2018 and 2019. The windfall is an estimate of the change in disposable income arising from commodity price changes. The windfall gain in year t for a country exporting x US dollars of commodity A and importing m US dollars of commodity B in year $t-1$ is defined as $(\Delta p_t^A x_{t-1} - \Delta p_t^B m_{t-1}) / Y_{t-1}$, in which Δp_t^A and Δp_t^B are the percentage changes in the prices of A and B between year $t-1$ and year t, and Y is GDP in year $t-1$ in US dollars. See also Gruss (2014).

expected to be sustained at a higher level as well.[3] The continued decline in headline unemployment rates, with limited signs of wage and price acceleration, is consistent with this interpretation.

Once the gaps close (estimated to occur by the end of 2018 for the advanced economy group), growth is expected to start declining toward potential. The United States, where recent fiscal policy changes are expected to push output above potential, is projected to see a later, but sharper, return to potential growth than most other advanced economies. Box 1.5 presents a stylized scenario analysis of the elements of the US tax reform to shed light on why the US economy is projected to grow considerably faster than potential for a few years. The simulations illustrate that the temporary allowance for full expensing of investment has a particularly large short-term impact on activity because it provides strong incentives to firms to advance and complete investment projects while the allowance is in place. As a result, the US tax reform will reduce growth momentum starting in 2020, and then more strongly when full investment expensing begins to be phased out in 2023.

The medium-term per capita growth rates of advanced economies are expected to be lower—not only than they currently are, but also below those registered in the precrisis decades. The main reason is the slowdown in labor force growth as populations of advanced economies continue to age (as discussed in Chapter 2), a drag that is expected to be offset only partially by some recovery in the growth of total factor productivity (to rates that are well below those registered in the precrisis years; Box 1.4 discusses productivity measurement in the digital age).

Emerging Market and Developing Economies: Effects of Recent Commodity Price Increases

The declines in metal prices since 2011 and the plunge in oil prices in 2014 drove a wedge between the economic performance of commodity-importing and commodity-exporting emerging market and developing economies (Figures 1.12 and 1.13). The growth rates of the two groups were broadly similar before 2014 (excluding faster-growing China) but have since diverged, with importers continuing to grow fast and exporters seeing their growth slow to about half of its average 2000–14 pace. With idiosyncratic problems exacerbating the loss in commodity revenues, some larger exporters—such as Brazil and Russia—experienced deep recessions in 2015–16, while Venezuela has suffered an intensifying economic and humanitarian crisis since 2014. Likewise, Saudi Arabia and some other oil exporters in the Middle East and sub-Saharan Africa have experienced recessions and/or substantial growth slowdowns in recent years as they started adjusting fiscal policy to the permanent loss of commodity revenues.

Output, and especially domestic demand, decelerated sharply in oil exporters in the aftermath of

[3]Advanced economy employment projections for 2021 have been raised by about 1.4 million relative to those in the October 2016 WEO.

terms-of-trade losses, which gave rise to large fiscal and external adjustment needs and tighter financial conditions. The extent of macroeconomic stress associated with the large decline in oil prices has become more apparent over time, with projected growth in oil exporters' GDP, and especially domestic demand, revised down through 2017 even as oil prices firmed somewhat. Looking ahead, the increase in commodity prices in the second half of 2017 creates space for oil exporters to consolidate fiscal balances more gradually but is only a very partial reversal of their initial terms-of-trade losses during 2014–16. In some cases, the price increase also reflects production restraints that directly weigh on real GDP. In addition, domestic political discord and strife continue to weigh heavily on economic activity in several oil exporters. As a result of these offsetting forces, the recovery in growth in oil exporters since the 2015 trough has been very gradual, and growth projections for the next five years are broadly unchanged since October 2017.

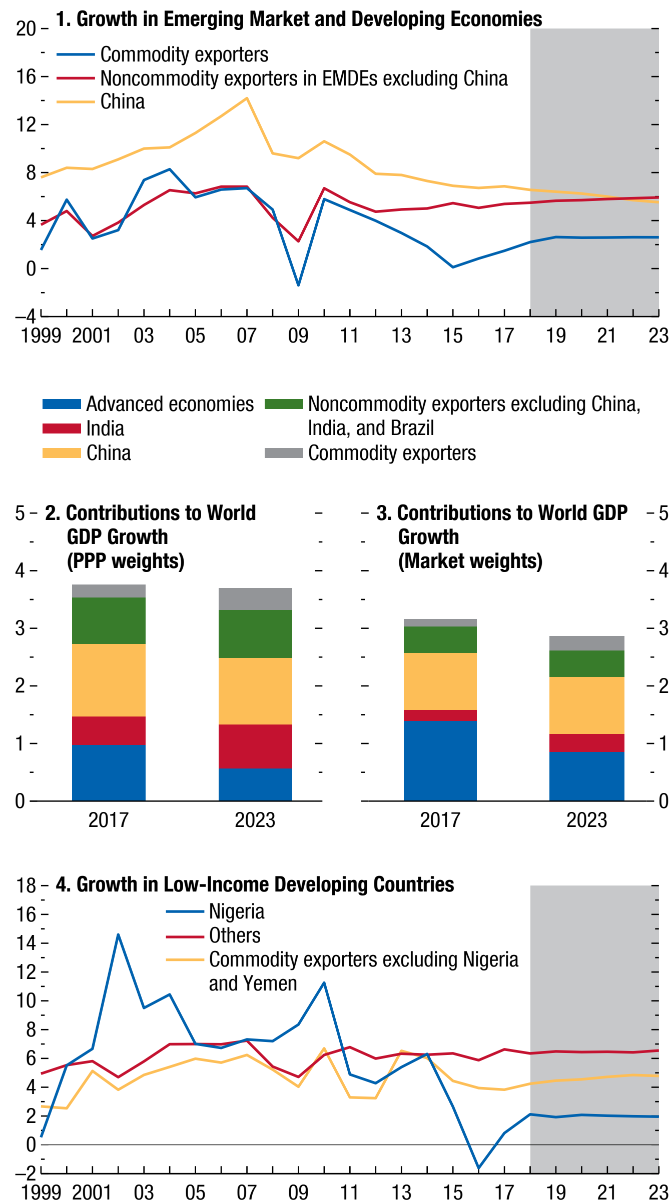
For oil importers, when oil prices fall, the windfall gains as a share of income tend to be smaller than the corresponding losses for oil exporters, given that the oil import bills of the former group are generally lower as a share of overall income than the oil export receipts of the second, smaller, group. The boost to domestic demand in oil importers stemming from the oil price decline of 2014 was, in many cases, partially offset by a reduction in energy subsidies, which implies an incomplete pass-through of the windfall to final users. To the extent that the recent oil price increases are passed on to final users, they may temper domestic demand. The negative effect, in many cases, is not large enough to trigger downward growth revisions, however, given offsetting improvements in external conditions, in particular stronger external demand.

Prospects for Income Convergence—A Glass One-Quarter Empty

The record of income convergence between advanced economies and emerging market and developing economies has not been favorable over the past five decades (as discussed in Chapter 2 of the April 2017 WEO). Over the next five years, the glass will be one-quarter empty: 40 emerging market and developing economies (about 27 percent of the total) are not expected to narrow their per capita income gaps relative to advanced economies. In fact, per capita incomes in 12 of those economies are expected to

Figure 1.13. GDP Growth, 1999–2023
(Percent)

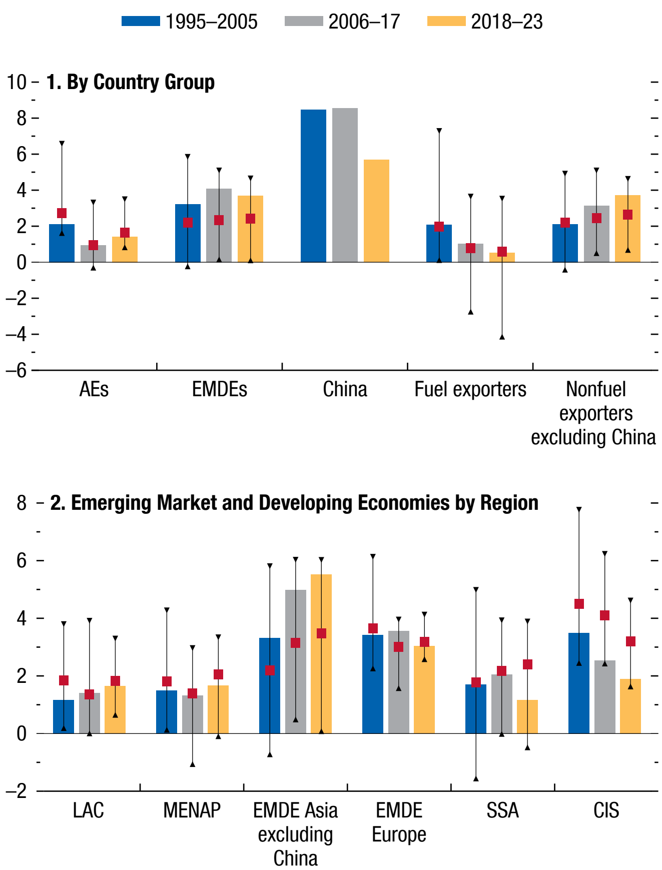
Growth in commodity exporters is projected to stabilize close to current levels over the medium term, well below the past average. Diversified economies are expected to maintain relatively robust growth rates.



Source: IMF staff estimates.
Note: EMDEs = emerging market and developing economies; PPP = purchasing power parity. Commodity exporters includes fuel and nonfuel primary products exporters, as indicated in Table D of the Statistical Appendix, plus Brazil and Peru.

Figure 1.14. Per Capita Real GDP Growth
(Percent)

Prospects for emerging market and developing economies to narrow their per capita income gaps relative to advanced economies vary across regions.



Source: IMF staff estimates.
Note: Bars denote PPP GDP-weighted averages, red markers indicate the medians, and black markers denote the top and bottom deciles of per capita GDP growth in the country groups. Country groups are defined in Chapter 3 of the April 2015 *World Economic Outlook*. The fuel and nonfuel exporter subgroups are defined in Table D of the Statistical Appendix and cover EMDEs only. AEs = advanced economies; CIS = Commonwealth of Independent States; EMDE = emerging market and developing economy; LAC = Latin America and the Caribbean; MENAP = Middle East, North Africa, Afghanistan, and Pakistan; PPP = purchasing power parity; SSA = sub-Saharan Africa.

decline over the five-year forecast horizon. Most economies with per capita growth below that of advanced economies are either commodity (mostly oil) exporters or small states (Figure 1.14)—they account for a smaller share of the total population and GDP of all emerging market and developing economies (about 11 percent). If the sample is limited to low-income developing countries, the share of the countries not expected to narrow their per capita income gap is one-quarter (14 countries), but these represent a larger share of the total population and GDP for the country group (some 30 percent).

Convergence prospects vary across regions. Income convergence is projected to continue in China, India, and east Asia more broadly, as well as in emerging Europe and parts of the Commonwealth of Independent States. By contrast, per capita growth in sub-Saharan Africa, Latin America and the Caribbean, and the Middle East, North Africa, Pakistan, and Afghanistan region is projected to fall short of or barely exceed that in advanced economies over the next few years, reflecting the weak performance of the many commodity exporters in these regions.

The Forecast

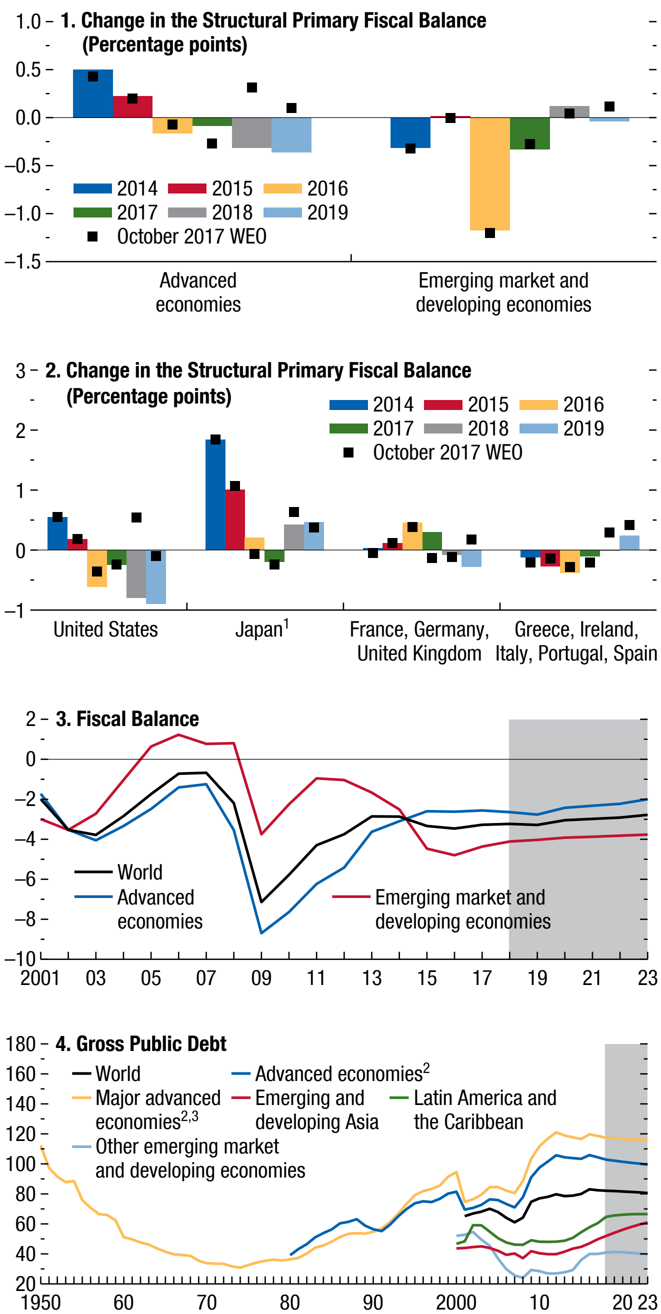
Policy Assumptions

The aggregate fiscal policy stance for advanced economies is projected to remain expansionary in 2018 and especially in 2019, while it is projected to turn broadly neutral in emerging market and developing economies (Figure 1.15). Relative to the October 2017 WEO assumptions, the forecast assumes a looser fiscal policy stance in 2018 and 2019, which reflects, to a large extent, expected weaker US structural fiscal balances in light of the recently legislated overhaul of the tax code. Fiscal policy is expected to be mildly contractionary in advanced economies for 2020–22 and more clearly contractionary in 2023, when the investment expensing provisions of US tax reform begin to expire.

On monetary policy, the forecast assumes faster normalization of the policy interest rate in the United States than projected in the October 2017 WEO, reflecting stronger demand and inflation pressure under more expansionary fiscal policy. The US policy interest rate target is projected to rise to about 2.5 percent by the end of 2018 and about 3.5 percent by the end of 2019, declining back to a long-term equilibrium rate of slightly less than 3 percent in 2022. In the euro area and Japan, the forecast assumes that monetary policy will remain very accommodative. Short-term rates are projected to remain negative in the euro area until mid-2019 and close to zero in Japan over the five-year forecast horizon. The assumed monetary policy stances across emerging market economies and the revisions relative to October 2017 vary, reflecting these economies' diverse cyclical positions.

Figure 1.15. Fiscal Indicators
(Percent of GDP, unless noted otherwise)

The fiscal policy stance is projected to remain expansionary in advanced economies in 2018 and especially 2019, while it is projected to turn broadly neutral in emerging market and developing economies.



Source: IMF staff estimates.
Note: WEO = *World Economic Outlook.*
[1]Japan's latest figures reflect comprehensive methodological revisions adopted in December 2016.
[2]Data through 2000 exclude the United States.
[3]Canada, France, Germany, Italy, Japan, United Kingdom, United States.

Assumptions on Financial Conditions and Commodity Prices

Global financial conditions are assumed to remain generally accommodative during 2018–19. Continued easing of lending conditions, notably in the euro area, is expected to offset the anticipated gradual rise in long-term interest rates, while the normalization of monetary policy in the United States and the United Kingdom is expected to proceed without triggering large or protracted increases in financial market volatility. Except for some vulnerable economies, most emerging markets are expected to face accommodative financial conditions under the baseline forecast, with higher policy rates but sustained risk appetite (continuing the recent record of generally contained sovereign bond spreads and strong equity market performance in most cases).

The IMF's commodity price index is expected to rise about 11.9 percent in 2018 relative to its 2017 average (bringing the cumulative increase from 2016 to about 28.9 percent) and then to fall about 3.7 percent in 2019. Oil prices are expected to average $62.3 a barrel in 2018 (up from $52.8 in 2017 and well above the projection of $50.2 a barrel in the October 2017 WEO). As supply recovers, oil prices are expected to decline to $58.2 a barrel in 2019, and further to about $53.6 a barrel in 2023. Metal prices are expected to strengthen by 13 percent in 2018, following a 22.2 percent increase in 2017 spurred by stronger global demand, and remain broadly stable thereafter.

Global Growth Outlook: Short-Term Strengthening, Medium-Term Moderation

Global growth is projected to strengthen from 3.8 percent in 2017 to 3.9 percent in 2018 and 2019, driven by a projected pickup in growth in emerging market and developing economies and resilient growth in advanced economies (Table 1.1). The forecast for 2018 and 2019 is stronger than in the October 2017 WEO by 0.2 percentage point for each year, with positive revisions compared with the October 2017 WEO for emerging market and developing economies and especially for advanced economies. The global effects of US fiscal policy changes account for almost half of the global growth upgrade for 2018–19 compared with October. Beyond 2019, global growth is projected to gradually decline to 3.7 percent by the end of the forecast horizon. The

Table 1.1. Overview of the *World Economic Outlook* Projections

(Percent change, unless noted otherwise)

		Projections		Difference from January 2018 *WEO Update*[1]		Difference from October 2017 WEO[1]	
	2017	2018	2019	2018	2019	2018	2019
World Output	**3.8**	**3.9**	**3.9**	**0.0**	**0.0**	**0.2**	**0.2**
Advanced Economies	**2.3**	**2.5**	**2.2**	**0.2**	**0.0**	**0.5**	**0.4**
United States	2.3	2.9	2.7	0.2	0.2	0.6	0.8
Euro Area	2.3	2.4	2.0	0.2	0.0	0.5	0.3
Germany	2.5	2.5	2.0	0.2	0.0	0.7	0.5
France	1.8	2.1	2.0	0.2	0.1	0.3	0.1
Italy	1.5	1.5	1.1	0.1	0.0	0.4	0.2
Spain	3.1	2.8	2.2	0.4	0.1	0.3	0.2
Japan	1.7	1.2	0.9	0.0	0.0	0.5	0.1
United Kingdom	1.8	1.6	1.5	0.1	0.0	0.1	–0.1
Canada	3.0	2.1	2.0	–0.2	0.0	0.0	0.3
Other Advanced Economies[2]	2.7	2.7	2.6	0.1	0.0	0.2	0.1
Emerging Market and Developing Economies	**4.8**	**4.9**	**5.1**	**0.0**	**0.1**	**0.0**	**0.1**
Commonwealth of Independent States	2.1	2.2	2.1	0.0	0.0	0.1	0.0
Russia	1.5	1.7	1.5	0.0	0.0	0.1	0.0
Excluding Russia	3.6	3.5	3.6	0.1	0.1	0.2	0.1
Emerging and Developing Asia	6.5	6.5	6.6	0.0	0.0	0.0	0.1
China	6.9	6.6	6.4	0.0	0.0	0.1	0.1
India[3]	6.7	7.4	7.8	0.0	0.0	0.0	0.0
ASEAN-5[4]	5.3	5.3	5.4	0.0	0.1	0.1	0.1
Emerging and Developing Europe	5.8	4.3	3.7	0.3	–0.1	0.8	0.4
Latin America and the Caribbean	1.3	2.0	2.8	0.1	0.2	0.1	0.4
Brazil	1.0	2.3	2.5	0.4	0.4	0.8	0.5
Mexico	2.0	2.3	3.0	0.0	0.0	0.4	0.7
Middle East, North Africa, Afghanistan, and Pakistan	2.6	3.4	3.7	–0.2	0.2	–0.1	0.2
Saudi Arabia	–0.7	1.7	1.9	0.1	–0.3	0.6	0.3
Sub-Saharan Africa	2.8	3.4	3.7	0.1	0.2	0.0	0.3
Nigeria	0.8	2.1	1.9	0.0	0.0	0.2	0.2
South Africa	1.3	1.5	1.7	0.6	0.8	0.4	0.1
Memorandum							
European Union	2.7	2.5	2.1	0.2	0.0	0.4	0.3
Low-Income Developing Countries	4.7	5.0	5.3	–0.2	0.0	–0.2	0.1
Middle East and North Africa	2.2	3.2	3.6	–0.2	0.3	0.0	0.4
World Growth Based on Market Exchange Rates	3.2	3.4	3.3	0.1	0.1	0.3	0.3
World Trade Volume (goods and services)	**4.9**	**5.1**	**4.7**	**0.5**	**0.3**	**1.1**	**0.8**
Imports							
Advanced Economies	4.0	5.1	4.5	0.7	0.0	1.3	0.9
Emerging Market and Developing Economies	6.4	6.0	5.6	0.5	0.6	1.1	0.7
Exports							
Advanced Economies	4.2	4.5	3.9	0.3	–0.1	0.9	0.5
Emerging Market and Developing Economies	6.4	5.1	5.3	0.4	0.7	0.6	1.0
Commodity Prices (US dollars)							
Oil[5]	23.3	18.0	–6.5	6.3	–2.2	18.2	–7.2
Nonfuel (average based on world commodity export weights)	6.8	5.6	0.5	6.1	–0.5	5.1	1.0
Consumer Prices							
Advanced Economies	1.7	2.0	1.9	0.1	–0.2	0.3	–0.1
Emerging Market and Developing Economies[6]	4.0	4.6	4.3	0.1	0.0	0.2	0.2
London Interbank Offered Rate (percent)							
On US Dollar Deposits (six month)	1.5	2.4	3.4	0.1	0.0	0.5	0.5
On Euro Deposits (three month)	–0.3	–0.3	0.0	0.0	0.1	0.0	0.0
On Japanese Yen Deposits (six month)	0.0	0.0	0.1	0.0	0.0	–0.2	–0.1

Note: Real effective exchange rates are assumed to remain constant at the levels prevailing during January 26–February 23, 2018. Economies are listed on the basis of economic size. The aggregated quarterly data are seasonally adjusted.

[1]Difference based on rounded figures for the current, January 2018 *World Economic Outlook Update*, and October 2017 *World Economic Outlook* forecasts.

[2]Excludes the Group of Seven (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.

[3]For India, data and forecasts are presented on a fiscal year basis and GDP from 2011 onward is based on GDP at market prices with fiscal year 2011/12 as a base year.

[4]Indonesia, Malaysia, Philippines, Thailand, Vietnam.

Table 1.1 *(continued)*

	Year over Year				Q4 over Q4[7]			
			Projections				Projections	
	2016	2017	2018	2019	2016	2017	2018	2019
World Output	**3.2**	**3.8**	**3.9**	**3.9**	**3.2**	**4.0**	**3.9**	**3.8**
Advanced Economies	**1.7**	**2.3**	**2.5**	**2.2**	**2.0**	**2.6**	**2.4**	**2.0**
United States	1.5	2.3	2.9	2.7	1.8	2.6	3.0	2.3
Euro Area	1.8	2.3	2.4	2.0	2.0	2.7	2.2	2.0
Germany	1.9	2.5	2.5	2.0	1.9	2.9	2.5	1.9
France	1.2	1.8	2.1	2.0	1.2	2.5	1.8	2.0
Italy	0.9	1.5	1.5	1.1	1.1	1.6	1.3	1.1
Spain	3.3	3.1	2.8	2.2	3.0	3.1	2.5	2.1
Japan	0.9	1.7	1.2	0.9	1.5	2.1	0.8	–0.1
United Kingdom	1.9	1.8	1.6	1.5	2.0	1.4	1.6	1.6
Canada	1.4	3.0	2.1	2.0	2.0	2.9	2.1	1.9
Other Advanced Economies[2]	2.3	2.7	2.7	2.6	2.5	2.9	2.7	2.8
Emerging Market and Developing Economies	**4.4**	**4.8**	**4.9**	**5.1**	**4.3**	**5.2**	**5.2**	**5.2**
Commonwealth of Independent States	0.4	2.1	2.2	2.1	0.8	1.9	2.3	1.6
Russia	–0.2	1.5	1.7	1.5	0.6	1.5	2.1	1.3
Excluding Russia	1.9	3.6	3.5	3.6	. . .	. . .	. . .	. . .
Emerging and Developing Asia	6.5	6.5	6.5	6.6	6.2	6.7	6.5	6.6
China	6.7	6.9	6.6	6.4	6.8	6.8	6.5	6.4
India[3]	7.1	6.7	7.4	7.8	6.0	7.5	7.4	7.8
ASEAN-5[4]	5.0	5.3	5.3	5.4	4.8	5.4	5.4	5.5
Emerging and Developing Europe	3.2	5.8	4.3	3.7	3.7	5.9	3.5	3.7
Latin America and the Caribbean	–0.6	1.3	2.0	2.8	–0.8	1.7	2.3	2.4
Brazil	–3.5	1.0	2.3	2.5	–2.4	2.2	3.1	2.3
Mexico	2.9	2.0	2.3	3.0	3.2	1.5	3.0	2.8
Middle East, North Africa, Afghanistan, and Pakistan	4.9	2.6	3.4	3.7	. . .	. . .	. . .	. . .
Saudi Arabia	1.7	–0.7	1.7	1.9	2.2	–1.2	2.3	2.1
Sub-Saharan Africa	1.4	2.8	3.4	3.7	. . .	. . .	. . .	. . .
Nigeria	–1.6	0.8	2.1	1.9	. . .	. . .	. . .	. . .
South Africa	0.6	1.3	1.5	1.7	1.0	1.9	0.7	2.3
Memorandum								
European Union	2.0	2.7	2.5	2.1	2.1	2.9	2.3	2.0
Low-Income Developing Countries	3.5	4.7	5.0	5.3	. . .	. . .	. . .	. . .
Middle East and North Africa	4.9	2.2	3.2	3.6	. . .	. . .	. . .	. . .
World Growth Based on Market Exchange Rates	2.5	3.2	3.4	3.3	2.6	3.4	3.3	3.0
World Trade Volume (goods and services)	**2.3**	**4.9**	**5.1**	**4.7**	**. . .**	**. . .**	**. . .**	**. . .**
Imports								
Advanced Economies	2.7	4.0	5.1	4.5	. . .	. . .	. . .	. . .
Emerging Market and Developing Economies	1.8	6.4	6.0	5.6	. . .	. . .	. . .	. . .
Exports								
Advanced Economies	2.0	4.2	4.5	3.9	. . .	. . .	. . .	. . .
Emerging Market and Developing Economies	2.6	6.4	5.1	5.3	. . .	. . .	. . .	. . .
Commodity Prices (US dollars)								
Oil[5]	–15.7	23.3	18.0	–6.5	16.2	19.6	3.2	–5.9
Nonfuel (average based on world commodity export weights)	–1.5	6.8	5.6	0.5	10.3	1.9	7.0	0.3
Consumer Prices								
Advanced Economies	0.8	1.7	2.0	1.9	1.2	1.7	2.0	2.0
Emerging Market and Developing Economies[6]	4.3	4.0	4.6	4.3	3.6	3.6	3.9	3.9
London Interbank Offered Rate (percent)								
On US Dollar Deposits (six month)	1.1	1.5	2.4	3.4	. . .	. . .	. . .	. . .
On Euro Deposits (three month)	–0.3	–0.3	–0.3	0.0	. . .	. . .	. . .	. . .
On Japanese Yen Deposits (six month)	0.0	0.0	0.0	0.1	. . .	. . .	. . .	. . .

[5]Simple average of prices of UK Brent, Dubai Fateh, and West Texas Intermediate crude oil. The average price of oil in US dollars a barrel was $52.81 in 2017; the assumed price based on futures markets is $62.30 in 2018 and $58.20 in 2019.
[6]Excludes Argentina and Venezuela. See country-specific notes for Argentina and Venezuela in the "Country Notes" section of the Statistical Appendix.
[7]For World Output, the quarterly estimates and projections account for approximately 90 percent of annual world output at purchasing-power-parity weights. For Emerging Market and Developing Economies, the quarterly estimates and projections account for approximately 80 percent of annual emerging market and developing economies' output at purchasing-power-parity weights.

slowdown is entirely because of advanced economies, where growth is projected to moderate in line with their modest potential growth; growth across emerging market and developing economies is expected to stabilize close to the current level.

Advanced Economies

Advanced economies are projected to grow at 2.5 percent in 2018—0.2 percentage point higher than in 2017—and 2.2 percent in 2019. For both years, this forecast is considerably stronger than the October WEO forecast (0.5 and 0.4 percentage point higher for 2018 and 2019, respectively). Positive revisions are broad based, reflecting stronger prospects for the euro area and Japan and especially the projected domestic and spillover effects of expansionary fiscal policy in the United States. Growth is projected to decline to 1.5 percent over the medium term, broadly in line with modest potential growth. The reversal of some of the positive short-term output effects of US tax reform beyond 2020 contributes to this decline.[4] Despite this slowdown, GDP is projected to remain above potential in 2023 in many advanced economies, including the United States and the euro area.[5]

In the *United States*, growth is expected to rise from 2.3 percent in 2017 to 2.9 percent in 2018, before moderating slightly to 2.7 percent in 2019 (0.6 and 0.8 percentage point stronger than projected for 2018 and 2019, respectively, in the October WEO). The upward revision reflects stronger-than-expected activity in 2017, firmer external demand, and the expected macroeconomic impact of the December 2017 tax reform—particularly lower corporate tax rates and the temporary allowance for full expensing of investment, which is anticipated to stimulate short-term activity. The revision also reflects higher public spending following the February 2018 bipartisan budget agreement. Fiscal policy changes are projected to add to growth through 2020, so that US real GDP is 1.2 percent higher by 2020 than in a projection without the tax policy changes. Given the increased fiscal deficit, which will require adjustment down the road, and the temporary nature of some provisions, growth is expected to be lower than in previous forecasts for a few years from 2022 onward, offsetting some of the earlier growth gains.

The above-trend growth rates of the *euro area* and *Japan*—important contributors to the long-awaited strengthening of economic activity in advanced economies—are expected to continue during 2018–19. The recovery in the *euro area* is projected to pick up slightly from 2.3 percent in 2017 to 2.4 percent this year, before moderating to 2 percent in 2019. The forecast is higher than in the October WEO by 0.5 and 0.3 percentage point for 2018 and 2019, respectively, reflecting stronger-than-expected domestic demand across the currency area, supportive monetary policy, and improved external demand prospects. Medium-term growth in the *euro area* is projected at 1.4 percent, held back by low productivity amid weak reform efforts and unfavorable demographics. *Japan*'s growth is projected to moderate to 1.2 percent in 2018 (from a strong above-trend outturn of 1.7 percent in 2017) before slowing further to 0.9 percent in 2019. The upward revision of 0.5 percentage point in 2018 and 0.1 percentage point in 2019 relative to the October WEO reflects more favorable external demand prospects, rising private investment, and the supplementary budget for 2018. Japan's medium-term prospects, however, remain weak, owing largely to a shrinking labor force.

Emerging Market and Developing Economies

Growth in emerging market and developing economies is expected to increase further—from 4.8 percent in 2017 to 4.9 percent in 2018 and 5.1 percent in 2019 (Table 1.1). Although the high growth rate reflects primarily continued strong economic performance in emerging Asia, the projected pickup in growth reflects improved prospects for commodity exporters after three years of very weak economic activity. Growth forecast revisions were positive for 2019: 0.1 percentage point for the aggregate, with the largest positive revisions for emerging Europe and Latin America. Beyond 2019, growth in emerging market and developing economies is projected to stabilize at about 5 percent over the medium term. This reflects some modest further strengthening in economic growth in commodity exporters, though to rates much more modest than over the past two decades; a steady decline in China's growth rate to a level that is still well above the emerging market and developing economy average; a gradual increase in India's growth rate as structural reforms raise poten-

[4] The temporary full expensing of investment implies more investment up front, but less investment down the road; see Box 1.5.

[5] Box 1.7 discusses in more detail the outlook for individual advanced economies.

tial output; and continued strong growth in other commodity importers.[6]

Emerging Asia, which is forecast to continue growing at about 6½ percent during 2018–19, remains the most important engine of global growth. In *China*, growth is projected to soften slightly from 6.9 percent in 2017 to 6.6 percent in 2018 and 6.4 percent in 2019. The forecast is higher (by 0.1 percentage point in both 2018 and 2019) relative to the October WEO, reflecting an improved external demand outlook. Over the medium term, the economy is projected to continue rebalancing away from investment toward private consumption and from industry to services, but nonfinancial debt is expected to continue rising as a share of GDP, and the accumulation of vulnerabilities clouds the medium-term outlook. Growth in *India* is projected to increase from 6.7 percent in 2017 to 7.4 percent in 2018 and 7.8 percent in 2019 (unchanged from the October WEO), lifted by strong private consumption as well as fading transitory effects of the currency exchange initiative and implementation of the national goods and services tax. Over the medium term, growth is expected to gradually rise with continued implementation of structural reforms that raise productivity and incentivize private investment.

Growth in emerging and developing Europe, now estimated at close to 6 percent in 2017, is projected to moderate to 4.3 percent in 2018 and 3.7 percent in 2019, supported by a favorable external environment with easy financial conditions and stronger export demand from the euro area and, for *Turkey*, an accommodative policy stance.

A gradual growth recovery continues in Latin America and the Caribbean, a region severely affected by the 2014–16 decline in commodity prices; growth is forecast to rise to 2.0 percent in 2018 and 2.8 percent in 2019. Following a deep recession in 2015–16, *Brazil*'s economy returned to growth in 2017 (1.0 percent) and is expected to improve to 2.3 percent in 2018 and 2.5 percent in 2019, buoyed by stronger private consumption and investment. Medium-term growth is set to moderate to 2.2 percent, weighed down by population aging and stagnant productivity.

Improved oil export revenue, stronger business confidence, and looser monetary policy helped *Russia*'s economy return to growth in 2017. Real GDP is projected to increase 1.7 percent this year, before moderating slightly to 1.5 percent through the rest of the projection horizon, weighed down by structural headwinds and the effect of sanctions on investment.

Growth in the Middle East, North Africa, Afghanistan, and Pakistan region is also expected to pick up in 2018 and 2019, but remains subdued at about 3½ percent. While stronger oil prices are helping a recovery in domestic demand in oil exporters, including *Saudi Arabia*, the fiscal adjustment that is still needed is projected to weigh on growth prospects.

Growth in sub-Saharan Africa is also projected to rise gradually during 2018–19 to 3.4 percent and 3.7 percent, respectively, as the challenging outlook in commodity exporters gradually improves. Growth in *South Africa* is expected to strengthen from 1.3 percent in 2017 to 1.5 percent in 2018 and 1.7 percent in 2019 (stronger than in the October WEO by 0.4 and 0.1 percentage point, respectively, for 2018 and 2019). Business confidence is likely to gradually firm up with the change in the political leadership, but growth prospects remain weighed down by structural bottlenecks. The medium-term outlook is subdued, with growth expected to stabilize at 1.8 percent over 2020–23.

Inflation Outlook

With supply effects and stronger demand putting upward pressure on commodity prices—and a strengthening global outlook narrowing output gaps—headline inflation is picking up, and core inflation is expected to rise gradually as wage dynamics start reflecting tighter labor markets.[7]

As shown in Table 1.1, headline inflation rates in advanced economies are projected to pick up to about 2 percent in 2018–19 (0.3 percentage point higher for 2018 than in the October WEO) from 1.7 percent in 2017, mostly as above-trend growth and closing output gaps add to price pressures.

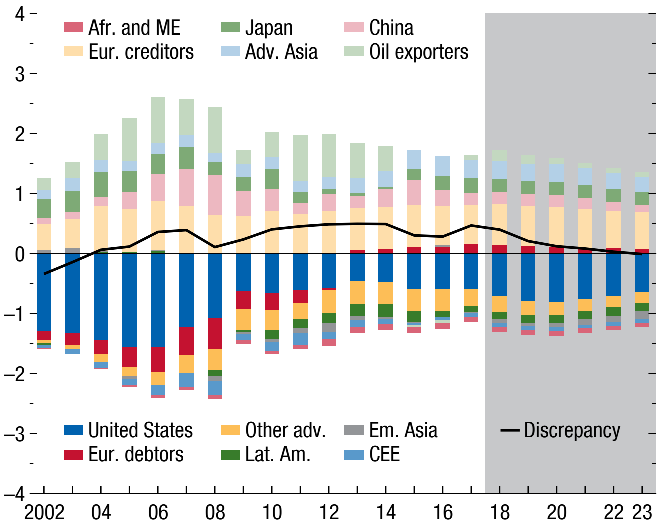
Core consumer price inflation (CPI)—excluding fuel and food prices—is expected to vary across the advanced economy group. In the *United States*, where output is set to rise above potential following the expected sizable fiscal expansion, core CPI is projected to increase from 1.8 percent in 2017 to 2 percent in 2018 and 2.5 percent in 2019, before declining to 2.3 percent over the medium term.

[6]Box 1.8 discusses in more detail the outlook for individual emerging market and developing economies.

[7]See Box 1.9 for details of the inflation outlook for individual countries.

Figure 1.16. Global Current Account Balance
(Percent of world GDP)

Current account balances are expected to remain broadly at their 2017–18 levels over the medium term.



Source: IMF staff estimates.
Note: Adv. Asia = advanced Asia (Hong Kong SAR, Korea, Singapore, Taiwan Province of China); Afr. and ME = Africa and the Middle East (Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Jordan, Kenya, Lebanon, Morocco, South Africa, Sudan, Tanzania, Tunisia); CEE = central and eastern Europe (Belarus, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, Turkey, Ukraine); Em. Asia = emerging Asia (India, Indonesia, Pakistan, Philippines, Thailand, Vietnam); Eur. creditors = European creditors (Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland); Eur. debtors = European debtors (Cyprus, Greece, Ireland, Italy, Portugal, Spain, Slovenia); Lat. Am. = Latin America (Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay); Oil exporters = Algeria, Azerbaijan, Iran, Kazakhstan, Kuwait, Nigeria, Oman, Qatar, Russia, Saudi Arabia, United Arab Emirates, Venezuela; Other adv. = other advanced economies (Australia, Canada, France, Iceland, New Zealand, United Kingdom).

The Federal Reserve's preferred measure—core personal consumption expenditure price inflation—is projected to increase to 1.7 percent in 2018 and 2.2 percent in 2019 (from 1.5 percent in 2017). In the *euro area*, with growth projected at above-trend rates over 2018–19, core CPI is expected to increase from 1.1 percent in 2017 to 1.2 percent in 2018 and 1.7 percent in 2019. Core CPI is projected to gradually increase to 2 percent by 2021 as output gaps narrow across the currency area and inflation expectations strengthen. In the *United Kingdom*, core CPI is expected to increase from 2.4 percent in 2017 to 2.5 percent this year, before moderating to 2.2 percent in 2019 (and further to 2 percent over the medium term) as interest rate hikes and the withdrawal of monetary support proceeds.

Excluding Venezuela (where inflation this year and next is expected to exceed 10,000 percent), headline inflation in emerging market and developing economies is expected to increase to 4.6 percent this year, from 4.0 percent in 2017. The projection for 2018 is stronger by 0.2 percentage point relative to the October WEO. In 2019 and beyond, inflation is expected to moderate to about 4.0 percent as energy prices stabilize and output gaps close. Compared with advanced economies, there is considerable diversity in inflation rates among emerging market and developing economies, reflecting heterogeneity in cyclical positions, central bank credibility, and inflation targets.

External Sector Outlook

Current Account Positions

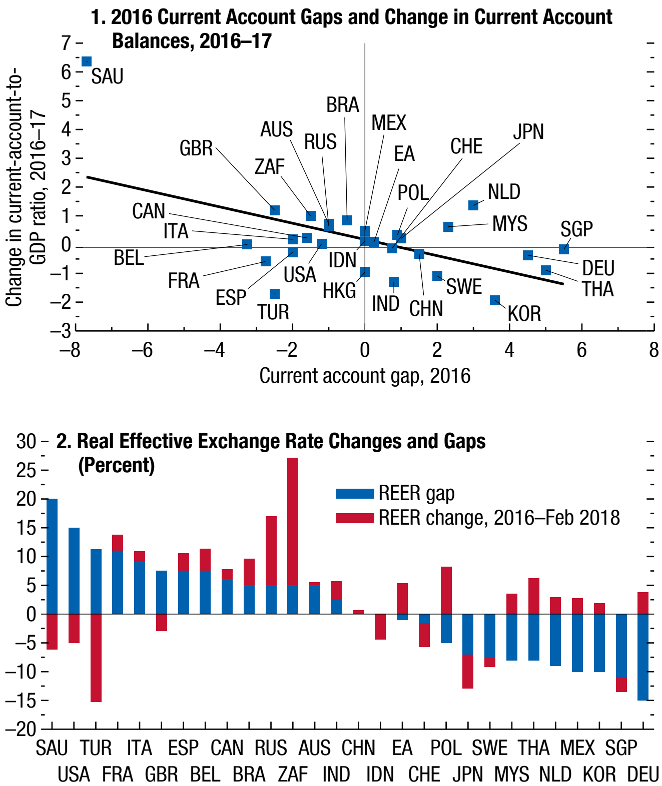
Current account balances in 2017, on the whole, have remained broadly stable compared with their 2016 levels (Figure 1.16). The most notable change has been an improvement in the current account balance of oil exporters (close to 3 percent of their GDP), reflecting a partial recovery in their export prices.

Forecasts for 2018 and 2019 indicate some further improvement in the current account balances of oil exporters (as average oil prices are projected to exceed those in 2017), as well as a widening of the US current account deficit, driven by expansionary fiscal policy (partially offset by stronger external demand). Over the medium term, current account balances are projected to remain broadly stable at their 2017–18 levels, with some narrowing of the US current account deficit as the expansionary effects of fiscal policy fade, mirrored by some narrowing of surpluses in China and to a lesser extent in Europe.

As highlighted in the IMF's 2017 *External Sector Report*, current account imbalances in 2016 were too large in relation to country-specific norms consistent with underlying fundamentals and desirable policies. As shown in the first panel of Figure 1.17, current account balances in 2017 moved in a direction consistent with some reduction in those excess imbalances, with medium-term current account projections suggesting a further reduction. However, the projected changes in current account balances for some of the world's largest economies suggest only a modest narrowing of imbalances (for example, Germany) or some widening (for example, the United States).

Figure 1.17. Real Exchange Rates and Current Account Balances in Relation to Economic Fundamentals

In 2017, current account balances moved modestly in directions consistent with reducing 2016 excess imbalances. Relative to 2016, real effective exchange rates have also moved slightly in a direction consistent with narrowing 2016 exchange rate gaps.

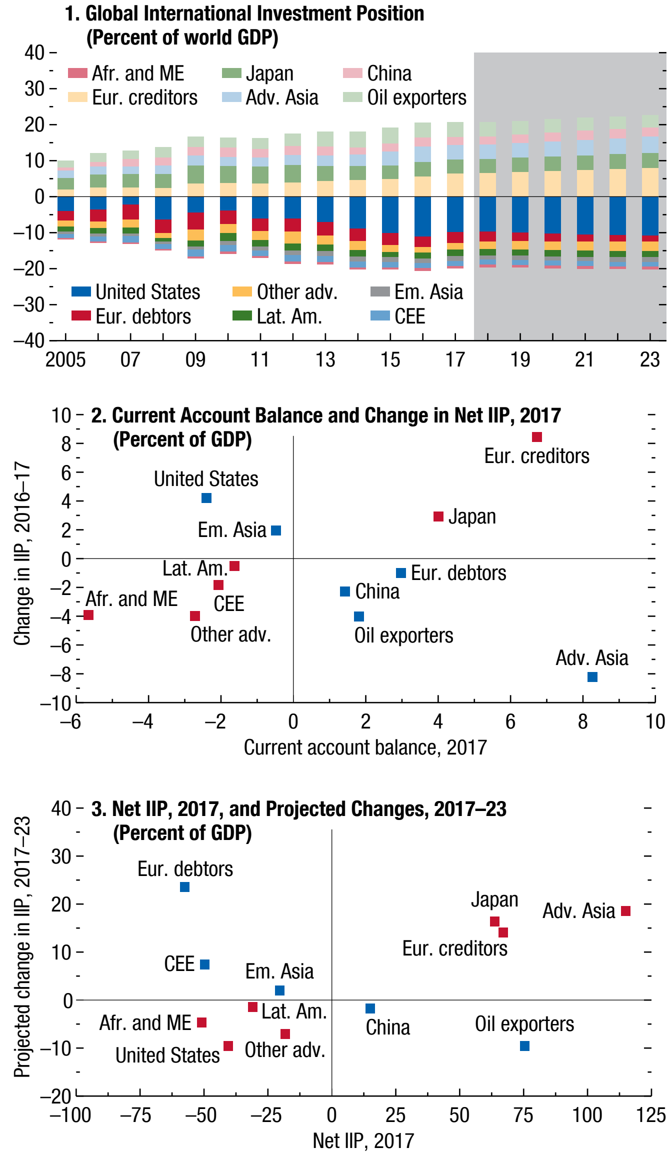


Source: IMF staff calculations.
Note: Data labels use International Organization for Standardization (ISO) country codes. EA = euro area; REER = real effective exchange rate.

Panel 2 of Figure 1.17 shows changes in real effective exchange rates between 2016 and their levels as of February 2018, together with the exchange rate gaps for 2016 identified in the 2017 *External Sector Report*. Real effective exchange rates have also, on average, moved modestly in a direction consistent with a narrowing of the 2016 gaps. Of course, changes in macroeconomic fundamentals since 2016 have affected not only real exchange rates and current account balances, but also their equilibrium value. An example is the strengthening of the terms of trade for most commodity exporters, which is reflected in their real appreciations depicted in panel 2. The 2018 *External Sector Report* will discuss how changes in fundamentals and desirable policies have affected the

Figure 1.18. Net International Investment Position

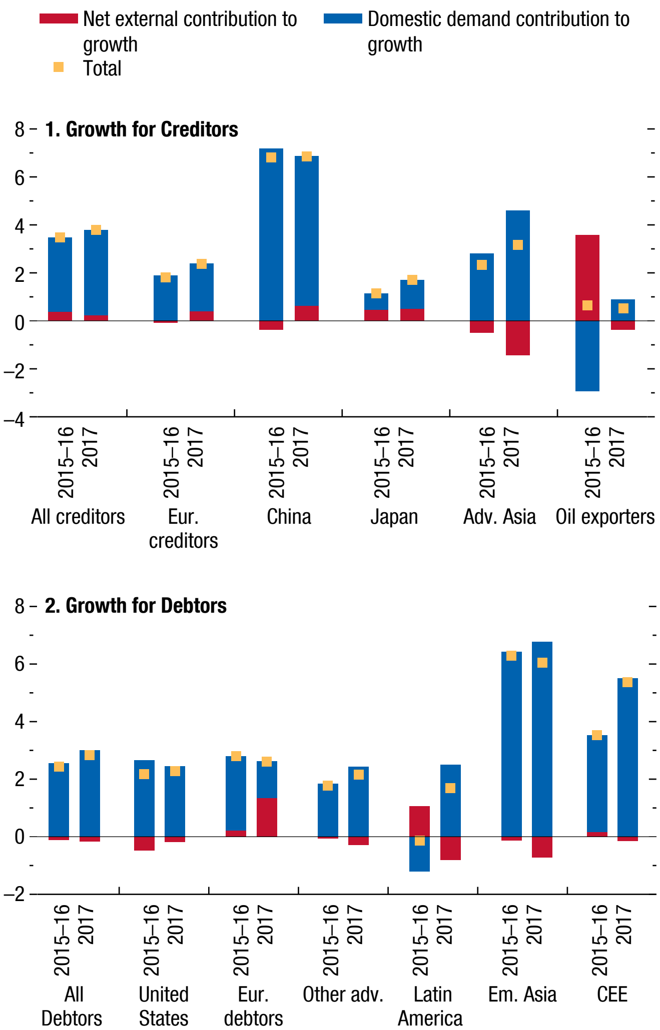
Creditor and debtor net international investment positions are projected to widen slightly over the medium term.



Source: IMF staff estimates.
Note: Adv. Asia = advanced Asia (Hong Kong SAR, Korea, Singapore, Taiwan Province of China); Afr. and ME = Africa and the Middle East (Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Jordan, Kenya, Lebanon, Morocco, South Africa, Sudan, Tanzania, Tunisia); CEE = central and eastern Europe (Belarus, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, Turkey, Ukraine); Em. Asia = emerging Asia (India, Indonesia, Pakistan, Philippines, Thailand, Vietnam); Eur. creditors = European creditors (Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland); Eur. debtors = European debtors (Cyprus, Greece, Ireland, Italy, Portugal, Spain, Slovenia); IIP = international investment position; Lat. Am. = Latin America (Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay); Oil exporters = Algeria, Azerbaijan, Iran, Kazakhstan, Kuwait, Nigeria, Oman, Qatar, Russia, Saudi Arabia, United Arab Emirates, Venezuela; Other adv. = Other advanced economies (Australia, Canada, France, Iceland, New Zealand, United Kingdom).

Figure 1.19. Growth for Creditors and Debtors
(Percent)

Growth in domestic demand was faster in creditor countries than in debtor countries in 2017, but the contribution of net external demand remained positive in creditor countries and negative in debtor countries.



Source: IMF staff calculations.
Note: Adv. Asia = advanced Asia (Hong Kong SAR, Korea, Singapore, Taiwan Province of China); CEE = central and eastern Europe (Belarus, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, Turkey, Ukraine); Em. Asia = emerging Asia (India, Indonesia, Pakistan, Philippines, Thailand, Vietnam); Eur. creditors = European creditors (Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland); Eur. debtors = European debtors (Cyprus, Greece, Ireland, Italy, Portugal, Spain, Slovenia); Latin America = Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay; Other adv. = other advanced economies (Australia, Canada, France, Iceland, New Zealand, United Kingdom); Oil exporters = Algeria, Azerbaijan, Iran, Kazakhstan, Kuwait, Nigeria, Oman, Qatar, Russia, Saudi Arabia, United Arab Emirates, Venezuela.

assessment of excess current account imbalances and exchange rate gaps for 2017.

International Investment Positions

Changes in international investment positions reflect both net financial flows and valuation changes arising from fluctuations in exchange rates and asset prices. As panel 1 in Figure 1.18 shows, over the next five years, creditor and debtor positions as a share of world GDP are projected to widen slightly. On the creditor side, this widening is explained primarily by the growing creditor positions of a group of European advanced economies—a result of large projected current account surpluses. On the debtor side, this reflects some increase in the debtor position of the United States and other advanced economies (a group including Canada, France, and the United Kingdom, among others), partially offset by a decline in the debtor position of euro area debtor countries.[8]

Similar trends are highlighted in panel 3 of Figure 1.18, which shows the projected changes in net international investment positions in percent of domestic GDP across countries and regions between 2017 and 2023 (the last year of the WEO projection horizon). The creditor positions in advanced European economies and Japan are projected at or above 80 percent of their GDP, while the debtor position of the United States is projected to reach 50 percent of GDP. One notable change is the reduction in net international investment position liabilities of a group of euro area debtor countries, including Italy and Spain, which are expected to fall by more than 20 percentage points of their GDP.

Domestic and External Contributions to GDP Growth

Another way to look at the prospects for global rebalancing is to examine the domestic and external contributions to GDP growth in creditor and debtor countries.

Growth in domestic demand was faster in creditor countries than in debtor countries in 2017, as in previous years, primarily reflecting high growth in

[8]Valuation changes can affect the evolution of these positions. For instance, between the end of 2016 and the end of 2017, the US net international investment position improved despite the US current account deficit, given the depreciation of the US dollar over this period, which increased the domestic currency value of foreign currency assets held by US residents (Figure 1.18, panel 2).

China (Figure 1.19). At the same time, the net external contribution to growth was again positive for creditors, driven this time by positive contributions from China, creditor Europe, and Japan. In contrast to the two previous years, the net external contribution to growth in oil exporters was instead negative, reflecting subdued export volumes and a recovery in imports after two years of severe contraction. Among debtor countries, the net external contribution to growth was strong and positive for euro area debtor countries but remained slightly negative for the United States in 2017 and is projected to become more negative in 2018 because of expansionary fiscal policy.

Predicted changes in global macroeconomic policies, together with their potential exchange rate repercussions, could lead flow imbalances to widen again—even further than currently anticipated (should, for instance, the dollar appreciate sharply on expectations of faster tightening of US monetary policy).[9] Stronger reliance on demand growth in some creditor countries, especially those with policy space to support it, such as Germany, would help facilitate domestic and global rebalancing while sustaining world growth over the medium term. In the US economy, which is already close to full employment, a medium-term plan to reverse the rising ratio of public debt, accompanied by fiscal measures to gradually boost domestic capacity along with demand, would help ensure more sustainable growth dynamics while helping contain external imbalances.

Risks

The balance of risks to the near-term forecasts remains two-sided and broadly balanced. The potential for upside growth surprises remains. Business and consumer confidence stayed strong through mid-February, and high-frequency indicators suggest that growth is likely to maintain a solid pace in the months ahead. Expectations of stronger business profitability could lead firms to expand their investment and hiring plans, as slack in labor markets may be larger than currently assessed (Chapter 2 of the October 2017 WEO). Furthermore, the ongoing recovery in investment could foster a rebound in productivity, implying higher potential growth in the period ahead. In turn, an acceleration in potential output would expand the scope for demand to rise before it hits capacity constraints and generates inflation pressure.

On the downside, the early February 2018 market turbulence and the equity market correction in March following the US tariff announcement on steel and aluminum and a range of Chinese products, as well as the announcement by China of retaliatory tariffs on imports from the US, serve as a cautionary reminder that asset prices can correct rapidly and trigger potentially disruptive portfolio adjustments. Although volatility is slightly higher than the pre-February episode lows, and term premiums are not as tightly compressed as they were in the fall, global financial conditions remain highly supportive. A more severe version of the early February episode—financial conditions tighten suddenly, triggered, for instance, by a faster pickup in inflation in the United States—remains a possibility. Depending on the magnitude of the repricing and the extent to which volatility is affected, this could temper the pickup in global demand (Scenario Box 1). In this context, a worsening of trade tensions and the imposition of broader barriers to cross-border trade would not only take a direct toll on economic activity (as shown in Scenario Box 1 of the October 2016 WEO) but would also weaken confidence, with further adverse repercussions.

Beyond the next few quarters, risks to the growth outlook are skewed to the downside. Concerns include a possible buildup of financial vulnerabilities as financial conditions remain easy; an erosion of support for global economic integration that could spur an inward shift in policies; and a host of noneconomic risks, including geopolitical strains, political discord, and climate shocks. The risks are interlinked: if one materializes, it could trigger the others. For example, a shift toward inward-looking policy approaches to cross-border flows of goods, capital, and labor can add to geopolitical tensions and global risk aversion, and noneconomic shocks can weigh on short-term economic activity and on confidence in the longer-term outlook, limiting appetite for investment. The resulting negative impact on growth could be severe, considering that there would be less room to cut interest rates or increase public spending to combat downturns than in the past.

Financial Vulnerabilities

The recent bout of turbulence in financial markets does not eliminate the possibility that financial

[9]The WEO assumes that real effective exchange rates remain broadly stable at the level of the reference period (in this case, February 2018).

conditions will remain accommodative into the medium term, with vulnerabilities building amid a search for yield. As discussed in the April 2018 GFSR, financial conditions are broadly unchanged relative to the fall, even as the US Federal Reserve has raised the policy interest rate and continued to allow a gradual contraction of its bond holdings. As noted in the October 2017 and April 2018 GFSR, investors have moved into riskier asset classes to counteract the low returns of more traditional securities. At the same time, the share of companies with low investment-grade ratings in advanced economy bond indices has increased significantly. Corporate debt remains high in some emerging markets—in some cases with a high reliance on funding sources outside traditional banking relationships. Tighter regulation of nonbank intermediation in China, where nonfinancial corporate sector debt is still rising, is a welcome start of a needed policy response to contain the accumulation of vulnerabilities.

Credit risk may be contained while global growth momentum is strong and borrowing rates are low, but it could come to the fore over the medium term, exposing financial fragility. An eventual global repricing of risk could be triggered by various shifts, including a broad-based pickup in inflation. The US economy operating above potential output amid temporary tax cuts could require faster-than-expected tightening of US monetary policy, which could lead to a rise in term premiums and debt service costs. Depending on its timing, the drag from such tightening of financial conditions could coincide with softer US demand following the reversal of tax cuts, which would amplify its negative international spillovers.

Even as the health of banking systems continues to improve, policies still have a key role to play in managing risks in both the bank and the nonbank financial sectors. Against this backdrop, a broad rollback of stronger financial regulation and oversight since the global financial crisis—both nationally and internationally—could facilitate excessive risk taking, with negative repercussions for global financial stability.

Finally, among emerging potential sources of financial tension, if the recent rapid growth of crypto assets is maintained and draws in larger institutional investors, the linkages with the broader financial system are likely to expand and may create new sources of financial stability risk. More broadly, cybersecurity breaches and cyberattacks on financial architecture could undermine international payment systems and disrupt the flow of goods and services.

Waning Support for Global Integration

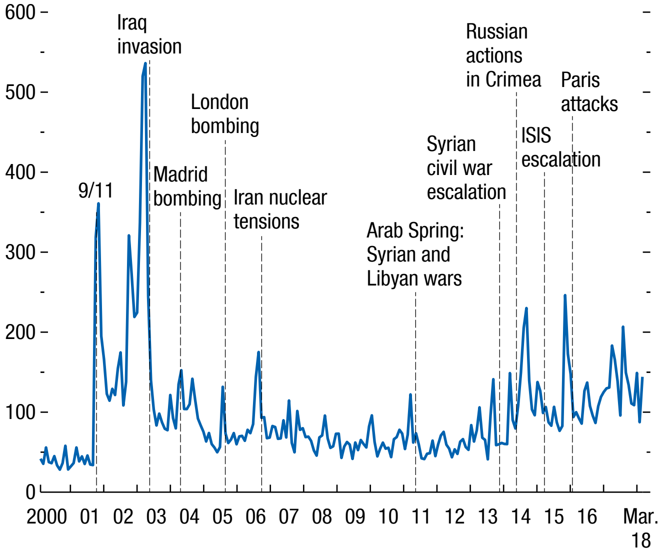
The Comprehensive and Progressive Agreement for Trans-Pacific Partnership—covering 11 countries accounting for approximately 15 percent of global trade—and the announced signing of the agreement to establish the Continental Free Trade Area, which would cover all of Africa, represent encouraging progress on plurilateral trade integration. At the same time, support for globalization appears to have weakened in some advanced economies. Free-trade agreements such as NAFTA and the economic arrangements between the United Kingdom and rest of the European Union are being renegotiated. The United States recently increased tariffs on imported solar panels and washing machines, and announced tariff actions on steel and aluminum and a range of Chinese products, while China announced retaliatory tariffs on imports from the US. An increase in tariffs and nontariff trade barriers could harm market sentiment, disrupt global supply chains, and slow the spread of new technologies, reducing global productivity and investment (Box 1.6 documents a rise in trade-restricting measures in G20 economies in recent years). Greater protectionism would also lower consumer welfare by making tradable consumer goods more expensive. Scenario analysis (IMF 2016a, Box 1) indicates that rising protectionism in all countries—leading to a 10 percent increase in import prices everywhere—lowers global output and consumption by about 1 ¾ percent after 5 years and close to 2 percent in the long term, while global investment and trade fall by even more. Moreover, curbs on immigration would prevent aging societies from effectively counteracting trend declines in the labor force growth rates. Widening external imbalances in some countries, including the United States—where the current account deficit is poised to increase given the projected impact of fiscal stimulus on domestic demand—could add to protectionist pressure. Increased trade tensions also make it more difficult for countries to deal cooperatively with international disruptions or shocks.

Noneconomic Factors

The medium-term global outlook remains clouded by geopolitical tensions (Figure 1.20), notably in east

Figure 1.20. Geopolitical Risk Index
(Index)

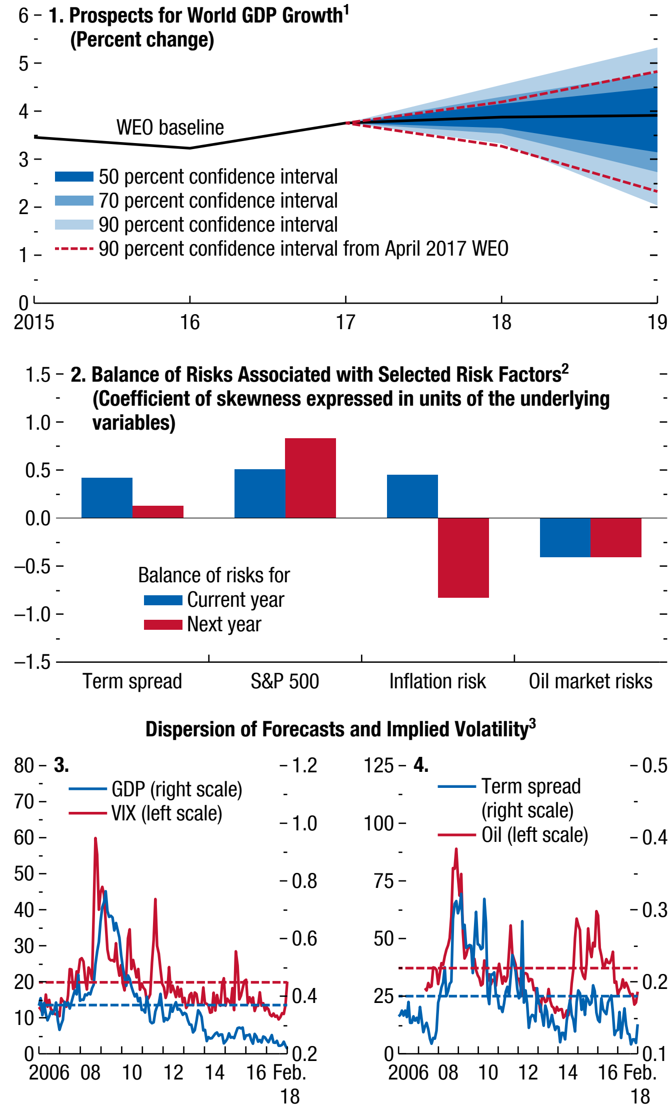
Geopolitical risks remain elevated.



Source: Caldara and Iacoviello (2017).
Note: ISIS = Islamic State.

Figure 1.21. Risks to the Global Outlook

The risks around the central growth forecast are two-sided and broadly even over 2018–19.



Sources: Bloomberg Finance L.P.; Chicago Board Options Exchange (CBOE); Consensus Economics; Haver Analytics; and IMF staff estimates.
[1]The fan chart shows the uncertainty around the April 2018 *World Economic Outlook* (WEO) central forecast with 50, 70, and 90 percent confidence intervals. As shown, the 70 percent confidence interval includes the 50 percent interval, and the 90 percent confidence interval includes the 50 and 70 percent intervals. See Appendix 1.2 of the April 2009 WEO for details. The 90 percent intervals for the current-year and one-year-ahead forecasts from the April 2017 WEO are shown.
[2]The bars depict the coefficient of skewness expressed in units of the underlying variables. The values for inflation risks and oil market risks enter with the opposite sign since they represent downside risks to growth.
[3]GDP measures the purchasing-power-parity-weighted average dispersion of GDP growth forecasts for the Group of Seven economies (Canada, France, Germany, Italy, Japan, United Kingdom, United States), Brazil, China, India, and Mexico. VIX is the CBOE Standard & Poor's (S&P) 500 Implied Volatility Index. Term spread measures the average dispersion of term spreads implicit in interest rate forecasts for Germany, Japan, the United Kingdom, and the United States. Oil is the CBOE crude oil volatility index. Forecasts are from Consensus Economics surveys. Dashed lines represent the average values from 2000 to the present.

Asia and the Middle East. For many countries already severely affected by conflict or its spillovers, the central forecast assumes a gradual easing of strains; more protracted resolution of tensions would delay recovery in these economies.[10]

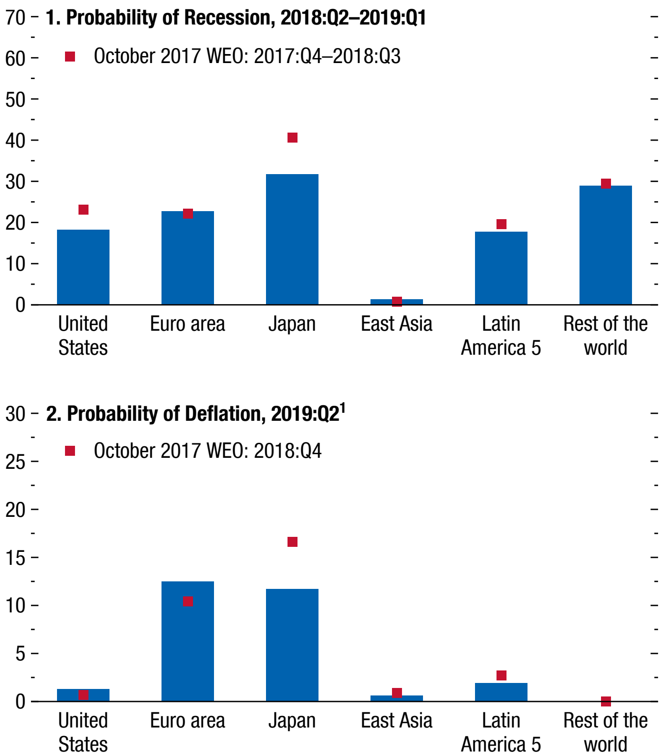
Political uncertainty also gives rise to reform implementation risks or the possibility of reoriented policy agendas, including in the context of upcoming elections or their immediate aftermath in several countries (such as Brazil, Colombia, Italy, and Mexico). Weak governance and large-scale corruption can also undermine confidence and popular support for reforms, taking a toll on economic activity.

Finally, recent extreme weather developments point to the risk of recurrent severe climate events that impose devastating humanitarian costs and economic losses on the affected regions. They may also add to migration flows that could destabilize recipient countries.

[10]Recent research shows that higher geopolitical tensions can weigh on global activity. See, for instance, Caldara and Iacoviello (2017).

Figure 1.22. Recession and Deflation Risks
(Percent)

For most regions, recession and deflation risks over a four-quarter horizon have declined since last fall.



Source: IMF staff estimates.
Note: East Asia comprises China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China, and Thailand; Latin America 5 comprises Brazil, Chile, Colombia, Mexico, and Peru; Rest of the world comprises Argentina, Australia, Bulgaria, Canada, Czech Republic, Denmark, Israel, New Zealand, Norway, Russia, South Africa, Sweden, Switzerland, Turkey, the United Kingdom, and Venezuela. October 2017 WEO data refer to simulations run in September 2017. WEO = *World Economic Outlook*.
[1]Deflation risk is measured by the four-quarter-ahead probability of deflation occurring together with a negative output gap.

Fan Chart Analysis

A fan chart analysis—based on equity and commodity market data, as well as the dispersion of inflation and term spread projections of private forecasters—shows that uncertainty around the central growth forecast is broadly even, but wider than a year ago (Figure 1.21). The increase is chiefly due to greater dispersion of views about future inflation and oil prices. Continued subdued inflation despite stronger demand appears to have contributed to a divergence in analysts' views about its future behavior. The wider spread of oil price forecasts seems to reflect, in part, differing views on the causes and likely persistence of the recent pickup in prices.

With stronger growth, the probability of a recession over a four-quarter horizon (2018:Q2–2019:Q1) has declined in most regions relative to the probability computed in the October 2017 WEO (Figure 1.22). At the same time, medium-term risks to growth remain salient. As discussed in the April 2018 GFSR, Growth-at-Risk analysis suggests that easy financial conditions imply some upside risk to short-term growth but pose risks to medium-term growth that are well above historical norms. Deflation risks—as measured by the four-quarter-ahead probability of deflation in the second quarter of 2019, occurring together with a negative output gap—have generally declined. In the euro area, the joint probability of four-quarter headline inflation turning negative in the second quarter of 2019 and a negative output gap in the same quarter, which is just above 10 percent, has risen modestly because of the base effect of a peak in oil prices in early 2018 and their subsequent decline.

Policy Priorities

As discussed in the "Recent Developments and Prospects" section, the current recovery is the broadest synchronized upsurge in global activity in close to a decade. Domestic and multilateral policies have a vital role to play in ensuring that the momentum is sustained, remaining output gaps close, and inflation expectations are well anchored. The strength of short-term economic activity provides an opportunity to start rebuilding fiscal buffers where needed and allows for more policy focus on other medium- and long-term priorities: boosting potential growth, reducing inequality, strengthening financial resilience, and coping with climate change.

Policies—Advanced Economies

Monetary Policy: Divergence Warranted by Differences in the State of the Cycle

The upswing in activity across advanced economies has lifted job creation, lowered unemployment rates, and narrowed output gaps. In most advanced economies, however, nominal wage growth and core inflation remain subdued, and market expectations of future inflation point to a slow convergence path back to central bank targets. Set against the backdrop of many years of subpar growth and low inflation, macroeconomic conditions in advanced economies generally call for continued monetary accommodation.[11] However, if output is close to potential and inflation is rising toward target, a gradual withdrawal of monetary support is warranted.

Continued monetary support is needed in the *euro area* and *Japan* until inflation durably increases toward central bank targets. The unemployment rate in the *United Kingdom* is close to historic lows; further declines could add to inflation pressure by triggering faster wage growth in a context of inflation that is already above target following currency depreciation after the June 2016 Brexit referendum. Gradual monetary tightening is therefore needed to ensure that inflation returns to target and expectations remain anchored. Similarly, unemployment rates in the *United States* have, over the past year, approached lows last seen in the 1990s, and there are nascent signs of a pickup in wages. With the economy already likely at potential, the December 2017 tax code overhaul and the February 2018 budget agreement could significantly stimulate activity and stoke wage and price pressures—in which case a faster withdrawal of monetary support may be needed. Overall, this highlights the need for data-dependent monetary policy normalization and the continued crucial role of communications in ensuring a smooth adjustment.

Fiscal Policy: Rebuild Buffers and Focus on Medium-Term Objectives

The cyclical recovery affords an opportunity to orient fiscal policy more firmly toward medium-term goals (see also Chapter 1 of the April 2018 *Fiscal Monitor*). In countries with little fiscal space, where a gradual strengthening of fiscal buffers is warranted, consolidation should proceed hand-in-hand with a shift in budget composition toward areas that lift potential output growth, while also remaining mindful of reducing inequality and improving the welfare of the most vulnerable. Doing so would help sovereign debt ratios remain sustainable, rebuild fiscal policy space to counter future downturns, and leave these economies better positioned to address long-term fiscal challenges stemming from aging-related health and pension outlays. The pace of consolidation should be calibrated to the strength of the recovery and avoid sharp drags on growth.

Countries with fiscal space should raise potential output and productivity by enhancing workforce skills, including in the area of digital literacy. These countries should improve infrastructure where needed and—where aging is expected to exert a significant drain on labor supply—should boost labor force participation through stronger family-friendly policies, reconsideration of labor taxation, actuarially fair pension systems, and labor market matching enhanced by more efficient active labor market programs (as discussed in Chapter 2).

In the *euro area*, several countries have exhausted their fiscal space and should gradually consolidate in as growth-friendly and evenly phased a manner as possible to rebuild buffers. In *Italy* and *Spain*, for example, high sovereign debt ratios together with unfavorable demographic trends call for an improvement in the structural primary balance to put debt firmly on a downward path. By contrast, *Germany* has fiscal space that should be used to increase public investment in areas that will lift potential growth by improving productivity and increasing the labor force participation of women and recent immigrants. These areas include enhancing digital infrastructure, child care and after-school programs, and the training and integration of refugees into the workforce. An important by-product of more public investment in Germany would be higher imports from the rest of the euro area, which would facilitate rebalancing of demand within the common currency area.

In *Japan*, a premature drop in the level of fiscal support should be avoided so as to sustain growth and promote structural reforms. The debt trajectory needs to be anchored by a credible medium-term fiscal consolidation plan, which should include a streamlining of health, pension, and long-term care benefits together with gradual and steady increases in the consumption tax rate starting in 2019.

The recently legislated tax code overhaul and bipartisan agreement on the federal budget in the *United States* will further add to rising fiscal deficits and unsustainable debt dynamics over the next five years. It

[11]As discussed in Chapter 2 of the October 2017 WEO there may be greater slack in labor markets than is captured by headline unemployment rates.

is therefore imperative to ensure higher future revenues and take measures to gradually curb the dynamics of public spending while shifting its composition toward much-needed improvements in infrastructure, poverty-alleviating measures, and policies to strengthen labor force participation.

Financial Sector Policies: Complete Balance Sheet Cleanup, Increase Resilience to Shocks

As discussed in the "Risks" section, a range of triggers could ignite financial tensions in global markets and undermine global growth prospects. In advanced economies, the postcrisis financial regulatory reform and balance sheet cleanup has improved institution-specific and system-wide resilience in financial sectors, but a few pockets of weakness remain. Fortifying these segments and, more broadly, avoiding a rollback of the regulatory reforms are essential for containing financial vulnerabilities.

In the euro area, continued progress on reducing nonperforming loans is essential for shedding crisis legacies and lifting an important constraint on credit intermediation (notably in *Greece, Italy,* and *Portugal*). More generally, there is a need to improve banks' cost efficiency and profitability, which will require proactive supervision and consolidation in overbanked economies. Appropriate and predictable use of creditor bail-ins and precautionary recapitalizations will be vital for reducing uncertainty and counterparty risk in situations of financial stress as well as for limiting the burden placed on taxpayers. For the whole currency area, completing the banking union remains a priority for placing the financial system on a stronger footing.

In *Japan,* the prolonged low-interest-rate environment and demographic headwinds have gradually weakened the profitability of financial institutions, particularly among regional banks. Increasing fee-based income and diversifying revenue sources, together with consolidation and rationalization, should help boost profitability.

In the *United States*, recent simplifications of regulations on medium-sized banks are warranted and unlikely to increase systemic risk. Broad-based deregulation that would loosen constraints on larger banks should, however, be avoided because it could once again encourage excessive risk taking and leave the financial system vulnerable to disruptive corrections. Continued efforts to improve financial literacy and protect consumers remain essential for preserving financial stability.

Structural Policies: Boost Potential Growth and Ensure that Benefits Are Shared Widely

Once output gaps close and advanced economies complete their cyclical recovery, the pace of expansion is set to moderate toward subdued potential growth over the medium term. Rising inequality and income polarization also threaten medium-term growth prospects by fueling support for inward-looking policies and could harm health and education outcomes among the affected groups.

In the *United States*, policy measures that can help lift potential output growth include public investment to augment infrastructure and maintain the quality of the existing stock; improvements in the efficiency of education spending; and more support for vocational apprenticeships, reskilling, and lifelong learning programs. According to the US Congressional Joint Committee on Taxation, the tax code overhaul is projected to reduce the average tax rate on upper-income US households relative to those in the middle and lower segments, especially over the medium term (when some provisions benefiting lower- and middle-income taxpayers expire), thus increasing income polarization.[12] Measures that can raise labor force participation and arrest income polarization include a larger Earned Income Tax Credit, expanded child tax credits, means-tested tax relief for lower-income working families for childcare-related expenses, and reform of the disability insurance program to encourage part-time work over disengagement from the labor force.

Relatively low total factor productivity growth and a trend decline in the labor force are key factors weighing on potential output growth in *Japan*. Raising productivity will require reforming the labor market to increase efficiency (for instance, with contracts that strike a better balance between job security and flexibility while promoting worker mobility across firms); lowering entry barriers to draw in more private investment (for example, in telecommunications and professional services); and furthering corporate governance reform. Offsetting the trend decline in the size of the labor force will require further increasing female and older worker labor force participation and allowing more use of foreign workers.

[12]Box 1.2 of the April 2018 *Fiscal Monitor* discusses the distributional implications of the US tax overhaul.

Structural reform priorities to boost productivity and innovation and reduce competitiveness disparities across the *euro area* vary, depending on country-specific bottlenecks. For instance, *Spain* should try to further reduce labor market duality and employment protection gaps between permanent and temporary workers, and target training and active labor market policies to boost employment prospects for young people and the long-term unemployed. In *Italy*, reforming wage bargaining arrangements to allow more firm-level flexibility should help align wages with productivity. In *Germany*, deregulating services would foster more competition and efficiency gains, and expanding the availability of venture capital could promote innovation.

Policies—Emerging Market Economies

Policy priorities in emerging market economies differ across countries within the group, depending on their cyclical positions and country-specific vulnerabilities. Common objectives across the group include strengthening financial resilience so that income gaps relative to advanced economies can continue to narrow sustainably and ensuring that opportunities and benefits associated with higher per capita income are shared broadly across the population.

Cyclical Policies: Manage Trade-Offs

In several emerging market economies, inflation is relatively subdued compared with historical averages. Improvements to monetary policy frameworks also appear to have lowered inflation expectations, including in *Brazil* and *India*. These developments have created room for monetary policy to support activity should downside risks to growth materialize. However, in a few countries, such as *Argentina* and *Turkey*, inflation remains above central bank targets, requiring a tight monetary stance to keep expectations anchored.

Fiscal policy is generally more constrained by the need to strengthen buffers and ensure sustainability of social insurance programs—particularly in commodity-exporting emerging market economies faced with subdued medium-term prospects for commodity prices, but also more broadly.

In *Argentina*, fiscal reforms approved at the end of 2017 provide improved guidance on fiscal discipline and will help address the country's large pension imbalances and begin a gradual reduction of high and distortionary taxes. However, further cuts to primary spending will be needed to achieve the primary deficit targets and open up space for further reduction of the tax burden. In *Brazil*, legislating social security reform remains a priority to ensure that spending is consistent with the constitutional fiscal rule and to guarantee long-term fiscal sustainability. Making use of the recent strengthening of activity to improve the primary balance over the short term would complement the overall consolidation strategy. In *China*, fiscal policy has played a vital part in shoring up short-term growth at the expense of eroding valuable policy space. Gradual consolidation, together with a shift of spending back onto the budget and away from off-budget channels, would help improve sustainability. *India*'s high public debt and recent failure to achieve the budget's deficit target call for continued fiscal consolidation into the medium term to further strengthen fiscal policy credibility.

Strengthening Financial Resilience

Balance sheet vulnerabilities pose a downside risk to medium-term growth prospects in many emerging market economies, requiring policy action. The corporate debt overhang and associated banking sector credit quality concerns exert a drag on investment in *India.* The recapitalization plan for major public sector banks announced in 2017 will help replenish capital buffers and improve the banking sector's ability to support growth. However, recapitalization should be part of a broader package of financial reforms to improve the governance of public sector banks, and banks' debt recovery mechanisms should be further enhanced. In *Turkey*, limiting balance sheet currency mismatches and the high exposure to foreign exchange risk are urgent priorities, especially with monetary policy normalization under way in the United States and the United Kingdom (and the resulting possibility of a shift of capital flows away from emerging market economies). Moreover, given that sudden repricing of term premiums remains a distinct possibility (as discussed in the "Risks" section) and that portfolio shifts could occur, it is important to mitigate rollover risk by avoiding excessive reliance on short-term borrowing. Regulators in *China* have taken important measures to rein in shadow banking and bring financial activity back onto bank balance sheets, where capital and provisioning requirements provide greater loss absorption capacity than in opaque off-balance-sheet channels. Nevertheless, total credit growth remains high. Early recognition of nonperforming assets, a reduction of forbearance, and gradually unwinding of the system of implicit guarantees to better align borrowing costs with risk-adjusted returns remain essential for improving credit allocation and containing the accumulation of vulnerabilities.

More broadly across emerging market economies, as shown in Chapter 2 of the October 2017 WEO, medium-term growth outcomes are improved by avoiding credit booms that lead to excessive risk taking and by permitting exchange rate flexibility to minimize the distortion of relative price signals and associated resource misallocation.

Boosting Potential Output Growth and Enhancing Inclusiveness

Strong growth over long stretches of the post-2000 period has allowed several emerging market economies to narrow income gaps relative to advanced economies and has enabled millions in these countries to climb out of poverty. As discussed earlier, the medium-term outlook for many emerging market economies is relatively subdued compared with the growth rates achieved since 2000. Country-specific constraints are, in many cases, important contributing factors that weigh on medium-term growth, limit employment opportunities for the working-age population, and prevent the benefits of growth from spreading widely.

In *South Africa*, the election of new political leadership reduces some of the policy uncertainty. However, advancement of the outstanding reforms is critical for reinvigorating economic growth and making it more inclusive. Improving infrastructure; reducing barriers to entry in key sectors, including transportation and telecommunications; improving the efficiency of government spending; and reducing policy uncertainty remain central to attracting private investment, raising productivity across the economy, and promoting job creation. The proposal to introduce a national minimum wage has the potential to hurt firms' competitiveness and employment prospects in the formal sector, but it could improve working conditions and reduce poverty. For a sustained rise in living standards and inclusiveness, however, broad-based efforts are needed to raise the quality of education and improve access to opportunities for all segments of society.

India has made progress on structural reforms in the recent past, including through the implementation of the goods and services tax, which will help reduce internal barriers to trade, increase efficiency, and improve tax compliance. While the medium-term growth outlook for India is strong, an important challenge is to enhance inclusiveness. The main priorities for lifting constraints on job creation and ensuring that the demographic dividend is not wasted are to ease labor market rigidities, reduce infrastructure bottlenecks, and improve educational outcomes.

In *Brazil*, reducing tariff and nontariff barriers to trade will help improve efficiency and raise productivity growth, and enhancing the appeal of the infrastructure concessions program to investors would help draw in private investment and fill important infrastructure shortfalls. In *Mexico*, implementation of certain aspects of the wide-ranging reform agenda approved five years ago has progressed well, including in the energy, financial, and telecommunications sectors. Building on these areas, priority should be accorded to initiatives that will lift key constraints on investment and boost growth over the medium term, including implementing judicial reforms that target corruption and promote the rule of law, as well as labor market reforms that help reduce informality.

More generally across emerging markets, there is room to make growth more inclusive and reduce inequality by increasing the coverage of personal income taxes, lowering the burden of indirect taxes, and increasing the share of transfers to the lowest income groups through improved targeting. Conditional cash transfers—adopted for example in *Brazil* and *Mexico*—that are linked to school enrollment or attendance at health clinics can lower current inequality and, by improving education and health outcomes, future income inequality (see the October 2017 *Fiscal Monitor*).

Policies—Low-Income Developing Countries

Low-income developing countries face multiple challenges in their effort to progress toward their 2030 Sustainable Development Goals. Fiscal positions have worsened across several countries in this group, poverty and inequality remains high, and financial vulnerabilities appear to be on the rise in some cases. Commodity exporters and those particularly exposed to natural disasters face additional complex challenges of diversifying their economies—a long-standing goal that has acquired renewed urgency with the subdued medium-term outlook for commodity prices and recurrent climate-related events as global temperatures rise (Chapter 3 of the October 2017 WEO). Many of the policy priorities discussed below are interlinked, are mutually reinforcing, and can achieve multiple objectives.

A Widespread Need to Strengthen Fiscal Positions

Fiscal positions have deteriorated in recent years across most low-income countries—encompassing both commodity exporters (those countries that generate at least 50 percent of their export revenue from commodities) and more diversified economies. While lower commodity prices since 2014 have dragged on revenue in commodity exporters, the broader pattern across low-income countries of worsening fiscal positions suggests that domestic revenue mobilization efforts have generally fallen short of rising expenditure requirements. Current spending—including rising debt service costs—appears to have contributed more than has public investment to the increase in total spending (IMF 2018a).

Continued efforts to broaden the tax base, enhance compliance, and reduce wasteful, poorly targeted subsidies would create essential resources for meeting critical social and developmental needs—including in the areas of health, sanitation and water delivery, electricity generation, roads, and education and training facilities. Fiscal consolidation efforts that focus on cutting current and recurrent expenditures generally appear to have smaller negative effects on economic activity than an equivalent reduction in public investment (see the October 2017 *Regional Economic Outlook: Sub-Saharan Africa*). Undertaking these efforts now—while growth is on the mend and the ongoing increase in commodity prices offers some respite—would help prevent a more painful adjustment farther down the road.

Promoting Inclusive Growth

As documented in the October 2017 *Fiscal Monitor*, inequality has declined since 2000 across sub-Saharan Africa, Asia, and Latin America—regions where several low-income economies are situated. Nevertheless, it remains high. Ensuring that poverty and inequality continue to fall is imperative from a welfare perspective and to secure support for needed structural reforms, avoid debilitating political conflict and civil strife, and make growth sustainable.

Priority policy areas to foster inclusive growth include universal health coverage of essential services to reduce infant and maternal mortality, targeted efforts to improve the delivery and take-up of early childhood education, initiatives to close primary and secondary enrollment gaps, and greater availability of clean water and sanitation. Increased access to credit, expanded vocational skills training, and improved infrastructure would help support new firm entry and boost opportunities for gainful employment of larger numbers.

Enhancing Financial Resilience

As discussed in IMF 2018a, some low-income countries (*Mozambique, Nigeria*) have experienced financial stress or deteriorating loan quality in recent years as growth has moderated and corporate balance sheets have weakened. In some countries—including *Chad* and *Zambia*—worsening fiscal positions have led governments to build up arrears to private contractors and have made it difficult for them to stay current on their loans. Further deterioration in loan quality would impair credit intermediation and the ability of the banking sector to support growth in these countries and would raise the risk of costly recapitalization, which would severely burden already-strained public finances.

Proactive supervision, ensuring adequate provisioning for losses by banks, reducing forbearance, and improving resolution frameworks to minimize expensive public bailouts are essential for strengthening financial resilience. Fiscal adjustments that place public finances on a sustainable path would additionally help curb budgetary arrears, allowing debt service to proceed on schedule and curtailing the buildup of nonperforming loans.

Furthermore, for economies that are not part of a currency union, allowing exchange rate flexibility while using reserves to smooth excess volatility can help buffer external shocks and, over time, prevent sustained departures from fundamental valuation (which lower the overall efficiency of economic activity).

Diversification and Coping with Climate Shocks

Economic diversification away from excessive dependence on commodities, or on a few sectors such as agriculture or tourism, is an overarching imperative for commodity exporters and those countries that are particularly exposed to natural disasters. While there is no unique template for all circumstances, general policy attributes that facilitate diversification or help countries cope with climate shocks include sound macro management and judicious use of policy buffers to smooth fluctuations, investment in education and training to improve workforce skills, increased access to credit, and a reduction in infrastructure gaps (see Chapter 3 of the October 2017 WEO and the October 2017 *Regional Economic Outlook* for sub-Saharan Africa). More broadly, governance reforms—for instance, strengthening incentives to improve the efficiency of public administration, reducing the risk of expropriation, enhancing transparency in project selection, and expediting business dispute resolutions according to established legal principles—would help lift private investment, create jobs, and expand the range of activity beyond primary, resource-based sectors.

Multilateral Policies

Sustaining global improvements in living standards and delivering greater economic security to a rising share of the world's population requires a well-functioning multilateral framework that can facilitate a cooperative approach to addressing shared challenges and resolving disagreements. Multilateral cooperation in a range of areas can help amplify the benefits of the country-level actions discussed in the preceding section while minimizing any adverse spillovers they may generate. This is particularly relevant at a time when unilateral tariff actions threaten to weaken the rules-based global trading system that has helped lift millions out of poverty and raised consumer welfare by lowering the price of tradable goods over the past several decades.

- *Trade:* Trade openness and global economic integration under a rules-based, multilateral trading system have been crucial for diffusing innovation, lifting productivity, and expanding the variety of goods and services available globally in recent decades (see, for example, Baldwin 2016). Reducing barriers in high-tariff sectors such as agriculture; fully implementing commitments under the February 2017 Trade Facilitation Agreement; and adapting the rules to cover areas of growing relevance, such as digital trade and e-commerce, can help further lower trade costs and contribute to global growth. While agreements at the global level, which cover the bulk of cross-border trade flows, are optimal in this regard, broad regional and plurilateral arrangements—such as the revised Trans-Pacific Partnership—can also help forge cross-country consensus on best practices. Trade openness, as is the case with other forces of structural transformation, can hurt certain groups as activity shifts to locations with comparatively lower overall operating costs. Measures should be adopted to help those adversely affected by greater economic integration.
- *Global financial stability:* Cooperative global efforts have been instrumental in advancing the postcrisis financial regulatory reform agenda to make the financial system safer, including through stronger bank capital buffers, a better bank asset liquidity profile, and more stable funding. Key remaining areas for action to complete the regulatory reform agenda and strengthen global financial stability include devising effective resolution frameworks for globally important financial institutions, bolstering central counterparty clearing for derivatives, and filling data gaps and enhancing supervision and regulation of nonbank financial institutions. Continued close cooperation is also needed on combating cross-border money laundering, financing of terrorism, and fortifying financial infrastructure against cybersecurity breaches. At the same time, regulators must ensure that correspondent banking relationships—through which globally active banks provide deposit-taking and remittance services to smaller banks in low-income countries—stay intact to ensure that these countries have access to vital international payments. In addition, an adequately financed global safety net remains critical for countries to have quick and predictable access to international liquidity if they are unable to tap existing mechanisms, including their own reserves, bilateral swap lines, and regional financing agreements. Finally, as discussed in the "External Sector Outlook" section, both deficit and surplus economies must implement measures that rebalance the composition of global demand and prevent a further buildup of excess global imbalances.
- *Taxation:* Differences across jurisdictions in the tax treatment of corporate profits and personal income encourage profit shifting and can enable tax evasion. Such erosion of tax bases may reduce national governments' revenues while some of the more aggressive preferential tax regimes bring limited substantive economic benefits or knowledge spillovers to the destination locations. Multilateral cooperation on taxation is a long-standing imperative. It has acquired renewed urgency at a time when high inequality and a stronger sense that global integration favors large corporations and wealthy individuals have combined to increase the appeal of inward-looking policy platforms that could undermine the global recovery.
- *Noneconomic issues:* As described in the "Risks" section, a range of noneconomic factors threaten the sustainability of global growth. Cross-border

cooperation remains vital for mitigating greenhouse gas emissions and for containing the associated detrimental consequences of rising global temperatures and devastating climate events, such as droughts, tropical cyclones, and wildfires. These events disproportionately hurt low-income countries, which have contributed the least to emissions and have relatively low capacity to tackle their fallout (see Chapter 3 of the October 2017 WEO). And by adding to migrant flows, climate-related events compound an already complex situation of displaced individuals and refugees fleeing conflict areas, often to countries already under severe strain. Multilateral effort remains indispensable for alleviating these pressures through financial resources directed to the recipient countries and for ensuring unimpeded aid flows to source locations.

Scenario Box 1. Impact of Tighter Global Financial Conditions

The IMF's Group of Twenty Model is used to explore the downside risks of tighter global financial conditions. To illustrate the potential implications, it is assumed that an inflation surprise in the United States (more likely to occur under expansionary fiscal policy) leads to faster-than-expected decompression of the US term premium, which rises 50 basis points in 2018 and an additional 50 basis points in 2019 (blue line in Scenario Figure 1). Thereafter, the term premium gradually returns to the baseline. The increase in the US term premium is passed on to all other countries in accordance with the spillover relationship established by the empirical work in the 2014 *Spillover Report*.

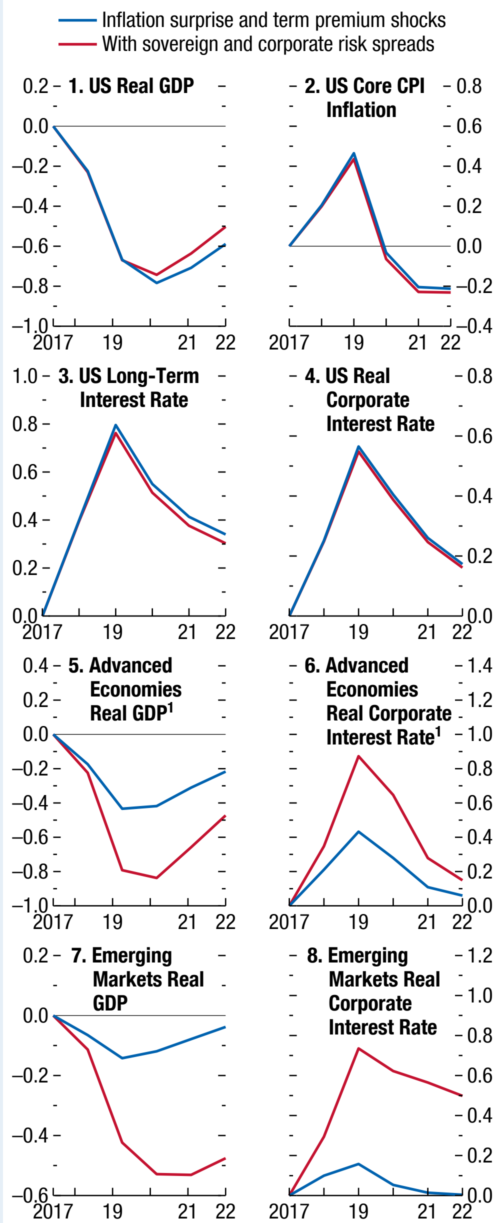
In addition, the tightening in financial conditions is assumed to heighten risk aversion, with associated increases in sovereign and corporate risk premiums (red line in Scenario Figure 1). In line with the time profile of the rise in the term premium, selected sovereign and corporate risk premiums increase in 2018 and 2019, decreasing thereafter at the same speed as the increase in the term premium. Risk spreads are calculated and categorized according to the IMF's assessment of countries' vulnerabilities stemming from financial, fiscal, and external risks, as well as from cross-sectoral and cross-border spillovers. In addition, capital flow pressures are assumed to constrain emerging market central banks so that they cannot fully offset the tightening in financial conditions by loosening monetary policy. Conventional monetary policy is also assumed to be constrained in the euro area and Japan by the path for short-term policy rates in the *World Economic Outlook* (WEO) baseline.

Higher real effective interest rates in the United States, owing to the faster decompression of the term premium and the need to lean against unexpectedly higher inflation, dampen aggregate demand, bringing US real GDP roughly ¾ percentage point below the WEO baseline by 2020.[1] Weaker US demand and, more important, the impact of tighter global financial conditions (red line) cause output to decline by about ½ percent relative to the baseline level by 2020 in emerging market economies, and more than ¾ percent in advanced economies (excluding the United States). In the latter, roughly half of the impact on activity

[1]In the outer years, the US real GDP path is a bit higher than in the first layer of the scenario. This is because US monetary policy is a little more accommodative as the more appreciated currency puts downward pressure on inflation, and the resulting stronger domestic demand in the United States more than offsets weaker foreign demand.

Scenario Figure 1. Inflation Surprise and Term Premium Shocks in the United States

(Percent deviation from baseline for real GDP; percentage point difference from baseline for CPI inflation and interest rates)



Source: IMF staff estimates.
Note: CPI = consumer price inflation.
[1]Excluding the United States.

Scenario Box 1. Impact of Tighter Global Financial Conditions *(continued)*

comes from the faster normalization of the term premium (blue line) and half from increased risk aversion (red line). The assumption of limited conventional monetary policy space in the euro area and Japan exacerbates the impact of the higher term and risk premiums on real interest rates and, thus, activity. However, the resulting impact could be mitigated in the euro area and Japan if unconventional monetary policy measures were implemented. In emerging markets, the overall impact from the term premium increase is relatively small as monetary policy responds and offsets a large part of the impact on real interest rates, mitigating the impact on real activity (blue line). However, when risk aversion increases and capital outflow pressures intensify, the scope for monetary policy to respond is limited and activity slows more significantly and persistently relative to the baseline (red line).

Box 1.1. Smartphones and Global Trade

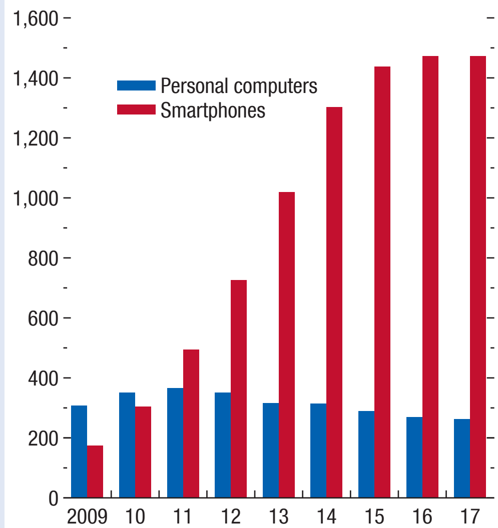
In 2017, global smartphone sales reached close to 1.5 billion units—one for every fifth person on earth (Figure 1.1.1). Demand has been driven by the increasing use of smartphones as the main computing platform across the world, substituting in part for personal computers. Mobile technology and services are estimated to have contributed $3.6 trillion (4.5 percent) to 2017 global GDP (GSM Association 2018).

The enormous global demand for smartphones in recent years has created highly complex and evolving supply chains across Asia. In 2017, China exported $128 billion worth of smartphones to the rest of the world, equivalent to 5.7 percent of its total exports. In Korea (the main supplier of smartphone components) semiconductor exports alone accounted for 17.1 percent of total exports. Similarly, components for smartphone production at the peak (October 2017) accounted for more than one-third of exports from Taiwan Province of China, 17.4 percent from Malaysia, and 15.9 percent from Singapore.

Smartphones contributed about one-sixth the estimated growth rate of global trade in 2017.[1] This growth was driven mainly by an increase in value added per unit, rather than units sold, which declined for the first time on record. As a result, the average sale price of an iPhone increased from $618 in 2016 to $798 in 2017, according to Apple Inc. quarterly financial statements. In the five main Asian economies involved in the tech cycle (China, Korea, Malaysia, Singapore, Taiwan Province of China), total exports grew by 6.7 percent in 2017. Even though tech exports accounted for less than 10 percent of total exports in the region, smartphone-related exports contributed about one-third the growth rate of total exports.

Ireland, Korea, and Taiwan Province of China are estimated to be the main beneficiaries of the new tech cycle in value-added terms. In Ireland, where the intellectual property of Apple Inc. resides, staff estimate the contribution in value-added terms of iPhone exports to account for one-fourth of the country's economic expansion in 2017.[2] At the same time, it is important to note that the income generated from smartphone sales does not fully contribute to the Irish economy. The acquisition of foreign-owned intellectual property assets leaves domestic employment mostly unchanged. (See Box 1.2 of the April 2017 *World Economic Outlook* for further details on issues relating to the measurement of Ireland's GDP.) In Korea, the production chain of smartphone-related components is estimated to have contributed about one-third of real GDP growth rate in 2017. In Taiwan Province of China, the contribution is estimated at about 40 percent. In contrast, for China the contribution is estimated to be much smaller, reflecting a larger and more diverse economy.

Figure 1.1.1. Global Sales of Personal Computers and Smartphones
(Millions of units)



Source: Gartner; and IDC.

A Rising Tech Cycle

Demand for smartphones is highly cyclical and related to the release dates of new smartphone models by global producers. Thus, production and trade in several Asian countries have become highly correlated, shaping a new tech cycle, which differs from the earlier tech cycle associated with personal computers.

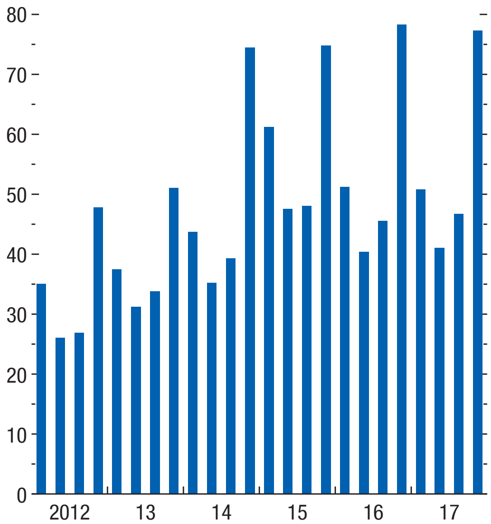
The authors of this box are Benjamin Carton, Yiqun Li, and Joannes Mongardini.

[1]The contribution is calculated as the net change in real exports of smartphone components as a share of the net change in total real exports.

[2]These estimates are based on iPhone sales as stated in Apple Inc. quarterly financial statements and staff assumptions about hardware costs, research and development costs, and distribution margins.

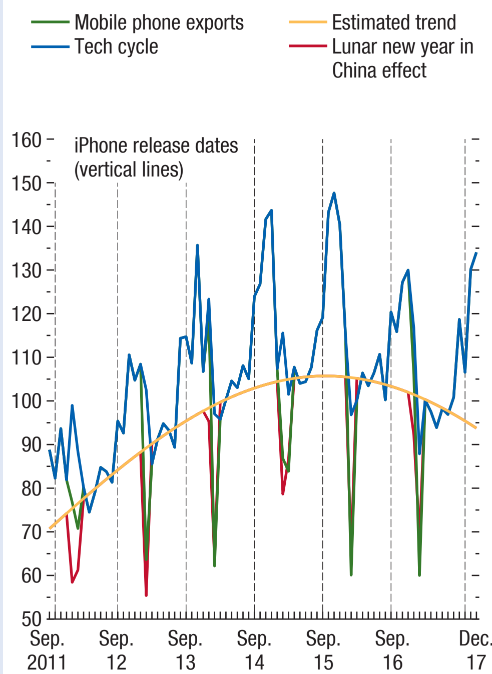
Box 1.1 *(continued)*

Figure 1.1.2. Global iPhone Sales
(Millions of units, quarterly)



Source: Apple Inc. quarterly financial statements (quarters shown are for calendar years).

Figure 1.1.3. China: Smartphone Export Cycle
(Millions of units)



Sources: Haver Analytics; TDM Data; and IMF staff calculations.

In a recent paper (Carton, Mongardini, and Li 2018), the new tech cycle is shown as being captured by nonseasonal factors. It critically depends on the release dates of iPhones as Apple Inc. flagship models drive global demand. In fact, iPhones topped global sales in the fourth quarter of 2017, surpassing Samsung Electronics phones.

Apple Inc.'s iPhone releases are the key determinant of the new tech cycle. Reflecting booming global demand, iPhone sales surged from 35.1 million units in the first quarter of 2012 to 78.3 million in the fourth quarter of 2016 (Figure 1.1.2). While a clear quarterly pattern is emerging—in which second- and third-quarter sales are usually weaker, reflecting the expectations of another release in the fourth quarter—the amplitude of this quarterly pattern has only really been established since the release of the iPhone 6/6 Plus in September 2014. Moreover, there are clear spillovers from the fourth quarter of the previous year onto the first quarter of the following year, ahead of the Lunar New Year in China.

The new tech cycle can be subdivided into two components. The first is the prerelease cycle, which comprises the export of all components from several Asian countries to China—the final producer of most smartphones. The second is the postrelease cycle, with shipments of smartphones from China to the rest of the world. Both pre- and postrelease cycles have a strong impact on growth and trade patterns in Asia and beyond.

Has the Global Market for Smartphones Become Saturated?

Global sales of smartphones may have plateaued in late 2015. By decomposing the cycle from trend for Chinese exports of smartphones, regression results show that the trend is nonlinear and may have reached its peak in September 2015, suggesting that future global demand for smartphones may grow more slowly (driven more by replacement demand than new acquisitions). This is confirmed by updated regression results on Chinese export data up to December 2017 (see Figure 1.1.3). In fact, global shipments of smartphones declined in 2017 for the first time on record (IDC 2018).

Box 1.1 *(continued)*

However, Asia continues to gain market share in other consumer electronics, including embedded automobile computers, smart appliances, and wearable devices. This is evident in the rising demand for Korean semiconductors and, to a lesser extent, in Taiwan Province of China's electronic export orders. In fact, trend demand for Korean semiconductor exports continues to accelerate, despite the slowdown in global smartphone sales, while in Taiwan Province of China electronic export orders continue to grow at a healthy pace.

Overall, the new tech cycle has become an important new feature of the global economy. Over the past six years, the enormous global demand for smartphones has changed the export and growth performance of several Asian countries through complex and evolving supply chains that involve several countries in the region. While the global market for smartphones may become saturated, demand for other electronics products continues to boost production of semiconductors, particularly in Korea. Therefore, the influence of the tech sector on Asia's export patterns and growth is unlikely to fade soon.

Box 1.2. What Has Held Core Inflation Back in Advanced Economies?

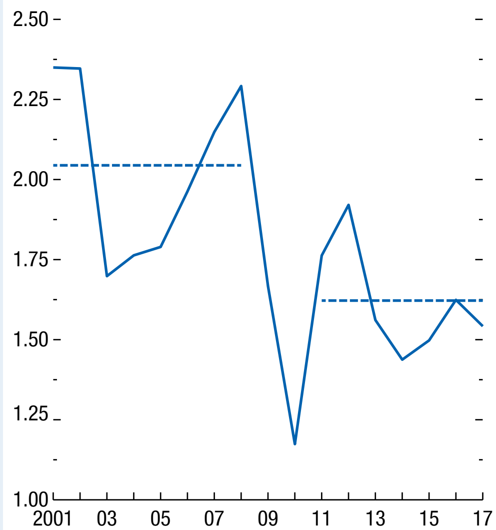
Core consumer price inflation in advanced economies declined a couple of years after the global financial crisis and has not recovered meaningfully since (Figure 1.2.1). Wage growth in advanced economies has also remained remarkably sluggish, with wages growing 1.5 percentage points less in 2017 than in the years leading up to the crisis. The absence of stronger wage and price pressures has been particularly puzzling in the past two years given the acceleration in demand and decline in unemployment in many countries (October 2017 *World Economic Outlook* [WEO] and Chapter 2 of the October 2016 WEO).

Several explanations have been put forth for the seemingly widespread disconnect between inflation and domestic activity. Some possible forces behind sluggish inflation could be domestic in origin, but may have operated in a synchronized manner across countries:

1. *Underestimation of slack:* Growth in productive capacity (potential output) may have been underestimated, and excess capacity may not have been declining as fast as the acceleration in activity or the decline in unemployment would suggest.[1]
2. *Expectations:* Even if output is accelerating and labor markets are tightening, firms may be reluctant to bid up wages and raise prices if they doubt the sustainability of the recovery. Another possibility is that the inflation expectations of firms and workers may have drifted down in a context of persistent undershooting of inflation targets, long-term unemployment, and a perceived narrowing in monetary policy space. Some foreign factors may also have weighed on core inflation. With an increasing range of products, services, and tasks traded across countries, competition from abroad may have put a lid on the relative prices and inflation rates of tradable products.[2]
3. *Drag from import prices and foreign competition:* With about half of advanced economy imports in 2016 originating in economies where output was below potential, sluggish inflation in advanced economies may in part reflect imported lower inflation from their trading partners.[3] The widespread use of digital technologies may have lowered trading costs, intensifying the competition for home-produced goods and putting downward pressure on their prices.[4]
4. *Enhanced tradability:* More generally, enhanced tradability and the threat of production relocation may have made inflation less sensitive to domestic factors and more responsive to foreign factors, including foreign demand and slack.

Figure 1.2.1. Advanced Economy Core Consumer Price Inflation

(Percent, year over year; dashed lines indicate 2001–08 and 2011–17 averages)



Source: IMF staff calculations.

Which of these factors have been more important in restraining inflation?[5] Disaggregated inflation data could shed light on the relative contributions of

The authors of this box are Oya Celasun, Weicheng Lian, and Ava Hong.

[1]Indeed, wage inflation has been more sluggish where the share of workers who are involuntarily working part time has remained high (Chapter 2 of the October 2017 WEO).

[2]See also Chapter 3 of the April 2006 WEO and Carney (2017) for a conceptual discussion of the effect of global factors on inflation.

[3]Chapter 2 of the October 2016 WEO documents that excess industrial capacity in major economies, especially China, exerted downward pressure on producer price inflation in 2015–16 through lower import prices.

[4]The decline in the prices of goods relative to services reflects faster efficiency gains in the production of goods in the past and the continued integration of countries with lower production costs into value chains and trade.

[5]In the traditional Phillips curve framework, which relates inflation rates to domestic slack, the channels in (1) and (2) would result in persistently negative error terms; channel (4) would also imply a flattening of the Phillips curve.

Box 1.2 *(continued)*

domestic versus foreign factors. If foreign factors are behind the weakness in inflation, it would suggest a larger decline in the inflation of tradable goods relative to nontradables, such as most services. Conversely, a broad-based decline in inflation rates across components within a country would suggest a greater role of domestic factors.

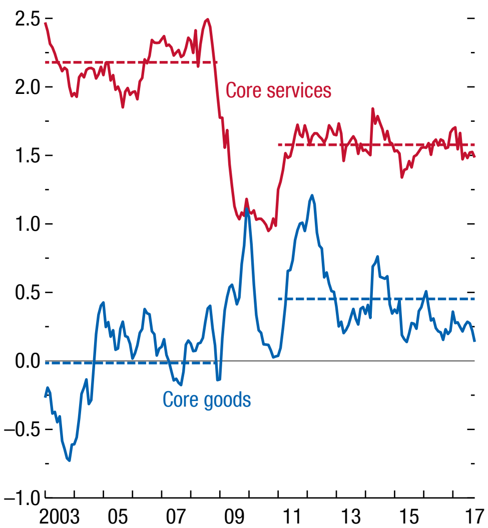
Separating core consumer price inflation in advanced economies into "core goods" and "core services" components reveals that disinflation since the global financial crisis—and the additional weakening over the past two years—was overwhelmingly the result of weaker services inflation (Figure 1.2.2).[6] By contrast, the weighted average of core goods inflation across 15 advanced economies shows no systematic weakening since the global financial crisis (but rather continued high volatility around a low level). While the changes in core goods inflation have been heterogeneous across countries (with some countries actually witnessing higher core goods inflation), the decline in services inflation has been remarkably broad (Figure 1.2.3).

An examination of core inflation by sector is also instructive (Figure 1.2.4). The sectors in which inflation has weakened the most relative to 2000–07 include medical services, education, and transportation services. By contrast, inflation has been higher for traded goods such as vehicles, medical products, and apparel, conflicting with arguments that the rise of online retail platforms has reduced profit margins and dragged goods prices down. Regression analysis suggests that declines in core inflation in specific sectors since the global financial crisis are more strongly related to country-specific factors than sector-specific factors. This suggests that global forces that affect inflation in specific sectors in a similar fashion across countries are unlikely to have contributed significantly to the decline in core inflation since the crisis.[7]

One possibility to consider is that tradability may have increased for services only, with no change in the tradability of goods. The sectors with especially weak inflation—medical care services and education—do not, however, seem more tradable than a few years ago. It is, instead, more likely that government policies have contributed to the decline in the rate of price increases in these sectors, given that prices of medical services and education are administered or regulated in many countries.

All in all, disaggregated inflation trends suggest that enhanced tradability and global competition are unlikely to have been the main culprits behind the sluggishness in inflation in recent years.[8] The weakness in the inflation of consumer service prices points to domestic factors—including government policies—as the more important restraints. A fruitful direction for future research would be to study the impact of enhanced tradability of service products and changes in factor mobility and labor market contestability on inflation.

Figure 1.2.2. Advanced Economy Core Consumer Goods and Core Services Consumer Price Inflation
(Percent, year over year; dashed lines indicate 2002–08 and 2011–17 averages)



Sources: Haver Analytics; and IMF staff calculations.
Note: The sample comprises 16 advanced economies: Australia, Austria, Canada, Denmark, Finland, France, Germany, Japan, Italy, Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom, and the United States.

[6]Food and all subcomponents relating to fuels are excluded from the core goods and core services series.

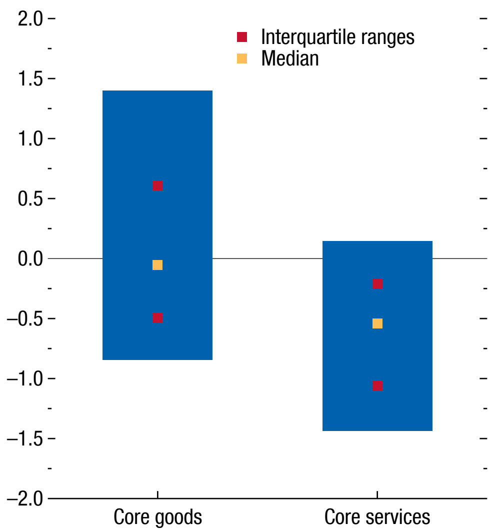
[7]In a regression of the change in sector-level inflation between 2002–08 and 2011–17, restricted to tradable sectors, country dummies explain 29 percent of the variation and sector dummies only 5 percent. In a similar analysis for nontradables, country dummies explain 21 percent of the variation and sector dummies 17 percent.

[8]Cross-border trade in services has increased markedly in recent years, aided by improvements in information and communication technologies.

Box 1.2 *(continued)*

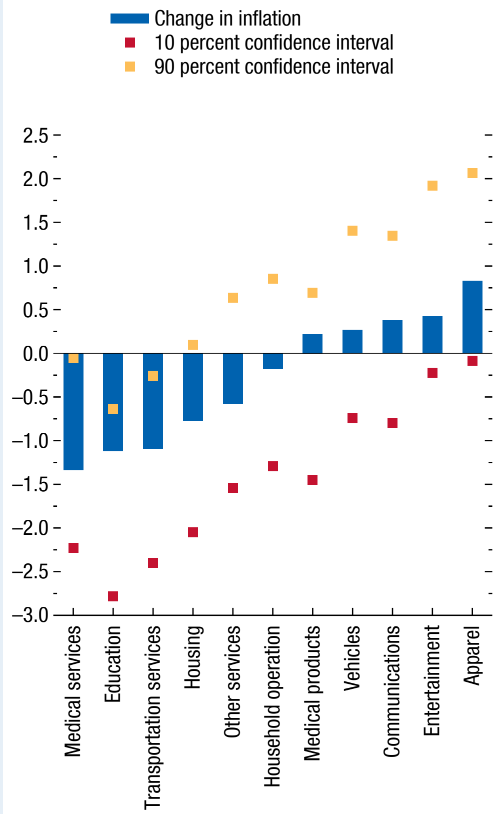
Figure 1.2.3. Cross-Country Distribution of Changes in Core Goods and Core Services Inflation, 2011–17 versus 2002–08

(Percent, year over year)



Source: IMF staff calculations.
Note: The sample comprises 16 advanced economies: Australia, Austria, Canada, Denmark, Finland, France, Germany, Japan, Italy, Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom, and the United States.

Figure 1.2.4. Changes in Sectoral Inflation, 2011–17 versus 2002–08



Sources: Haver Analytics; and IMF staff calculations.
Note: Dummies from a regression of changes in sectoral inflation between 2002–08 and 2011–17 over both country and sector dummies. The sample comprises 16 advanced economies: Australia, Austria, Canada, Denmark, Finland, France, Germany, Japan, Italy, Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom, and the United States.

Box 1.3. Recent Dynamics of Potential Growth

Global economic activity has gathered momentum over the past year, thanks in part to a resurgence of investment in advanced economies. Whether this momentum can be sustained, and what it implies for the calibration of macroeconomic policies, depends partly on whether the faster expansion is mostly cyclical (that is, reflecting an acceleration in demand) or also a reflection of faster growth in potential output (that is, an acceleration in supply capacity). A recovery based on stronger potential growth is more likely to be sustained than one driven purely by demand.

Potential growth is estimated to have declined in both advanced and emerging market economies in the wake of the global financial and euro area crises (April 2015 *World Economic Outlook* [WEO]), reflecting weaker growth in labor, capital, and total factor productivity. In the aftermath of these crises, potential growth was projected to rise at a relatively limited pace through 2020. This box updates the estimates in the April 2015 WEO and finds that potential growth has indeed increased somewhat in recent years—mainly due to a recovery in total factor productivity growth—but remains well below precrisis rates. The box also discusses incorporating information on financial cycles into the calculation of potential output—the concept of "sustainable growth."

To What Extent Has Potential Growth Recovered?

The behavior of inflation in relation to unemployment and output contains valuable information on the underlying dynamics of potential growth. When output outstrips potential output and labor markets tighten, inflation pressure is expected to strengthen; conversely, inflation is expected to weaken when demand falls short of supply. The puzzlingly weak response of inflation to the pickup in output and declining unemployment over the past one and a half years suggests that *potential* output may have risen alongside *actual* output.

Multivariate filtering techniques (as described for example in Blagrave and others 2015) make use of a simple model that incorporates information on the relationship between the degree of slack in the economy on one hand and inflation and unemployment on the other. Specifically, the Phillips curve (for inflation) and Okun's law (for unemployment) are used to pin down estimates of the output gap, and thus the evolution of potential growth over time. Applying this approach suggests that potential growth picked up, on average, by 0.4 percentage point between 2011 and 2017 for 10 large advanced economies, compared with an average uptick in actual growth of 0.6 percentage point over this period. By contrast, a group of five emerging markets (excluding China) has seen potential growth decline about 0.7 percentage point since 2011, compared with an actual growth slowdown of 1.9 percentage points—more recently, however, there are signs of a turnaround (Figure 1.3.1).

What Is Driving the Recovery?

To shed light on the drivers of potential growth in advanced economies, the estimates of potential output can be decomposed in line with a standard Cobb-Douglas production function:

$$\overline{Y}_t = \overline{A}_t \overline{L}_t^{\alpha} K_t^{1-\alpha},$$

in which $\overline{Y}_t$ is potential output as estimated by the multivariate filter, K_t is the stock of capital, $\overline{L}_t$ is potential employment, and $\overline{A}_t$ is potential total factor productivity, which is treated as the residual in our approach.[1] For the analysis, the share of labor for each country (α) is proxied using estimates from Chapter 3 of the April 2015 WEO.

Estimates of potential employment ($\overline{L}_t$) are derived from estimates of the nonaccelerating inflation rate of unemployment (NAIRU, $\overline{U}_t$), the working-age population (W_t), and the trend labor force participation rate ($\overline{LFRP}_t$) as follows:[2]

$$\overline{L}_t = (1 - \overline{U}_t)\, W_t \overline{LFRP}_t.$$

Based on this exercise, the modest increase in estimates of potential growth is attributed predominantly to a pickup in total factor productivity (TFP) growth—the residual in the framework (Figure 1.3.2). The rebound in TFP growth can be partly explained by cyclical factors, as some of the headwinds from

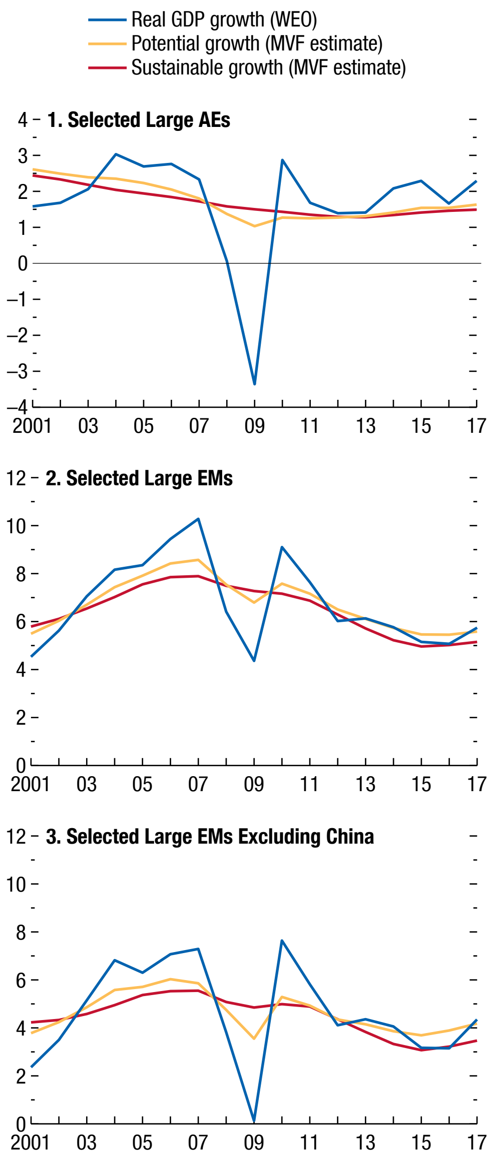
The authors of this box are Olivier Bizimana, Patrick Blagrave, Mico Mrkaic, and Fan Zhang, with support from Sung Eun Jung.

[1]This residual includes utilization of the inputs of production (labor and capital), labor quality (that is, human capital accumulation), and possible measurement errors in the inputs of production. Data on capital stock are from the Organisation for Economic Co-operation and Development.

[2]Baseline estimates of the trend participation rate are constructed using WEO data, whereas estimates of the NAIRU are produced by the multivariate filter during the estimation of potential output.

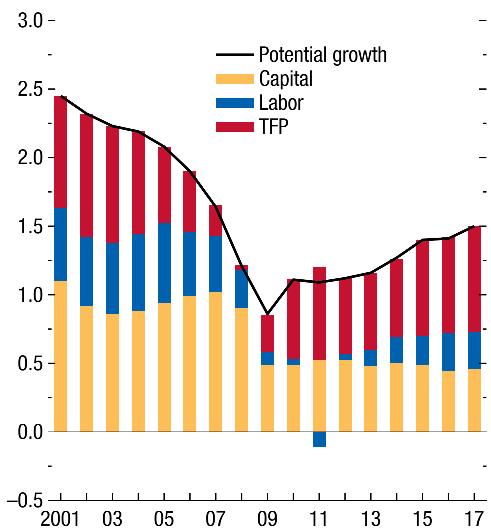
Box 1.3 *(continued)*

Figure 1.3.1. Different Measures of Growth
(Percent)



Source: IMF staff calculations.
Note: AEs = advanced economies (Australia, Canada, France, Germany, Italy, Japan, Korea, Spain, United Kingdom, United States); EMs = emerging market economies (Brazil, China, India, Mexico, Russia, Turkey); MVF = multivariate filter; WEO = *World Economic Outlook.*

Figure 1.3.2. Production Function Decomposition: Selected Large Advanced Economies
(Percent)



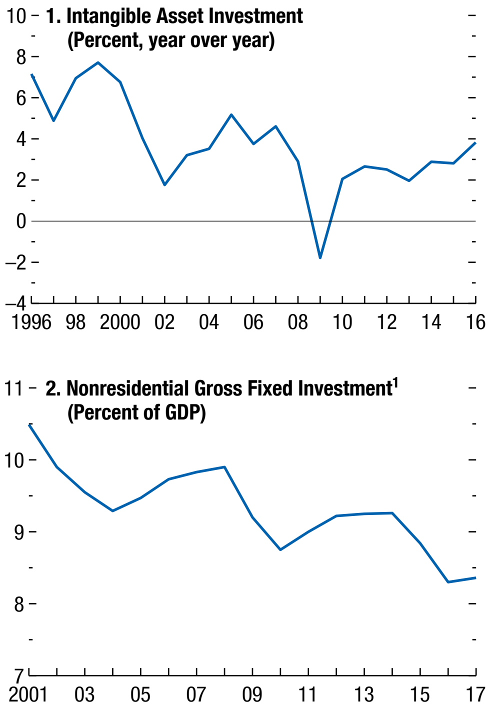
Source: IMF staff calculations.
Note: Advanced economies = Australia, Canada, France, Germany, Italy, Japan, Spain, United Kingdom, United States; TFP = total factor productivity.

the global financial crisis and euro area sovereign debt crisis have subsided. In particular, the meaningful easing of financial conditions since 2014 is likely to have facilitated investment in productivity-enhancing innovation, such as research and development and intangible capital, which can boost total factor productivity (Figure 1.3.3, panel 1). However, there is heterogeneity among advanced economies, with investment in intangible assets showing a strong rebound in some (for example, the United States and Japan), while it contracted in others (for example, Canada and Australia). In addition, capacity utilization rates in most major advanced economies have bounced back to more normal levels. The recent uptick in estimates of trend TFP growth are closely aligned with estimates of TFP growth using actual GDP, capital stock, and labor force data (Figure 1.3.4).

Interestingly, despite the recent recovery of investment growth in major advanced economies, the contribution of capital-stock growth to potential remains weak, and well below its precrisis average. This

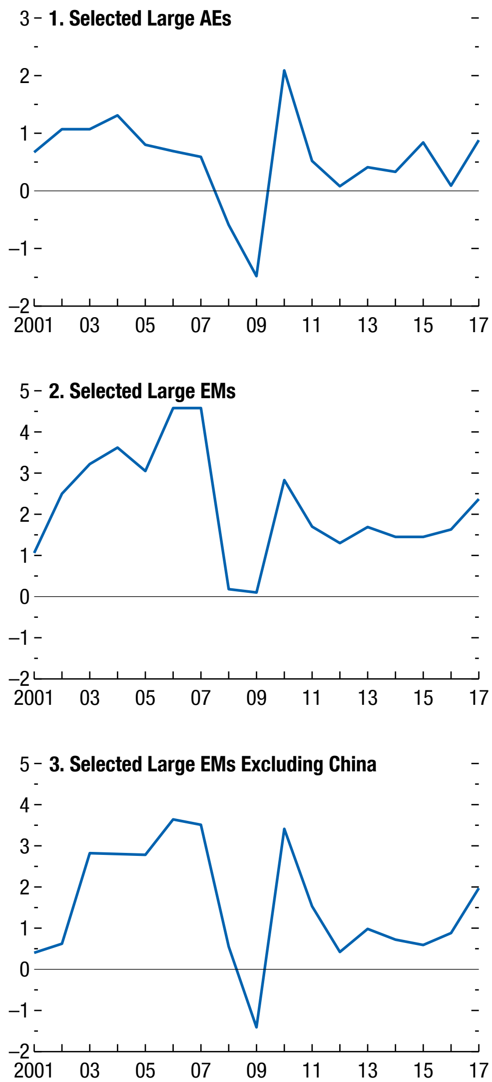
Box 1.3 *(continued)*

Figure 1.3.3. Investment in Selected Advanced Economies



Source: IMF staff calculations.
Note: Advanced economies = Australia, Canada, France, Germany, Italy, Japan, Korea, Spain, United Kingdom, United States.
[1]Gross fixed capital formation data are used for Japan and Korea.

Figure 1.3.4. Total Factor Productivity Growth
(Percent)



Source: IMF staff calculations.
Note: AEs = advanced economies (Australia, Canada, France, Germany, Italy, Japan, Korea, Spain, United Kingdom, United States); EMs = emerging market economies (Brazil, China, India, Mexico, Russia, Turkey).

is because the *level* of investment (as a share of output) remains depressed, as shown in (Figure 1.3.3, panel 2), implying that growth in the capital stock remains subdued. Also of note is that, despite a slight rebound in the contribution of labor inputs in advanced economies, it remains weak overall because of tepid working-age population growth in many countries, which counteracts the impact of a recent slight decline in the NAIRU on potential employment growth.

Estimates of Sustainable Growth

A second relevant concept—"sustainable growth"—aims to estimate an economy's growth in the absence of imbalances associated with financial cycles. Similar to the estimation of potential GDP, sustainable GDP growth rates are estimated by means of a mul-

Box 1.3 *(continued)*

tivariate filter (see Berger and others 2015). The filter estimates sustainable growth by controlling for deviations in credit, house, and stock prices and inflation from their own longer-term trends and removing their cyclical influence on output from the estimates. For example, if wide swings in output are accompanied by wide swings in credit, the filter interprets such joint movements as unsustainable and adjusts the rate of sustainable growth accordingly.[3]

Sustainable growth estimates are similar to those for potential growth in advanced economies but show a slightly more modest increase in recent years. The acceleration of credit activity and the growth of property and equity prices in the recent period imply that recent GDP growth is at least partly fueled by a financial acceleration; consequently, the estimate of underlying sustainable output growth is corrected downward. For emerging markets, estimates of sustainable output growth are modestly weaker than those for potential growth, with financial factors playing a similar role.

Summary

Estimates of potential growth have increased slightly in recent years as temporary crisis-related effects on total factor productivity growth have unwound. Still, there is not yet any signal that contributions from labor and capital inputs are on a fast upswing. This finding indicates that policy measures to address structural weakness—including investment in infrastructure and labor market initiatives to offset the economic effects of aging—are needed to boost medium-term growth prospects.

[3]The methodology for estimating sustainable growth is based on the work of Borio, Disyatat, and Juselius (2013). Related methods of estimating potential or sustainable output—including those that incorporate estimates of equilibrium interest rates—are discussed in Alichi and others (forthcoming).

Box 1.4. Has Mismeasurement of the Digital Economy Affected Productivity Statistics?

Slow productivity growth has led to questions about whether productivity is being underestimated. Overstated deflators for information and communications technology (ICT) products are a likely source of underestimation. Research on deflators in the US national accounts suggests an underestimation of about 0.3 percentage point, compared with a productivity slowdown of about 1.5–2.0 percentage points. Profit shifting to tax havens may also have depressed measured US productivity growth before 2008.

Productivity grows when output increases faster than labor inputs or, in the case of total factor productivity, combined labor and capital inputs. A worldwide slowdown in productivity growth beginning near the time of the global financial crisis is seen in the data for most of the world's economies, with productivity growth 1–2 percentage points lower than its previous trend in many advanced economies (Adler and others 2017). However, advances in digital technology and their diffusion throughout economies seem more rapid than ever, leading some to suggest that productivity growth is being underestimated.

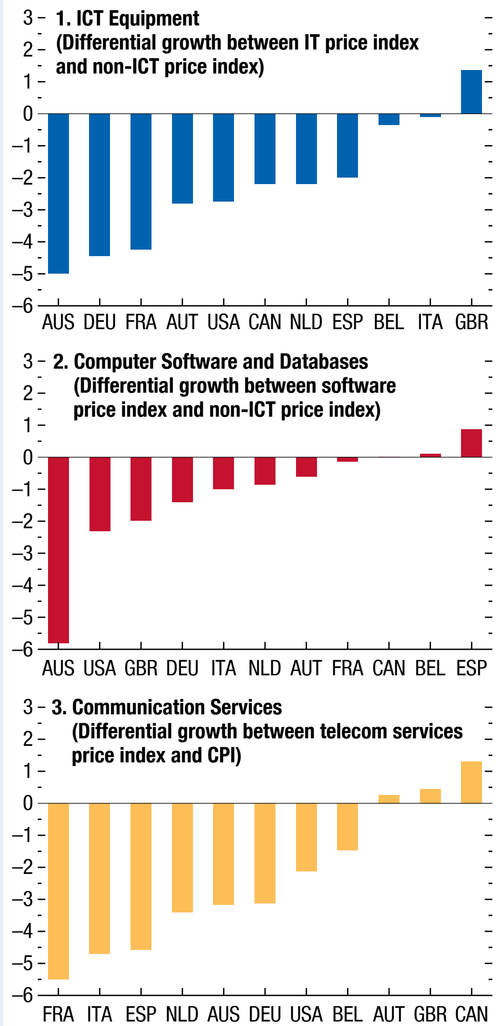
Research on errors in measuring ICT products before and after the productivity slowdown shows that they play at most a small role, in that productivity was also underestimated before the slowdown began (Byrne, Fernald, and Reinsdorf 2016). Nevertheless, the underestimation is more important compared with measured productivity at today's lower rates of productivity growth (often less than 1 percent a year).

Accuracy of the deflators used to calculate real output growth is a key question in measuring productivity. Adjusting prices for quality change is often challenging: underadjustment for quality changes could mean price changes are overstated for ICT equipment and software that embody improved technology. Price samples may also underrepresent new products and suppliers that have become important in buyers' purchasing patterns. Deflators for ICT products vary widely across Organisation for Economic Co-operation and Development (OECD) countries, which may reflect differences in quality adjustment procedures and item samples (Figure 1.4.1). For example, research in the United Kingdom suggests that the rate of change in telecommunications service prices was overstated by 7 percentage points during 2010–15 (Abdirahman and others 2017).

The impact of mismeasurement of ICT prices on aggregate measures of productivity depends on the

Figure 1.4.1. Difference between ICT Price Indices and General Non-ICT Price Index, Selected OECD Countries

(Percent difference in average annual growth, 2010–15)



Source: Ahmad, Ribarsky, and Reinsdorf 2017.
Note: Data reported for Spain for ICT equipment and computer software and database correspond to 2010–14. Data reported for Austria for communications services correspond to 2011–15. Data labels use International Organization for Standardization (ISO) country codes. CPI = consumer price index; ICT = information and communications technology.

Box 1.4 *(continued)*

weight of the affected items. Quality-adjusted prices for ICT equipment and software in the United States in Byrne, Fernald, and Reinsdorf (2016) and Byrne and Corrado (2017) show substantially lower growth than the official deflators, but the implied adjustment to US labor productivity growth is just 24 basis points during 2004–14. Adjusting for unmeasured improvements in telecommunications services and unmeasured price savings from e-commerce could add another 8–10 basis points.[1] The size of these effects in other economies depends on their price measurement methods and on the importance of these items in domestic production.

A different kind of measurement issue is raised by globalization. Productivity statistics cover production within a nation's economic territory, but digitalization has facilitated fragmentation of production across global supply chains, as well as multinational companies' relocation for tax arbitrage purposes of their headquarters, intellectual property and other assets, and operations. Multinational companies engaged in tax-driven relocation may misreport the location of production of their output. To investigate this possibility, Guvenen and others (2017) use indicators to apportion the worldwide output of multinational companies with headquarters or operations in the United States. This apportionment increases the estimated rate of US productivity growth by 0.25 percentage point for 2004–08 but has no effect thereafter.

The scope of productivity statistics is limited to output sold at market prices, raising questions about the possible omission of welfare gains from free digital products. These products fall into three categories: free replacements for nondigital products, such as video calls over the Internet, online bill paying, and the camera and GPS capabilities of a smartphone; free media, funded by advertising and data collection; and products produced by volunteers.

[1]Mismeasurement of quality changes in medical care could also be significant but estimates of the possible impact are unavailable.

Many of the free digital replacements could be captured in productivity statistics by including them in the deflator calculations as quality improvements in a priced digital product. Based on the weights of items with free or low-cost digital replacements in an average consumption basket for OECD countries in 2005, the average impact on productivity growth could be 0.1–0.2 percent a year during the years of significant digital replacement, with a smaller effect today (Reinsdorf and Schreyer 2017).

Research on techniques for inclusion of viewers' consumption of free media funded by advertising generally finds only a tiny effect on productivity growth. However, a more extreme proposal, by Nakamura, Samuels, and Soloveichik (2017), to count all free information supplied for marketing purposes in viewers' consumption—and to define the deflator for online media in a way that implies a rapid decline—would increase the estimated rate of US productivity growth by 0.1 percentage point. The effect of expansion of the definition of investment to include collection of user data has not yet been investigated.

Questions about nonmarket production or welfare (that are beyond the scope of productivity statistics) on market producers may be addressed in future research on other indicators. Production of open-source software by volunteers is one such question. Furthermore, by expanding access to information and variety, and enabling new kinds of services, digital platforms have raised households' productivity in the use of their time for nonmarket production for their own consumption. Tasks previously part of market production have shifted to nonmarket production (for example, households now act as their own travel agents), and low-productivity uses of households' time have shifted to market production (for example, e-commerce has replaced driving to the store and finding items on the shelf). Research on these questions could provide important context for productivity statistics.

Box 1.5. Macroeconomic Impact of Corporate Tax Policy Changes

This box uses the IMF's Global Integrated Monetary and Fiscal Model (GIMF) to compare the macroeconomic impact in the United States of temporarily reducing the corporate income tax rate with the impact of temporarily increasing the investment expensing allowance.[1] The results illustrate that a temporary increase in investment expensing can have a much larger short-term impact on activity than a temporary cut in the corporate income tax that causes an identical decline in fiscal revenue.

Assumptions

Under the corporate income tax reduction simulation, it is assumed that revenue from domestic and foreign sales is subject to tax and that all costs can be deducted from revenue to calculate the profit that forms the tax base (to approximate the corporate income tax system in the United States). These costs include labor, rent, capital depreciation, interest expenses, and intermediate inputs, including those that are imported.

The simulation that reduces the corporate income tax rate reduces the tax payments on corporate profits.[2] The simulation that increases the investment expensing allowance component assumes that the corporate tax rate remains unchanged, but that some of firms' investment expenditure can now be considered expenses and, hence, deducted from corporate revenue.

In both simulations, it is assumed that the fiscal authority credibly changes the corporate tax system (the corporate income tax rate or the share of investment expenditure that can be deducted) such that the government revenue from taxing the corporate sector is reduced by half a percent of GDP for five years. Thereafter, the corporate tax rate and investment allowances both return to their baseline. After five years, transfer payments to households are reduced to bring government debt back to its baseline level over the long term.

The authors of this box are Benjamin Carton, Emilio Fernandez, and Benjamin Hunt.

[1]See Carton, Fernandez-Corugedo, and Hunt (2017) for a detailed description of the version of GIMF used in these simulations.

[2]That is, it reduces *both* the tax payments stemming from corporate revenue and the amount that can be deducted from the cost of using all inputs, including capital depreciation and interest expensing.

Results

The propagation of both tax policies is broadly similar because they both increase the return on capital expenditure. However, the quantitative difference in their impact is striking. The impact of introducing a temporary increase in the investment expensing allowance (red line in Figure 1.5.1) has a significant impact on investment and output. Under the increase in the investment expensing allowance scenario, firms receive a tax benefit only from their investment expenditure, which sharply increases the incentive to invest while the increased allowance is in place.[3] The boom in investment supports employment and real wages, which also boosts consumption and raises the price of domestically produced goods.

In response, the monetary authority tightens policy. The resulting higher real interest rate offsets some of the reduction in the cost of capital, which dampens private investment and partly offsets the impact of higher household incomes on consumption expenditure. In addition, the increase in the real interest rate leads to an appreciation of the real effective exchange rate, lowering import prices and export competitiveness. Lower import prices together with additional domestic demand increase the demand for imports, while higher export prices decrease exports. Net exports contribute negatively to GDP growth, and the current account worsens.

Once the investment allowance expires and the return on capital declines, firms reduce their investment expenditure and let the capital stock return to the baseline. This lowers employment and real wages and, hence, consumption—all of which eventually return to the baseline. The gradual reduction in domestic demand leads policymakers to ease monetary policy, which eventually reduces the real interest rate and leads the real exchange rate to depreciate. As a result, imports decline, whereas exports get a boost from the temporary increase in output and the exchange rate decline.

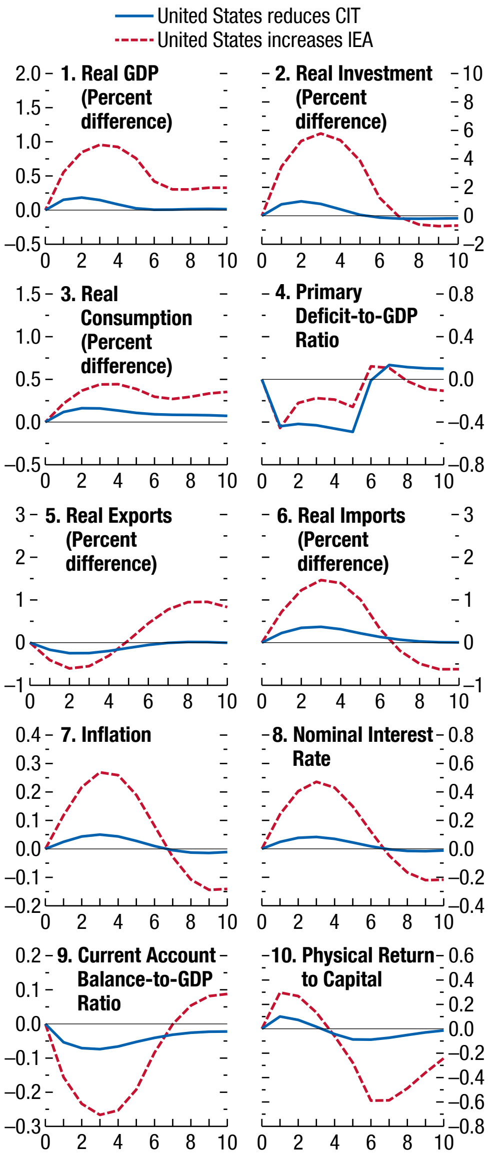
The impact of a temporary corporate income tax reduction (blue line in Figure 1.5.1) increases the returns from the use of all factors of production, including already-installed capital, thereby stimulat-

[3]The initial increase in investment is dampened by the presence of investment adjustment costs, which capture the fact that firms do not have additional investment plans ready to be launched and that it can be costly to install capital.

Box 1.5 *(continued)*

Figure 1.5.1. Impact of a Temporary Increase in the Investment Expense Allowance and a Temporary Decrease in the Corporate Income Tax Rate

(Percentage point difference from baseline, unless noted otherwise)



Source: IMF staff estimates.
Note: Years are on the *x*-axes. CIT = corporate income tax rate; IEA = investment expense allowance.

ing investment, employment, and real wages over the duration of the cut. Because the return on all factors of production rises and because much of that increase in return is on existing capital, the corporate income tax cut affects the incentive to invest much less than does the increase in the investment expensing allowance. Hence, the temporary tax cut has less impact on investment, which also results in lower employment, wages, consumption, and domestic demand.

Box 1.6. A Multidimensional Approach to Trade Policy Indicators

Recent events underscore the importance of trade and trade policy to the global economy. A move toward inward-looking policies can risk undermining the economic recovery under way. In contrast, addressing trade distortions can also raise productivity and growth, and a generalized move to more open trade can facilitate adjustment in countries facing greater import competition (IMF-WTO-WB 2017). Trade policy discussions stand to benefit from having a strong factual basis covering the multiple dimensions that are nowadays relevant to assess trade policy. To this end, this box describes and discusses a set of indicators of trade regimes which can be a helpful tool to guide policy discussions (see Cerdeiro and Nam 2018).

Barriers to trade can take many different forms, ranging from import tariffs to regulatory barriers, restrictions on services trade, and controls on foreign investment. Because of this diversity, no single indicator can provide a complete characterization of a country's trade regime. The indicators discussed here relate to three areas of trade policy—trade in goods, trade in services, and foreign direct investment. It is important to note that none of the indicators described aims to benchmark countries' performance against commitments they may have, either under the World Trade Organization (WTO) or vis-à-vis any other forum or agreement.

Figure 1.6.1 illustrates the results for the Group of Twenty (G20) as well as its advanced economy and emerging market members. In panel 1, four of the indicators aim to measure barriers to goods trade: average tariffs, the fraction of imports covered by nonautomatic licensing procedures, an index on trade facilitation, and the level of agricultural support. In addition, two indicators measure restrictions to services trade, and two aim to capture barriers to foreign direct investment. All indicators are normalized, such that being closer to the edge of the figure in panel 1 should be read as being more open.[1]

There are at least two salient features in the figure. First, on average, G20 advanced economies appear to have more open trade regimes than their emerging market counterparts, with the exception of agricultural support, which remains relatively large in some advanced economies. Emerging market economies should not necessarily be expected to be as open as advanced economies, which began to open to trade much earlier. At the same time, emerging market economies have liberalized faster over the past two decades, particularly from the mid-1990s to the mid-2000s, after which liberalization slowed across all countries. Second, the gap between advanced economies and emerging market economies is particularly pronounced for one of the services trade measures and trade facilitation. This lends partial support to the view that liberalization efforts have been somewhat asymmetric—not just across countries, but also across sectors.

In light of concerns that the period since the 2008 global financial crisis has seen an increase in different forms of protectionism, despite pledges to avoid this outcome, indicators that reflect the evolution of a more granular set of trade policies since 2008 are presented. While there is considerable heterogeneity within groups of countries, overall, emerging market G20 members appear to have adopted more trade-restricting measures since the crisis (Figure 1.6.1, panel 2).

All countries, however, including advanced economies, remain relatively far from free trade. Figure 1.6.2 shows the resulting indicators of countries' trade regimes if the edge of the figure represents free trade, rather than the most open country within the G20. The distance from free trade is largest for services restrictions, investment restrictions, trade facilitation, and, interestingly, in further most-favored-nation tariff reductions.

Because of the limitations inherent to any summary indicator, and given the lack of quantitative information for some important policy areas, these indicators are best used in conjunction with qualitative sources, including WTO Trade Policy Reviews. Information about countries' specific context is also essential for discussions about the scope, sequencing, and pace of trade reforms (see, for example,

The authors of this box are Diego Cerdeiro and Rachel J. Nam.

[1]Given that the different indicators are not expressed in comparable units of measure, every indicator is normalized with respect to a reference set of countries (G20 members in this box), where 0 corresponds to the country that is least open and 1 to the country that is most open for that indicator. It is important to bear in mind that the comparability across different policy dimensions that this normalization allows is only in a distance-to-frontier sense.

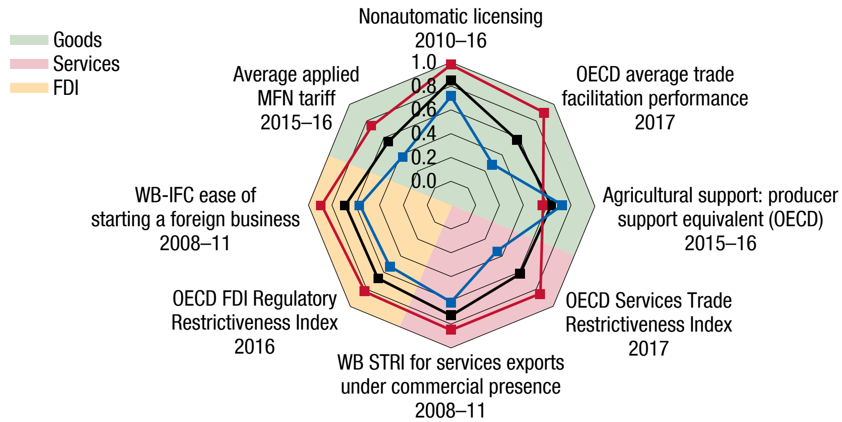
Box 1.6 *(continued)*

Figure 1.6.1. Selected Trade Policy Indicators: Example with Group of Twenty Member Countries

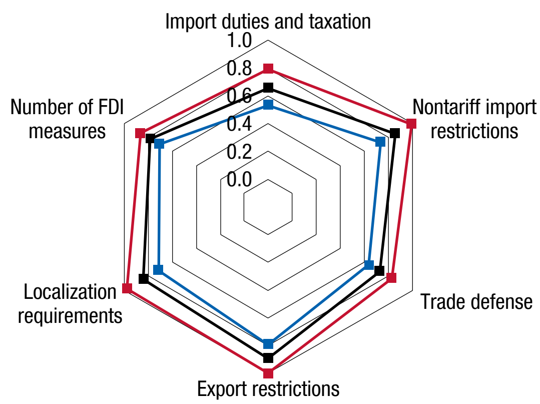
(0 = least open country in G20; 1 = most open country in G20)

G20 average — G20 AE average — G20 EM average

1. Overall Trade Regime



2. Trade Restrictive Measures Adopted since 2008[1]
(Measures in effect as of end-January 2018)

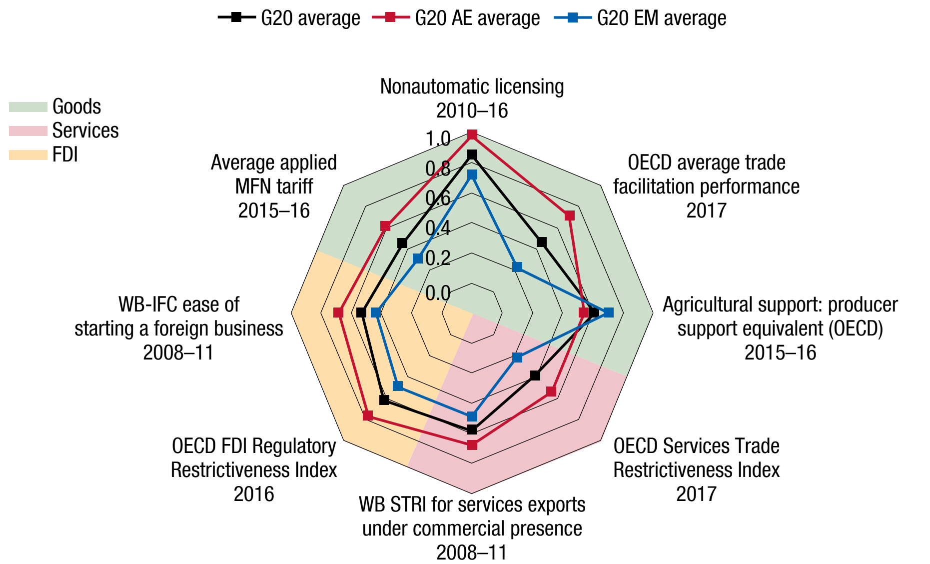


Sources: Global Trade Alert; Organisation for Economic Co-operation and Development (OECD); United Nations COMTRADE database; United Nations Conference on Trade and Development TRAINS; World Bank STRI; World Trade Organization (WTO), World Tariff Profiles; and IMF staff calculations.
Note: The indicators reflect no judgment as to WTO compliance of underlying measures, nor whether certain measures (such as trade defense) are an appropriate response to the actions of other countries. The "ease of starting a business" indicator is based on perceptions as part of an established International Finance Corporation survey process.
AE = advanced economy; AM = advanced economies; EM = emerging market; FDI = foreign direct investment; G20 = Group of Twenty; IFC = International Finance Corporation; MFN = most-favored nation; STRI = Services Trade Restrictiveness Index; WB = World Bank.
[1]Import (export) coverage ratio, except for the case of FDI (number of measures).

IMF 2010). It would also be useful to quantify other aspects of countries' trade regimes—including behind-the-border regulations that can hinder trade, state support (subsidies, state-owned enterprises), government procurement, and intellectual property. Better data, both across countries and in terms of policy areas that significantly affect trade, would help to better inform policy discussions.

Box 1.6 *(continued)*

Figure 1.6.2. Free Trade Normalization: Alternative Normalization
(0 = G20 most closed; 1 = free trade)



Sources: Organisation for Economic Co-operation and Development (OECD); United Nations COMTRADE database; World Bank STRI; World Trade Organization (WTO), World Tariff Profiles; and IMF staff calculations.
Note: The indicators reflect no judgment as to WTO compliance of underlying measures, nor whether certain measures (such as trade defense) are an appropriate response to the actions of other countries. The "ease of starting a business" indicator is based on perceptions as part of an established International Finance Corporation survey process.
AE = advanced economy; AM = advanced economies; EM = emerging market; FDI = foreign direct investment; G20 = Group of Twenty; IFC = International Finance Corporation; MFN = most favored nation; STRI = Services Trade Restrictiveness Index; WB = World Bank.

Box 1.7. Growth Outlook—Advanced Economies

Advanced economies are projected to grow at 2.5 percent in 2018—0.2 percentage point higher than in 2017—and 2.2 percent in 2019 (Table 1.1). For both years, this forecast is considerably stronger than the October *World Economic Outlook* (WEO) forecast (0.5 and 0.4 percentage point higher for 2018 and 2019, respectively). Growth in advanced economies is projected to decline to 1.5 percent over the medium term, broadly in line with modest potential growth.

- The growth forecast for the *United States* has been revised up given stronger-than-expected activity in 2017, higher projected external demand, and the expected macroeconomic impact of the recent changes in fiscal policy. As a by-product, stronger domestic demand is projected to increase imports and widen the current account deficit. The US growth forecast has been raised from 2.3 to 2.9 percent in 2018 and from 1.9 to 2.7 percent in 2019. Growth is expected to be lower than in previous forecasts for a few years from 2022 onward, given the temporary nature of some tax provisions.
- The recovery in the *euro area* is expected to strengthen from 2.3 percent in 2017 to 2.4 percent in 2018, before moderating to 2.0 percent in 2019. The forecast is higher than in the October WEO by 0.5 and 0.3 percentage point for 2018 and 2019, respectively, reflecting stronger-than-expected domestic demand across the euro area, supportive monetary policy, and improved external demand prospects. Growth forecasts for 2018–19 for all major economies in the euro area have been revised up relative to the October WEO. In *France*, growth is expected to firm up from 1.8 percent in 2017 to 2.1 percent this year, before softening slightly to 2.0 percent in 2019. In *Germany*, growth is expected to remain stable at 2.5 percent in 2018 and moderate to 2.0 percent in 2019. *Italy*'s economy is also set to grow at a stable rate of 1.5 percent this year, softening to 1.1 percent in 2019. In *Spain*, growth is projected to decline from 3.1 percent in 2017 to 2.8 percent in 2018 and 2.2 percent in 2019. Medium-term growth in the *euro area* is projected at 1.4 percent, held back by low productivity amid weak reform efforts and unfavorable demographics.
- In the *United Kingdom*, growth is projected to slow from 1.8 percent in 2017 to 1.6 percent in 2018 and 1.5 percent in 2019, with business investment expected to remain weak in light of heightened uncertainty about post-Brexit arrangements. The forecasts are broadly unchanged relative to the October WEO. The medium-term growth forecast is also broadly unchanged at 1.6 percent, reflecting the anticipated higher barriers to trade and lower foreign direct investment following Brexit. Assumptions regarding the Brexit outcome remain broadly unchanged relative to the October WEO. (The UK is assumed to exit the customs union and the single market, but tariffs on goods trade with the European Union remain at zero, and non-tariff costs increase only moderately.)
- *Japan*'s growth is projected to moderate to 1.2 percent in 2018 (from a strong above-trend outturn of 1.7 percent in 2017) before slowing further to 0.9 percent in 2019. The upward revision of 0.5 percentage point in 2018 and 0.1 percentage point in 2019 relative to the October WEO reflects more favorable external demand prospects, rising private investment, and the Supplementary Budget for 2018. Japan's medium-term prospects, however, remain weak, mainly due to unfavorable demographics and a trend decline in the labor force.

Box 1.8. Growth Outlook—Emerging Market and Developing Economies

Growth in emerging market and developing economies is expected to increase from 4.8 percent in 2017 to 4.9 percent in 2018 and 5.1 percent in 2019 (0.1 percentage point higher for 2019 than in the October *World Economic Outlook* (WEO); Table 1.1). Beyond 2019, growth in emerging market and developing economies is projected to stabilize around 5 percent over the medium term.

- In *China*, growth is projected to moderate from 6.9 percent in 2017 to 6.6 percent in 2018 and 6.4 percent in 2019. The forecast is higher (by 0.1 percentage point in both 2018 and 2019) relative to the October WEO, reflecting an improved external demand outlook. Over the medium term, growth is expected to gradually slow to 5.5 percent with continued rebalancing from investment to consumption as policy support through fiscal and credit channels is gradually reduced, the social safety net is strengthened, and precautionary saving declines. The economy is also assumed to maintain progress on rebalancing from industry to services. However, rising nonfinancial debt as a share of GDP and the accumulation of vulnerabilities weigh on the medium-term outlook.
- Growth elsewhere in emerging and developing Asia is expected to remain strong. *India*'s economy is projected to grow at 7.4 percent in 2018 and 7.8 percent in 2019, up from 6.7 percent in 2017. The forecast is unchanged from the October WEO, with the short-term firming of growth driven by a recovery from the transitory effects of the currency exchange initiative and implementation of the national goods and services tax, and supported by strong private consumption growth. Among the ASEAN-5 economies (*Indonesia, Malaysia, Philippines, Thailand, Vietnam*), broadly stable growth is projected for the group, at 5.3 percent in 2018 and 5.4 percent in 2019 (compared with 5.3 percent in 2017).
- Recovery in *Latin America and the Caribbean* is strengthening, with growth for the region projected to increase from 1.3 percent in 2017 to 2.0 percent in 2018 and 2.8 percent in 2019 (an upward revision of 0.1 and 0.4 percentage point, respectively, for 2018 and 2019 relative to the October WEO).
  - *Mexico*'s economy is projected to accelerate from 2.0 percent in 2017 to 2.3 percent in 2018 and 3.0 percent in 2019 (0.4 and 0.7 percentage point higher than projected in the October WEO), benefiting from stronger US growth. Complete implementation of the structural reform agenda is projected to maintain growth close to 3 percent over the medium term.
  - Following a deep recession in 2015–16, *Brazil*'s economy returned to growth in 2017 (1.0 percent) and is expected to improve to 2.3 percent in 2018 and 2.5 percent in 2019 on the back of stronger private consumption and investment. The growth forecast is higher than in the October WEO by 0.8 percentage point for 2018 and 0.5 in 2019. Medium-term growth is set to moderate to 2.2 percent.
  - In *Argentina*, growth is expected to moderate from 2.9 percent in 2017 to 2.0 percent in 2018 (0.5 percentage point lower than in the October WEO forecast) due to the effect of the drought on agricultural production, as well as the needed fiscal and monetary adjustment to improve the sustainability of public finances and reduce high inflation. Thereafter, growth is set to recover gradually to 3.3 percent over the medium term.
  - In *Venezuela*, real GDP is forecast to fall by about 15 percent in 2018 and a further 6 percent in 2019—a significant downward revision compared with the declines projected in the October WEO (9.0 percent and 4.0 percent, respectively, for 2018 and 2019)—as the collapse in oil production and exports intensifies the crisis that has led to output contraction since 2014.
- The outlook for the *Commonwealth of Independent States* is broadly unchanged since the October 2017 WEO, with growth for the region expected to inch up from 2.1 percent in 2017 to 2.2 percent in 2018 and stabilize around that level thereafter. *Russia*'s return to growth in 2017 was supported by improved oil export revenue, stronger business confidence, and looser monetary policy. The Russian economy is expected to grow by 1.7 percent this year, before softening to 1.5 percent over the medium term as structural headwinds and sanctions weigh on activity. Russia's emergence from recession has helped other economies in the region through trade and remittance flows. Growth projections for 2018 have been revised up for Azerbaijan to 2.0 percent (0.7 percentage point higher than in the October WEO) on higher public investment, and Kazakhstan to 3.2 percent (higher by 0.4 percentage point relative to the October WEO) reflecting

Box 1.8 *(continued)*

stronger oil production, but medium-term prospects remain subdued.

- Growth in *emerging and developing Europe* is projected to moderate from 5.8 percent in 2017 to a still-robust 4.3 percent in 2018 and soften further to 3.7 percent in 2019 (0.8 and 0.4 percentage point higher, respectively, than projected in the October WEO). Stronger external demand, generated by the improved momentum in euro area economic activity, has generally lifted near-term growth prospects across the group. In *Poland*, strong domestic consumption, faster absorption of EU funds, and supportive macro policies are expected to lift activity above potential this year. Growth is projected at 4.1 percent in 2018, moderating to 3.5 percent in 2019—stronger by 0.8 and 0.5 percentage point, respectively, than projected in the October WEO. *Turkey's* economy is also projected to grow above potential, buoyed by improved external demand conditions and supportive policies on multiple fronts—expansionary fiscal policy, state loan guarantees, procyclical macroprudential policy, and an accommodative monetary stance. Growth is projected at 4.4 percent in 2018 and 4.0 percent in 2019, an upward revision of 0.9 percentage point for 2018 and 0.5 percentage point for 2019 relative to the October WEO.
- Growth in *sub-Saharan Africa* is projected to rise to 3.4 percent in 2018 (from 2.8 percent in 2017) and improve slightly thereafter through the medium term to about 4.0 percent. While the headline numbers suggest a broadly unchanged picture relative to the October WEO, revisions to growth projections for key large economies point to underlying differences in prospects across the region. In *Nigeria*, the economy is projected to grow 2.1 percent in 2018 and 1.9 percent in 2019 (up from 0.8 percent in 2017), reflecting improved oil prices, revenue, and production and recently introduced foreign exchange measures that contribute to better foreign exchange availability. The forecast is 0.2 percentage point stronger in each year relative to the October WEO forecast. Similarly, for the region's other large oil dependent economy, *Angola*, growth is projected to rise from 0.7 percent in 2017 to 2.2 percent in 2018 and 2.4 percent in 2019 (upward revisions of 0.6 and 1.0 percentage point, respectively, relative to the October WEO) as the firming of oil prices lifts disposable income and business sentiment improves. Growth in *South Africa* is also expected to strengthen from 1.3 percent in 2017 to 1.5 percent in 2018 and 1.7 percent in 2019, (stronger than in the October WEO by 0.4 and 0.1 percentage point, respectively, for 2018 and 2019). Business confidence is likely to gradually firm up as political uncertainty diminishes, but growth prospects remain weighed down by structural bottlenecks.
- In the *Middle East*, *North Africa, Afghanistan, and Pakistan* region, growth is projected to increase from 2.6 percent in 2017 to 3.4 percent in 2018 and 3.7 percent in 2019. Growth is expected to stabilize thereafter at about 3.6 percent through the medium term. The need for fiscal consolidation as a result of structurally lower oil revenues, security challenges, and structural impediments weigh on the medium-term prospects for many economies in the region. Relative to the forecasts in the October WEO, with the pickup in oil prices, prospects for oil exporters have improved somewhat (with a small downward revision to 2018 growth and a more-than-offsetting positive revision to 2019 growth), while those of oil importers have softened slightly. In *Saudi Arabia*, growth is projected to resume this year, rising to 1.7 percent from a contraction of 0.7 percent in 2017. Growth in 2019 is expected to rise slightly to 1.9 percent as oil output increases, with the assumed expiration of the Organization of the Petroleum Exporting Countries Plus production cut agreement. The forecast has been revised up from the October WEO by 0.6 and 0.3 percentage point for 2018 and 2019, respectively. Growth in *Egypt* is projected to rise to 5.2 percent in 2018 and 5.5 percent in 2019 (0.7 and 0.2 percentage point higher, respectively, than in the October WEO), reflecting stronger momentum in domestic demand and the effect of structural reforms. *Pakistan's* economy is expected to expand at a robust pace of 5.6 percent this year (up from 5.3 in 2017), before moderating to 4.7 percent in 2019. While the forecast for 2018 is unchanged relative to the October WEO, for 2019, it has been revised down by 1.3 percentage points, partly reflecting an increase in macroeconomic vulnerabilities.

Box 1.9. Inflation Outlook—Regions and Countries

As shown in Table 1.1, inflation rates in advanced economies are projected to pick up to 2.0 percent in 2018, from 1.7 percent in 2017. Inflation in emerging market and developing economies excluding Venezuela is expected to increase to 4.6 percent this year, from 4.0 percent in 2017. The group aggregates mask notable differences across individual countries.

Advanced Economies

- In the *United States*, headline consumer price inflation is expected to increase from 2.1 percent in 2017 to 2.5 percent in 2018, before softening to 2.4 percent in 2019. Core consumer price inflation (CPI)—excluding fuel and food prices—is projected to increase from 1.8 percent in 2017 to 2.0 percent in 2018 and 2.5 percent in 2019 as output is set to rise above potential following the expected sizable fiscal expansion. Core personal consumption expenditure price inflation, the Federal Reserve's preferred measure, is projected to increase from 1.5 percent in 2017 to 1.7 percent in 2018 and 2.2 percent in 2019. Inflation rates are projected to moderate over the medium term, reflecting a monetary policy response that will keep expectations and actual inflation well anchored.
- Headline inflation in the *euro area* is expected to remain at 1.5 percent in 2018 and inch up to 1.6 percent in 2019. With the recovery boosting growth above potential for 2018–19, core CPI is expected to increase from 1.1 percent in 2017 to 1.2 percent in 2018 and 1.7 percent in 2019. Core CPI is projected to gradually increase to 2 percent by 2021 as growth remains above trend for the next couple of years and inflation expectations strengthen.
- In *Japan*, headline inflation is expected to increase to 1.1 percent in 2018–19 (from 0.5 percent in 2017) due to higher energy and food prices and strong domestic demand. Core inflation is projected to rise from 0.1 percent in 2017 to 0.5 percent in 2018 and increase further to 0.8 percent in 2019. Inflation is likely to remain below the Bank of Japan's target over the forecast horizon, reflecting generally slow pass-through of strong demand to wages and firms' operating costs and a very gradual adjustment in inflation expectations.
- Diminishing slack in the economy, together with the pass-through effects of depreciation of the pound, are projected to keep inflation in the *United Kingdom* above the Bank of England's target in 2018. Headline inflation is projected at 2.7 percent in 2018, the same as in 2017. Core CPI (excluding energy, food, alcoholic beverages and tobacco prices) is expected to increase from 2.4 percent in 2017 to 2.5 percent this year, before moderating to 2.2 percent in 2019 (and further to 2 percent over the medium term) as interest rate hikes and the withdrawal of monetary support proceed.

Emerging Market and Developing Economies

- Headline inflation in *China* is expected to pick up to 2.5 percent this year and to about 3 percent over the medium term as food and energy prices rise and core inflation inches up as a result of diminished excess capacity in the industrial sector, continued robust demand for services, and growing pressure on wages as the labor force declines.
- In *Brazil* and *Russia,* headline inflation is expected to remain subdued in the range of 3–4 percent in 2018 as output gaps gradually close, with growth continuing to recover from the recession of 2015–16. Inflation is expected to rise over the medium term, with firmer core inflation and the projected modest pickup in commodity prices, but to remain at levels well below the average of the past decade. In *Mexico,* the average inflation rate is projected to decline to about 4.4 percent in 2018 (from 6.0 percent in 2017) as the effects of temporary factors such as fuel price liberalization fade, dropping further to about 3.0 percent in 2019.
- Inflation in sub-Saharan Africa is projected to moderate slightly in 2018 and 2019 but is expected to remain in double digits in key large economies, reflecting the pass-through effects of currency depreciation and their impact on inflation expectations (Angola), supply factors, and assumed monetary policy accommodation to support fiscal policy (Nigeria).

Special Feature: Commodity Market Developments and Forecasts

Commodity prices have increased since the release of the October 2017 World Economic Outlook *(WEO). Supply outages, the extension of the production agreement by the Organization of the Petroleum Exporting Countries (OPEC), and stronger-than-expected global economic growth all pushed oil prices higher. Metal prices also increased following better-than-expected growth in all major economies and production cuts in China. Agricultural prices rose markedly less than those of other commodities, but they have been catching up following unfavorable weather, especially in the Western Hemisphere.*

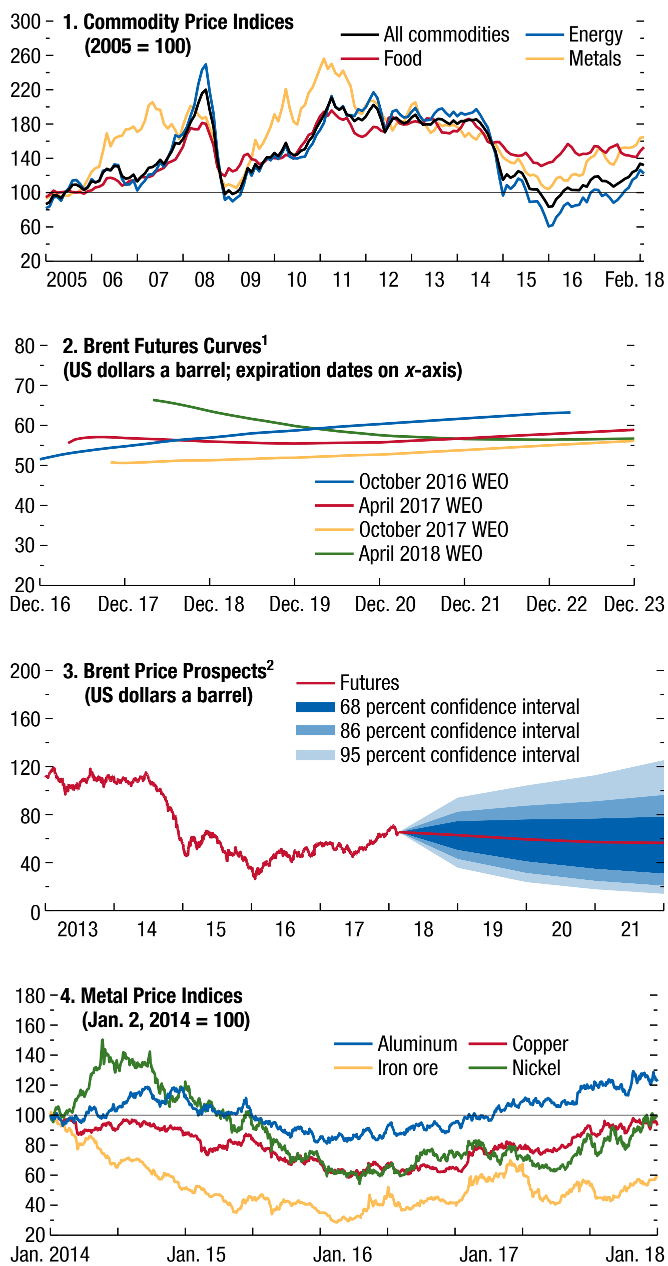
The IMF's Primary Commodities Price Index rose 16.9 percent between August 2017 and February 2018, the reference periods for the October 2017 and current WEO (Figure 1.SF.1, panel 1). Energy prices and metal prices increased substantially, 26.9 percent and 8.3 percent, respectively, while agricultural prices increased markedly less, by 4.1 percent. Oil prices increased to above $65 a barrel (as of January), attaining their highest level since 2015, in response to unplanned outages and stronger global economic growth. Since then, prices have receded following stronger-than-expected US production. Natural gas prices increased sharply as a result of winter heating use and strong demand from China. Coal prices increased, but by less than other energy prices, because a shift from coal to gas is under way in many countries.

Oil Prices Highest since 2015

Among key influences on oil prices, on November 30, 2017, OPEC agreed to extend to the end of 2018 the production target in place since January 2017. This extension was the second (following the April 2017 agreement that had extended the November 2016 agreement). The agreement entails a cut of 1.2 million barrels a day (mbd) relative to October 2016 production. Russia and other non-OPEC countries agreed to stick to current production levels, implying additional cuts of about 0.6 mbd relative to the October 2016 level.

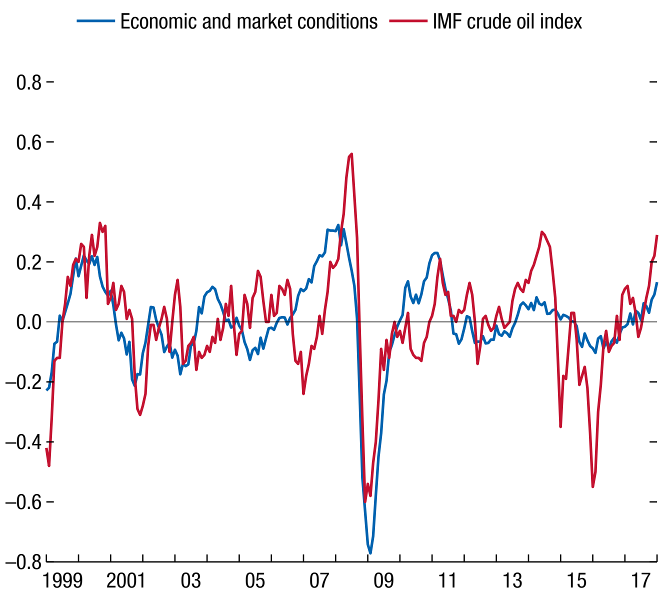
The authors of this feature are Christian Bogmans (team coleader), Akito Matsumoto (team coleader), and Rachel Yuting Fan, with research assistance from Lama Kiyasseh.

Figure 1.SF.1. Commodity Market Developments



Sources: Bloomberg Finance L.P.; IMF, Primary Commodity Price System; Thomson Reuters Datastream; and IMF staff estimates.
Note: WEO = *World Economic Outlook*.
[1]WEO futures prices are baseline assumptions for each WEO and are derived from futures prices. April 2018 WEO prices are based on February 22, 2018, closing.
[2]Derived from prices of futures options on February 22, 2018.

Figure 1.SF.2. Detrended IMF Crude Oil Index and Economic and Market Conditions



Sources: Haver Analytics; IMF, Primary Commodity Price System; and IMF staff calculations.

In addition to the OPEC extension, unplanned outages, including on the US Gulf Coast, in Venezuela, and in other locations, cut supply unexpectedly. Although 2017 non-OPEC supply was slightly stronger than expected, the sharp decline in production in Venezuela—following further deterioration in its macroeconomic and financial conditions—more than offset the increase in non-OPEC production. While Libya's production increased dramatically during 2017, a recent outage there together with one in the North Sea further reduced global oil supply. Hurricane damage to infrastructure slowed the US production response to rising oil prices. (The rig count returned to its August 2017 level only in February 2018, even though oil prices were rising from their trough below $50 a barrel since June 2017.) However, the stronger-than-expected increase in US oil production in early 2018 eventually helped pull oil prices down from the January high. These events were concentrated between late 2017 and early 2018, so spot prices moved much more than futures.

Oil Price Rally: Largely Supply Driven

Despite the increase in global aggregate demand, recent revisions to oil market expectations point to a mostly supply-driven oil price rally. The main reason is that a typical income elasticity of demand would imply at most a 0.2 percent increase in oil demand as a result of the 0.2 percentage point upward revision of global growth for 2018 in the current WEO. Based on a fixed supply curve, with price elasticity of supply between 0.03 and 0.1, the 0.2 percent increase in oil demand would imply a 2–6 percent increase in prices—that is, a $1 to $3 price increase over an initial level of $50 a barrel.

The biggest supply surprise is the faster-than-expected deterioration in Venezuelan output. Venezuela produced 2.38 mbd of crude oil in 2016 and 2.10 mbd in the third quarter of 2017. The latest production figure stands at 1.62 mbd in December 2017, and many expect that it will decline to close to 1.0 mbd by the end of 2018. An additional decline in production, some of which is probably already priced in, would push prices even higher.

To sum up, if the supply forecast for 2018 is revised down by 0.8 mbd, and the oil demand elasticity is identical to the oil supply elasticity, it implies that roughly 80 percent of the recent price increase was caused by a deterioration in supply conditions.

An alternative method to infer the role of demand and supply factors in driving price changes uses regression analysis. Figure 1.SF.2 plots a proxy for global demand; that is, economic and market conditions—a weighted index based on the purchasing managers' index, industrial production, and equity prices against the detrended movement in oil prices (obtained by using the Hodrick-Prescott filter). The purchasing managers' index and equity prices proxy for market sentiment and financial factors, respectively—the latter relates to speculative demand for oil. Figure 1.SF.1 shows that global demand fluctuations explain oil price movements well over the past couple of decades, especially earlier in the sample period, when demand from China and the financial crisis of 2008 and its recovery were key drivers of oil prices. More recently, however, fluctuations in global demand have been muted, compared with the large swings in prices, suggesting that demand shocks have lost much of their explanatory power. Specifically, the price collapse of 2014 and the notable subsequent swings seem only weakly related to movements in global demand. A regression-based calculation suggests that only 20 percent of oil price fluctuations since August 2017 can be attributed to changes in global demand.

Oil Futures

Oil futures contracts point to a decline in prices to about $53.6 a barrel in 2023 (Figure 1.SF.1, panel 2). Baseline assumptions for the IMF's average petroleum spot prices, based on futures prices, suggest average annual prices of $62.3 a barrel in 2018—an increase of 18.0 percent from the 2017 average—and $58.2 a barrel in 2019 (Figure 1.SF.1, panel 3). The decline is due to an expected increase of US supply and the eventual end of the OPEC deal.

Uncertainty remains around the baseline assumptions for oil prices, although risks are balanced. Upside risks include further declines in Venezuelan production and unplanned outages elsewhere. At the same time, stronger-than-expected US and Canadian production could push prices down sooner than predicted.[1] However, the long end of the futures curve is expected to stay at about $55, given current technology trends.

Natural Gas and Coal

The natural gas price index—an average for Europe, Japan, and the United States—rose sharply, by 45.0 percent, between August 2017 and February 2018, reflecting seasonal factors, including an extremely cold winter in Europe. Strong demand for liquefied natural gas (LNG) in China, where the government has reduced the use of coal to mitigate air pollution, helped drive the spot LNG price to its highest level in three years. India's LNG demand also grew strongly in the second half of 2017. Higher oil prices add extra upward pressure to natural gas prices in countries where oil-linked pricing is more common.

The coal price index—an average of Australian and South African prices—increased by 8.4 percent from August 2017 to February 2018. Following the introduction of coal import restrictions in July 2017, China's coal imports declined in the second half of 2017 compared with the previous year, although total imports were higher than in 2016 as a result of increases in the first half of the year. More recently, however, Chinese import restrictions were temporarily lifted to accommodate strong winter heating demand.

[1]The US Energy Information Administration expects US crude oil production in 2018 to reach 10.3 mbd, exceeding the previous high of 9.6 mbd recorded in 1970, and to increase further in 2019. Canada's oil production, which has been growing strongly, is expected to grow further.

Metal Prices Increasing

Metal prices increased by 8.3 percent between August 2017 and February 2018, in line with better-than-expected growth in all major economies. Purchasing managers' indices for major economies have been well above the 50-point mark that separates growth from contraction, led by the United States and the euro area, and were about 60 as of February 2018. The World Bureau of Metal Statistics reported a wider demand-supply gap for all base metals, especially aluminum, as solid economic growth led to higher demand, while supply was limited, partially owing to China's production cuts. Depreciation of the US dollar has also supported dollar-denominated metal commodities.

Iron ore returned to trading at about $78 a ton in February, rising 4.1 percent from its August price of $74.6 a ton. The force behind the recovery comes from higher steel prices and state-mandated curbs on steel mills in China, which have lowered output despite strong demand. Rising coal prices due to China's import restrictions further amplified the effect during the traditional restocking season for iron ore, adding more demand to this raw material for steel production. However, markets are expecting a decline over the medium term, linked to expected lower steel production.

Aluminum and copper hit multiyear highs following production cuts in China (which contributes more than half of both global production and consumption of aluminum) to reduce air pollution during the winter. In turn, this has led to a larger global supply-demand deficit and pushed aluminum prices to close February 7.5 percent higher than August. Likewise, copper prices gained 8 percent during the same period, boosted by solid demand in China. Futures markets suggest further price increases of both metals over the medium term, in line with improved global macroeconomic prospects.

The price of nickel, a key ingredient in stainless steel and batteries in electric vehicles, reached multiyear highs in February, up 24.8 percent over August 2017. Owing to strong demand from China and tight supplies, nickel inventories at London Metal Exchange warehouses fell since October to a 14-month low in January. Cobalt, another raw material for batteries, has experienced sharp price increases since 2016, fueled by tight supply and rising demand from electric vehicle manufacturers. Hitting a nine-year high in late

January, cobalt prices were up 38.2 percent in February 2018 relative to their August 2017 average.[2]

Uranium was hovering at about $20 since August, but rallied in early November following the announcement of production cuts by two of the world's biggest producers. The price has receded since early December and fell 11.2 percent between August 2017 and February 2018.

Adverse Weather Driving Food Prices Higher

The IMF's agricultural price index rose 4.1 percent from August 2017 to February 2018, given that unfavorable weather conditions in recent months are expected to reduce this year's harvests of many grains and oilseeds. The subindices of food and agricultural raw materials rose by 4.1 and 6.0 percent, respectively, and the beverages index declined by 3.6 percent. The drop in beverage prices can be attributed to a substantial decline in the price of coffee (by 12.7 percent) while the gain in the index of raw agricultural materials follows a rally in the price of cotton.

Wheat prices increased by 23.9 percent between August 2017 and February 2018. Following the Northern Hemisphere harvests and continued stock building in most of the world, except China, wheat prices remained under significant pressure until November. Since then, prices have rallied—winter wheat crops in the key southern Plains region of the United States were likely significantly damaged by cold and dry winter weather.

Soybean prices trended up from August 2017 to February 2018, increasing by 7.5 percent, following concerns over weather in South America. A deterioration in the next Argentine soybean crop because of hot and dry conditions has stimulated early buying, providing price support for the soybean complex. The outlook is bullish as continued feed demand growth and supportive global biodiesel policies counter historically large global stocks.

Maize prices have also increased since August, rising by 10.1 percent, following the upward trend of soybean prices. While dry weather in Argentina has already reduced yields of the partially harvested corn crop, in Brazil, rainfall is hampering planting, potentially reducing future yields.

[2]Box 1.SF.1 studies the role of cobalt and lithium as important raw materials in the production of electric vehicle batteries.

Palm oil prices rose by 3.4 percent from August 2017 to February 2018. Prices trended down throughout 2017 as production growth in Indonesia and Malaysia continued to outpace demand growth and stocks recovered. But prices increased in early 2018 as higher oil prices stimulated biodiesel demand in Indonesia. Another major support for palm oil prices is the reduction in supplies of rival oilseeds, such as soybeans, caused by bad weather.

Cotton prices increased by 11.3 percent between August 2017 and February 2018. The recent price increase follows worries over pest damage to India's crop, resulting in lower stocks available for export, as well as setbacks to the latest US harvest during the hurricane season. Looking ahead, the recent increase in oil prices is likely to provide support for cotton prices, because it makes artificial fibers more expensive. Falling stocks in China are also likely to contribute upward pressure on prices.

Pork prices declined by 11.2 percent from August 2017 to February 2018 due to seasonal factors. While supplies are expected to increase in 2018, especially in the United States, strong demand from China, Japan, Mexico, and the United States implies that markets are again expected to clear at higher year-over-year prices. Beef prices rose by 3.1 percent because supply growth in the United States, a major producer and exporter, was offset by strong export demand. Moreover, drought in the United States reduced the number of cattle placed on feedlots.

Following dry weather in west Africa at the beginning of 2018, output of cocoa is expected to fall in all producer countries, including the top producer, Côte d'Ivoire, although the world is still projected to run a production surplus in 2017–18. The reduction in expected supply comes at a time of strong demand. These developments led to an increase in the price of cocoa of 6.8 percent between August 2017 and February 2018.

The price of Arabica coffee declined by 7.6 percent between August 2017 and February 2018, reflecting weaker-than-expected demand for exports at the beginning of the 2017–18 season.

The price of sugar decreased by 6.7 percent between August 2017 and February 2018, reflecting upward revisions to an expected 2017–18 surplus global production. In India, most notably, output may exceed that of the previous season by as much as 40 percent. Strong supplies from Brazil and Europe in 2018–19 are likely to lead to another surplus year.

The prices of most major agricultural commodities have been revised up slightly, reflecting diminishing excess supply. Overall, food prices are projected to increase by 2.6 percent in 2018 and 1.8 percent in 2019, mostly on account of rising cereal and oilseed prices (compared with the previously projected decrease of 0.7 percent and increase of 2.6 percent, respectively) and are expected to decline again thereafter.

Weather disruptions and variability are an upside risk to the forecast for agricultural prices. The ongoing weak-to-moderate La Niña weather pattern has peaked and is expected to weaken further over the spring. It has proved to be a significant source of price volatility for several commodities. The recent worries over Argentina's soybean crop, as well as the reported setback to winter wheat crops in the key southern Plains region of the United States—both caused by cold and dry winter weather—are consistent with historical patterns of the weather phenomenon. Changes in trade policies may be another upside risk factor, especially for agricultural importers. A depreciating US dollar helped stimulate exports in 2017, but a partial reversal in 2018 could put upward pressure on prices for importing countries. Uncertainty over global corn acreage, as production margins for farmers remain low, could put upward pressure on corn prices by the end of this year.

Box 1.SF.1. The Role of Metals in the Economics of Electric Vehicles

The emergence of electric vehicle markets is supported by the falling costs of lithium-ion batteries, the most common and industry-preferred battery for such vehicles. Conversely, the emergence of electric vehicles has helped reduce the production costs of these batteries through economies of scale. A lithium-ion battery consists of an anode, typically graphitic carbon, and a cathode, separated by a liquid organic electrolyte. The cathode typically uses lithium and some combination of copper, nickel, manganese, aluminum, and cobalt.

Expenditures on metals for cathode construction make up a large share of total lithium-ion and electric vehicle costs. Substitution with other materials is difficult. Lithium is an important ingredient because it is an element that is easily ionized or "charged." In addition, it allows for high energy density and, as such, yields batteries that dominate in the automotive area and in portable electronics. Cobalt is important for similar reasons but, at historically high prices, its cost share significantly exceeds that of lithium.

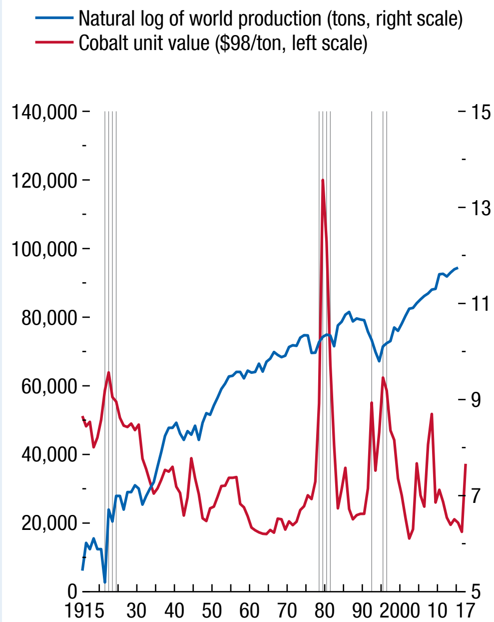
As supplies of lithium and cobalt have been unable to keep up with the surge in demand following the rapid growth of electric car sales in recent years, prices have been rising. The Chinese spot price of lithium carbonate increased by more than 30 percent in 2017. Even more noteworthy is the price path of cobalt: after more than doubling between September 2016 and April 2017, prices rose an additional 25 percent between November 2017 and January 2018. The question now is how production of these metals will change. To answer this question, this box analyzes global supply conditions.

Supply Conditions of Lithium and Cobalt

Australia and Chile are by far the biggest producers of lithium, together accounting for more than three-quarters of world production; Argentina is a distant third. According to the US Geological Survey, world reserves stood at 600 times global output in 2015. Production is thus not limited by physical resource scarcity. But, although recent production deficits and rising prices have encouraged new productive capacity, this new capacity has not so far kept prices in check.

The authors of this box are Christian Bogmans and Lama Kiyasseh.

Figure 1.SF.1.1. Hundred Years of Cobalt Mining



Sources: US Geological Survey; and IMF staff calculations.
Note: Gray lines indicate boom years.

Unlike lithium, cobalt supply is likely to remain relatively tight, at least over the next 5 to 10 years. In 2016 more than 50 percent of global supply originated in the Democratic Republic of the Congo. China (6.3 percent), Canada (5.9 percent), and Russia (5.0 percent) are other important, but much smaller, players. There is also an unofficial "artisanal" stream of production, some of it under the control of insurgent militias and relying on child labor. Geopolitical instability in the Democratic Republic of the Congo has the potential to disrupt supply, as it did at the end of the 1970s when political unrest led to a price boom (Figure 1.SF.1.1). Furthermore, the refining of cobalt is also geographically concentrated, with China by far being the biggest producer.

The specificities of the cobalt production process are perhaps the weakest link in the supply chain. Cobalt is mostly produced as a by-product of mining of other metals, nickel (50 percent), and copper (35 percent); only 6 percent of world production originates from primary production (see Olivetti and others 2017). For nickel-cobalt mines, most of the revenues come

Box 1.SF.1 *(continued)*

from nickel. This implies that the supply of cobalt from nickel-cobalt mines is inelastic with respect to the price of cobalt.

The situation is different, however, for copper: given last year's prices, a copper-cobalt mine could have obtained more than half its revenue from cobalt. Most cobalt-copper ore and reserves are in the Democratic Republic of the Congo, which implies that the rising price of cobalt will generate new supplies primarily from that country, further concentrating cobalt production. Last year, mining companies from the West and China invested heavily in copper mines in the Democratic Republic of the Congo.

Since 1915 there have been four price boom episodes—defined as a sequence of years during which real prices are in the upper 10 percent of a normal distribution's right tail. Those during 1978–81 and 1995–96 elicited sharp responses: world production grew by 54.1 and 36.1 percent in 1983 and 1995, respectively, significantly higher than the 50-year average of 4.8 percent. As of January 2018, prices of 15-month cobalt futures suggest that 2018 will be the first boom year since the 1995–96 episode.

Outlook

Future demand for cobalt and lithium will depend on the growth of their end-use products—including electronics and automobiles—which in turn depend on oil prices, economic growth, and battery technology, among other factors. Based on a forecast of global lithium-ion battery consumption, global lithium demand is expected to increase from 181 kilotons of lithium carbon equivalent to 535 kilotons by 2025 (Deutsche Bank 2017). This demand could be matched by investments in productive capacity, but there could still be supply constraints: new mining projects have long lead times, and concerns about the local environmental impact of mining in Latin America and elsewhere could slow the issuance of permits.

When it comes to cobalt, the situation seems to be more pressing. Based on a modest forecast of 10 million electric vehicle sales in 2025, Olivetti and others (2017) suggest a demand for cobalt exceeding 330 kilotons by 2025—almost three times the current world production. Such demand would require average annual growth of more than 11 percent for the next decade, well beyond that of the past 50 years. Historical evidence from the 20th century suggests that most commodity price booms peak within two years of their onset (Jacks 2013) as they give way to permanent changes in productive capacity and new productivity-enhancing investment. But occasionally they last longer. The required growth in cobalt production—historically unprecedented—is a risk to the electrification of the transportation sector.

Several developments could limit price volatility. These include increased recycling of cobalt and new primary production mining techniques. Perhaps most important, progress in battery technology could bring the surge in cobalt prices to a halt. One of the leading alternatives to the lithium-ion battery concept—the solid-state battery—would mean smaller and more-energy-dense batteries that would not need cobalt as an input. Widescale adoption of a mature solid-state battery concept would reduce the demand for cobalt. Continued research in this area will prevent resource constraints from delaying or altogether halting progress in electric vehicles and portable electronics.

Annex Table 1.1.1. European Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment

(Annual percent change, unless noted otherwise)

	Real GDP			Consumer Prices[1]			Current Account Balance[2]			Unemployment[3]		
		Projections			Projections			Projections			Projections	
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
Europe	**3.0**	**2.7**	**2.3**	**2.6**	**2.7**	**2.6**	**2.3**	**2.4**	**2.4**	**. . .**	**. . .**	**. . .**
Advanced Europe	**2.4**	**2.3**	**2.0**	**1.7**	**1.7**	**1.7**	**2.9**	**2.9**	**3.0**	**7.9**	**7.4**	**7.1**
Euro Area[4,5]	2.3	2.4	2.0	1.5	1.5	1.6	3.5	3.2	3.2	9.1	8.4	8.1
Germany	2.5	2.5	2.0	1.7	1.6	1.7	8.0	8.2	8.2	3.8	3.6	3.5
France	1.8	2.1	2.0	1.2	1.5	1.6	–1.4	–1.3	–0.9	9.4	8.8	8.4
Italy	1.5	1.5	1.1	1.3	1.1	1.3	2.9	2.6	2.2	11.3	10.9	10.6
Spain	3.1	2.8	2.2	2.0	1.7	1.6	1.7	1.6	1.7	17.2	15.5	14.8
Netherlands	3.1	3.2	2.4	1.3	2.0	2.2	9.8	9.6	8.9	5.1	4.9	4.8
Belgium	1.7	1.9	1.7	2.2	1.6	1.8	0.1	0.3	0.2	7.2	7.0	6.8
Austria	2.9	2.6	1.9	2.2	2.2	2.2	2.1	2.5	2.0	5.5	5.2	5.1
Greece	1.4	2.0	1.8	1.1	0.7	1.1	–0.8	–0.8	–0.6	21.5	19.8	18.0
Portugal	2.7	2.4	1.8	1.6	1.6	1.6	0.5	0.2	–0.1	8.9	7.3	6.7
Ireland	7.8	4.5	4.0	0.3	0.9	1.3	12.5	9.8	8.7	6.7	5.5	5.2
Finland	3.0	2.6	2.0	0.8	1.2	1.7	0.7	1.4	1.9	8.7	8.0	7.5
Slovak Republic	3.4	4.0	4.2	1.3	1.9	1.9	–1.5	–0.3	0.5	8.3	7.5	7.4
Lithuania	3.8	3.2	3.0	3.7	2.2	2.2	1.0	–0.1	–0.6	7.1	6.9	6.8
Slovenia	5.0	4.0	3.2	1.4	1.7	2.0	6.5	5.7	5.2	6.8	5.9	5.5
Luxembourg	3.5	4.3	3.7	2.1	1.4	1.8	5.5	5.4	5.3	5.8	5.5	5.2
Latvia	4.5	4.0	3.5	2.9	3.0	2.5	–0.8	–1.9	–2.2	8.7	8.2	8.1
Estonia	4.9	3.9	3.2	3.7	3.0	2.5	3.2	2.0	0.7	5.8	6.3	6.7
Cyprus	3.9	3.6	3.0	0.7	0.4	1.6	–4.7	–4.1	–4.6	11.3	10.0	9.1
Malta	6.6	5.7	4.6	1.3	1.6	1.8	10.2	9.9	9.5	4.0	4.2	4.4
United Kingdom	1.8	1.6	1.5	2.7	2.7	2.2	–4.1	–3.7	–3.4	4.4	4.4	4.5
Switzerland	1.1	2.3	2.0	0.5	0.7	1.0	9.3	9.7	9.4	3.2	3.0	3.0
Sweden	2.4	2.6	2.2	1.9	1.5	1.6	3.2	3.1	3.1	6.7	6.3	6.3
Norway	1.8	2.1	2.1	1.9	1.9	2.0	5.1	6.1	6.5	4.2	3.9	3.7
Czech Republic	4.3	3.5	3.0	2.4	2.3	2.0	1.1	0.3	0.4	2.9	3.0	3.2
Denmark	2.1	2.0	1.9	1.1	1.4	1.7	7.6	7.6	7.2	5.8	5.7	5.6
Iceland	3.6	3.2	3.0	1.8	2.4	2.3	3.6	3.3	2.6	2.8	3.1	3.3
San Marino	1.5	1.3	1.3	0.9	1.0	1.1	. . .	. . .	. . .	8.0	7.4	6.8
Emerging and Developing Europe[6]	**5.8**	**4.3**	**3.7**	**6.2**	**6.8**	**6.3**	**–2.6**	**–2.9**	**–2.7**	**. . .**	**. . .**	**. . .**
Turkey	7.0	4.4	4.0	11.1	11.4	10.5	–5.5	–5.4	–4.8	11.0	10.7	10.7
Poland	4.6	4.1	3.5	2.0	2.5	2.5	0.0	–0.9	–1.2	4.9	4.1	4.0
Romania	7.0	5.1	3.5	1.3	4.7	3.1	–3.5	–3.7	–3.7	5.0	4.6	4.6
Hungary	4.0	3.8	3.0	2.4	2.7	3.3	3.6	2.5	2.4	4.0	3.8	3.5
Bulgaria[5]	3.6	3.8	3.1	1.2	2.0	2.1	4.5	3.0	2.3	6.2	6.0	5.8
Serbia	1.8	3.5	3.5	3.1	2.7	3.0	–4.6	–4.5	–4.1	14.6	14.3	14.0
Croatia	2.8	2.8	2.6	1.1	1.5	1.5	3.7	3.0	2.1	12.2	12.0	11.2

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Tables A6 and A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Current account position corrected for reporting discrepancies in intra-area transactions.
[5]Based on Eurostat's harmonized index of consumer prices except for Slovenia.
[6]Includes Albania, Bosnia and Herzegovina, Kosovo, FYR Macedonia, and Montenegro.

Annex Table 1.1.2. Asian and Pacific Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment
(Annual percent change, unless noted otherwise)

	Real GDP			Consumer Prices[1]			Current Account Balance[2]			Unemployment[3]		
		Projections			Projections			Projections			Projections	
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
Asia	**5.7**	**5.6**	**5.6**	**2.1**	**2.9**	**2.9**	**2.1**	**1.8**	**1.8**	**. . .**	**. . .**	**. . .**
Advanced Asia	**2.4**	**2.1**	**1.9**	**1.0**	**1.4**	**1.5**	**4.3**	**4.3**	**4.3**	**3.4**	**3.4**	**3.3**
Japan	1.7	1.2	0.9	0.5	1.1	1.1	4.0	3.8	3.7	2.9	2.9	2.9
Korea	3.1	3.0	2.9	1.9	1.7	1.9	5.1	5.5	5.8	3.7	3.6	3.3
Australia	2.3	3.0	3.1	2.0	2.2	2.4	–2.3	–1.9	–2.3	5.6	5.3	5.2
Taiwan Province of China	2.8	1.9	2.0	0.6	1.3	1.3	13.8	13.6	13.5	3.8	3.8	3.7
Singapore	3.6	2.9	2.7	0.6	1.2	1.0	18.8	18.9	18.7	2.2	2.1	2.1
Hong Kong SAR	3.8	3.6	3.2	1.5	2.2	2.1	3.0	3.1	3.2	3.1	3.1	3.1
New Zealand	3.0	2.9	2.9	1.9	1.7	2.1	–2.7	–2.6	–3.0	4.7	4.5	4.6
Macao SAR	9.3	7.0	6.1	1.2	2.2	2.4	30.4	32.1	33.1	2.0	2.0	2.0
Emerging and Developing Asia	**6.5**	**6.5**	**6.6**	**2.4**	**3.3**	**3.3**	**0.9**	**0.6**	**0.6**	**. . .**	**. . .**	**. . .**
China	6.9	6.6	6.4	1.6	2.5	2.6	1.4	1.2	1.2	3.9	4.0	4.0
India[4]	6.7	7.4	7.8	3.6	5.0	5.0	–2.0	–2.3	–2.1	. . .	. . .	. . .
ASEAN-5	**5.3**	**5.3**	**5.4**	**3.1**	**3.2**	**2.9**	**2.1**	**1.5**	**1.3**	**. . .**	**. . .**	**. . .**
Indonesia	5.1	5.3	5.5	3.8	3.5	3.4	–1.7	–1.9	–1.9	5.4	5.2	5.0
Thailand	3.9	3.9	3.8	0.7	1.4	0.7	10.8	9.3	8.6	0.7	0.7	0.7
Malaysia	5.9	5.3	5.0	3.8	3.2	2.4	3.0	2.4	2.2	3.4	3.2	3.0
Philippines	6.7	6.7	6.8	3.2	4.2	3.8	–0.4	–0.5	–0.6	5.7	5.5	5.5
Vietnam	6.8	6.6	6.5	3.5	3.8	4.0	4.1	3.0	2.4	2.2	2.2	2.2
Other Emerging and Developing Asia[5]	**6.0**	**6.1**	**6.3**	**5.2**	**5.2**	**5.3**	**–2.2**	**–2.7**	**–2.6**	**. . .**	**. . .**	**. . .**
Memorandum												
Emerging Asia[6]	**6.6**	**6.5**	**6.6**	**2.3**	**3.2**	**3.2**	**1.0**	**0.7**	**0.7**	**. . .**	**. . .**	**. . .**

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Tables A6 and A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]See country-specific notes for India in the "Country Notes" section of the Statistical Appendix.
[5]Other Emerging and Developing Asia comprises Bangladesh, Bhutan, Brunei Darussalam, Cambodia, Fiji, Kiribati, Lao P.D.R., Maldives, Marshall Islands, Micronesia, Mongolia, Myanmar, Nauru, Nepal, Palau, Papua New Guinea, Samoa, Solomon Islands, Sri Lanka, Timor-Leste, Tonga, Tuvalu, and Vanuatu.
[6]Emerging Asia comprises the ASEAN-5 (Indonesia, Malaysia, Philippines, Thailand, Vietnam) economies, China, and India.

Annex Table 1.1.3. Western Hemisphere Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment
(Annual percent change, unless noted otherwise)

	Real GDP			Consumer Prices[1]			Current Account Balance[2]			Unemployment[3]		
		Projections			Projections			Projections			Projections	
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
North America	**2.3**	**2.8**	**2.6**	**2.5**	**2.7**	**2.5**	**–2.4**	**–3.0**	**–3.3**	**. . .**	**. . .**	**. . .**
United States	2.3	2.9	2.7	2.1	2.5	2.4	–2.4	–3.0	–3.4	4.4	3.9	3.5
Canada	3.0	2.1	2.0	1.6	2.2	2.2	–3.0	–3.2	–2.5	6.3	6.2	6.2
Mexico	2.0	2.3	3.0	6.0	4.4	3.1	–1.6	–1.9	–2.2	3.4	3.5	3.4
Puerto Rico[4]	–7.7	–3.6	–1.2	1.9	2.2	0.8	. . .	. . .	. . .	12.5	12.0	11.3
South America[5]	**0.7**	**1.7**	**2.5**	**. . .**	**. . .**	**. . .**	**–1.4**	**–2.0**	**–2.2**	**. . .**	**. . .**	**. . .**
Brazil	1.0	2.3	2.5	3.4	3.5	4.2	–0.5	–1.6	–1.8	12.8	11.6	10.5
Argentina	2.9	2.0	3.2	25.7	22.7	15.4	–4.8	–5.1	–5.5	8.4	8.0	7.5
Colombia	1.8	2.7	3.3	4.3	3.5	3.4	–3.4	–2.6	–2.6	9.3	9.2	9.1
Venezuela	–14.0	–15.0	–6.0	1,087.5	13,864.6	12,874.6	2.0	2.4	3.6	27.1	33.3	37.4
Chile	1.5	3.4	3.3	2.2	2.4	3.0	–1.5	–1.8	–1.9	6.7	6.2	5.8
Peru	2.5	3.7	4.0	2.8	1.6	2.0	–1.3	–0.7	–1.1	6.7	6.7	6.7
Ecuador	2.7	2.5	2.2	0.4	1.0	1.4	–0.4	–0.1	0.3	4.6	4.3	4.3
Bolivia	4.2	4.0	3.8	2.8	3.5	4.5	–5.8	–5.4	–5.2	4.0	4.0	4.0
Uruguay	3.1	3.4	3.1	6.2	7.0	6.1	1.6	0.6	–0.1	7.4	7.1	7.1
Paraguay	4.3	4.5	4.1	3.6	4.2	4.0	–1.8	–2.0	–1.2	5.7	5.7	5.7
Central America[6]	**3.7**	**3.9**	**4.0**	**2.6**	**3.4**	**3.4**	**–2.5**	**–2.9**	**–2.6**	**. . .**	**. . .**	**. . .**
Caribbean[7]	**2.7**	**3.8**	**3.7**	**3.8**	**4.5**	**3.5**	**–3.2**	**–3.2**	**–2.9**	**. . .**	**. . .**	**. . .**
Memorandum												
Latin America and the Caribbean[8]	1.3	2.0	2.8	4.1	3.6	3.5	–1.6	–2.1	–2.3	. . .	. . .	. . .
East Caribbean Currency Union[9]	1.8	1.8	3.6	1.1	1.2	1.8	–9.2	–12.0	–8.5	. . .	. . .	. . .

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Tables A6 and A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Puerto Rico is a territory of the United States but its statistical data are maintained on a separate and independent basis.
[5]Includes Guyana and Suriname. Data for Argentina's and Venezuela's consumer prices are excluded. See country-specific notes for Argentina and Venezuela in the "Country Notes" section of the Statistical Appendix.
[6]Central America comprises Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.
[7]The Caribbean comprises Antigua and Barbuda, The Bahamas, Barbados, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago.
[8]Latin America and the Caribbean comprises Mexico and economies from the Caribbean, Central America, and South America. Data for Argentina's and Venezuela's consumer prices are excluded. See country-specific notes for Argentina and Venezuela in the "Country Notes" section of the Statistical Appendix.
[9]Eastern Caribbean Currency Union comprises Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines as well as Anguilla and Montserrat, which are not IMF members.

Annex Table 1.1.4. Commonwealth of Independent States Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment

(Annual percent change, unless noted otherwise)

	Real GDP			Consumer Prices[1]			Current Account Balance[2]			Unemployment[3]		
		Projections			Projections			Projections			Projections	
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
Commonwealth of Independent States[4]	**2.1**	**2.2**	**2.1**	**5.5**	**4.6**	**4.8**	**1.3**	**2.8**	**2.3**	**. . .**	**. . .**	**. . .**
Net Energy Exporters	**2.0**	**2.1**	**2.0**	**4.8**	**4.1**	**4.5**	**1.9**	**3.6**	**3.1**	**. . .**	**. . .**	**. . .**
Russia	1.5	1.7	1.5	3.7	2.8	3.7	2.6	4.5	3.8	5.2	5.5	5.5
Kazakhstan	4.0	3.2	2.8	7.4	6.4	5.6	–2.9	–1.4	–1.3	5.0	5.0	5.0
Uzbekistan	5.3	5.0	5.0	12.5	19.5	12.9	3.7	0.2	–1.1	. . .	. . .	. . .
Azerbaijan	0.1	2.0	3.9	13.0	7.0	6.0	3.5	5.6	7.0	5.0	5.0	5.0
Turkmenistan	6.5	6.2	5.6	8.0	9.4	8.2	–11.5	–9.0	–7.8	. . .	. . .	. . .
Net Energy Importers	**3.1**	**3.2**	**3.3**	**10.2**	**8.3**	**6.7**	**–3.7**	**–4.2**	**–4.1**	**. . .**	**. . .**	**. . .**
Ukraine	2.5	3.2	3.3	14.4	11.0	8.0	–3.7	–3.7	–3.5	9.4	9.2	8.8
Belarus	2.4	2.8	2.4	6.0	6.0	6.0	–1.8	–2.5	–2.7	1.0	1.0	1.0
Georgia	4.8	4.5	4.8	6.0	3.6	3.0	–9.3	–10.5	–9.5	. . .	. . .	. . .
Armenia	7.5	3.4	3.5	0.9	3.5	4.0	–2.6	–2.8	–2.8	18.9	18.9	18.6
Tajikistan	7.1	4.0	4.0	7.3	6.3	6.0	–2.6	–5.2	–4.7	. . .	. . .	. . .
Kyrgyz Republic	4.5	3.3	4.9	3.2	4.5	5.0	–7.8	–13.6	–12.2	7.1	7.0	7.0
Moldova	4.0	3.5	3.8	6.6	4.7	5.1	–4.7	–3.7	–4.7	4.2	4.2	4.1
Memorandum												
Caucasus and Central Asia[5]	4.1	3.7	3.9	9.0	9.1	7.2	–2.5	–2.0	–1.7	. . .	. . .	. . .
Low-Income CIS Countries[6]	5.4	4.6	4.7	9.5	13.5	9.6	–1.1	–4.0	–4.2	. . .	. . .	. . .
Net Energy Exporters Excluding Russia	3.9	3.7	3.8	9.6	9.9	7.6	–2.0	–1.2	–1.0	. . .	. . .	. . .

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Table A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States (CIS), are included in this group for reasons of geography and similarity in economic structure.
[5]Caucasus and Central Asia comprises Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan.
[6]Low-Income CIS countries comprise Armenia, Georgia, the Kyrgyz Republic, Moldova, Tajikistan, and Uzbekistan.

Annex Table 1.1.5. Middle East, North African Economies, Afghanistan, and Pakistan: Real GDP, Consumer Prices, Current Account Balance, and Unemployment

(Annual percent change, unless noted otherwise)

	Real GDP			Consumer Prices[1]			Current Account Balance[2]			Unemployment[3]		
		Projections			Projections			Projections			Projections	
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
Middle East, North Africa, Afghanistan, and Pakistan	**2.6**	**3.4**	**3.7**	**6.3**	**8.2**	**6.8**	**–0.9**	**0.5**	**–0.3**	**...**	**...**	**...**
Oil Exporters[4]	**1.7**	**2.8**	**3.3**	**3.4**	**6.3**	**5.5**	**1.2**	**3.0**	**1.8**	**...**	**...**	**...**
Saudi Arabia	–0.7	1.7	1.9	–0.9	3.7	2.0	2.7	5.4	3.6	...	...	...
Iran	4.3	4.0	4.0	9.9	12.1	11.5	4.3	7.0	6.3	11.8	11.7	11.6
United Arab Emirates	0.5	2.0	3.0	2.0	4.2	2.5	4.7	5.3	5.1	...	...	...
Algeria	2.0	3.0	2.7	5.6	7.4	7.6	–12.3	–9.3	–9.7	11.7	11.2	11.8
Iraq	–0.8	3.1	4.9	0.1	2.0	2.0	0.7	0.2	–1.6	...	...	...
Qatar	2.1	2.6	2.7	0.4	3.9	3.5	1.3	2.5	1.8	...	...	...
Kuwait	–2.5	1.3	3.8	1.5	2.5	3.7	2.0	5.8	3.6	1.1	1.1	1.1
Oil Importers[5]	**4.2**	**4.7**	**4.6**	**12.4**	**12.2**	**9.5**	**–6.5**	**–6.2**	**–5.7**	**...**	**...**	**...**
Egypt	4.2	5.2	5.5	23.5	20.1	13.0	–6.5	–4.4	–3.9	12.2	11.1	9.7
Pakistan	5.3	5.6	4.7	4.1	5.0	5.2	–4.1	–4.8	–4.4	6.0	6.1	6.1
Morocco	4.2	3.1	4.0	0.8	1.4	2.0	–3.8	–3.6	–3.5	10.2	9.5	9.2
Sudan	3.2	3.7	3.5	32.4	43.5	39.5	–5.5	–6.2	–6.8	19.6	18.6	17.6
Tunisia	1.9	2.4	2.9	5.3	7.0	6.1	–10.1	–9.2	–7.8	15.3	15.0	14.8
Lebanon	1.2	1.5	1.8	4.5	4.3	3.0	–25.0	–25.8	–25.2	...	...	...
Jordan	2.3	2.5	2.7	3.3	1.5	2.5	–8.7	–8.5	–7.9	...	...	...
Memorandum												
Middle East and North Africa	2.2	3.2	3.6	6.6	8.7	7.1	–0.6	1.1	0.2	...	...	...
Israel[6]	3.3	3.3	3.5	0.2	0.7	1.3	3.0	2.6	2.7	4.2	4.2	4.2
Maghreb[7]	6.4	3.8	3.0	5.4	6.7	6.3	–8.2	–7.8	–7.8	...	...	...
Mashreq[8]	3.9	4.8	5.1	20.8	17.8	11.7	–9.7	–8.2	–7.6	...	...	...

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Tables A6 and A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Includes Bahrain, Libya, Oman, and Yemen.
[5]Includes Afghanistan, Djibouti, Mauritania, and Somalia. Excludes Syria because of the uncertain political situation.
[6]Israel, which is not a member of the economic region, is included for reasons of geography but is not included in the regional aggregates.
[7]The Maghreb comprises Algeria, Libya, Mauritania, Morocco, and Tunisia.
[8]The Mashreq comprises Egypt, Jordan, and Lebanon. Syria is excluded because of the uncertain political situation.

Annex Table 1.1.6. Sub-Saharan African Economies: Real GDP, Consumer Prices, Current Account Balance, and Unemployment
(Annual percent change, unless noted otherwise)

	Real GDP			Consumer Prices[1]			Current Account Balance[2]			Unemployment[3]		
		Projections			Projections			Projections			Projections	
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
Sub-Saharan Africa	**2.8**	**3.4**	**3.7**	**11.0**	**9.5**	**8.9**	**–2.6**	**–2.9**	**–3.1**	**. . .**	**. . .**	**. . .**
Oil Exporters[4]	**0.4**	**1.9**	**2.0**	**18.3**	**15.5**	**14.8**	**0.2**	**–0.2**	**0.0**	**. . .**	**. . .**	**. . .**
Nigeria	0.8	2.1	1.9	16.5	14.0	14.8	2.5	0.5	0.4	16.5	. . .	. . .
Angola	0.7	2.2	2.4	31.7	27.9	17.0	–4.5	–2.2	–0.1	. . .	. . .	. . .
Gabon	0.8	2.7	3.7	3.0	2.8	2.5	–4.8	–1.5	–1.9	. . .	. . .	. . .
Chad	–3.1	3.5	2.8	–0.9	2.1	2.6	–5.2	–4.3	–5.5	. . .	. . .	. . .
Republic of Congo	–4.6	0.7	4.6	0.5	1.5	1.6	–12.7	3.0	4.8	. . .	. . .	. . .
Middle-Income Countries[5]	**3.0**	**3.1**	**3.5**	**5.2**	**5.0**	**5.0**	**–2.3**	**–2.7**	**–2.9**	**. . .**	**. . .**	**. . .**
South Africa	1.3	1.5	1.7	5.3	5.3	5.3	–2.3	–2.9	–3.1	27.5	27.9	28.3
Ghana	8.4	6.3	7.6	12.4	8.7	8.0	–4.5	–4.1	–4.0	. . .	. . .	. . .
Côte d'Ivoire	7.8	7.4	7.1	0.8	1.7	2.0	–1.2	–1.5	–1.3	. . .	. . .	. . .
Cameroon	3.2	4.0	4.5	0.6	1.1	1.3	–2.5	–2.5	–2.4	. . .	. . .	. . .
Zambia	3.6	4.0	4.5	6.6	8.2	8.0	–3.3	–2.6	–1.9	. . .	. . .	. . .
Senegal	7.2	7.0	7.0	1.4	1.5	1.5	–9.4	–7.9	–7.5	. . .	. . .	. . .
Low-Income Countries[6]	**6.0**	**5.8**	**6.1**	**8.9**	**7.4**	**6.2**	**–6.8**	**–6.7**	**–7.5**	**. . .**	**. . .**	**. . .**
Ethiopia	10.9	8.5	8.3	9.9	11.2	8.6	–8.1	–6.5	–6.3	. . .	. . .	. . .
Kenya	4.8	5.5	6.0	8.0	4.8	5.0	–6.4	–6.2	–5.7	. . .	. . .	. . .
Tanzania	6.0	6.4	6.6	5.3	4.8	5.0	–3.8	–5.4	–6.0	. . .	. . .	. . .
Uganda	4.5	5.2	5.8	5.6	3.6	4.3	–4.5	–6.9	–9.5	. . .	. . .	. . .
Madagascar	4.1	5.1	5.6	8.1	7.8	6.8	–3.4	–4.0	–4.8	. . .	. . .	. . .
Democratic Republic of the Congo	3.4	3.8	4.0	41.5	25.8	13.7	–0.5	0.3	–0.9	. . .	. . .	. . .
Memorandum												
Sub-Saharan Africa Excluding South Sudan	2.9	3.4	3.7	10.5	9.2	8.6	–2.6	–2.9	–3.1	. . .	. . .	. . .

Note: Data for some countries are based on fiscal years. Refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Movements in consumer prices are shown as annual averages. Year-end to year-end changes can be found in Table A7 in the Statistical Appendix.
[2]Percent of GDP.
[3]Percent. National definitions of unemployment may differ.
[4]Includes Equatorial Guinea and South Sudan.
[5]Includes Botswana, Cabo Verde, Lesotho, Mauritius, Namibia, Seychelles, and Swaziland.
[6]Includes Benin, Burkina Faso, Burundi, the Central African Republic, Comoros, Eritrea, The Gambia, Guinea, Guinea-Bissau, Liberia, Malawi, Mali, Mozambique, Niger, Rwanda, São Tomé and Príncipe, Sierra Leone, Togo, and Zimbabwe.

Annex Table 1.1.7. Summary of World Real per Capita Output

(Annual percent change; in international currency at purchasing power parity)

	Average 2000–09	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019	2023
World	**2.4**	**4.0**	**3.0**	**2.0**	**2.2**	**2.3**	**2.1**	**1.9**	**2.4**	**2.7**	**2.7**	**2.5**
Advanced Economies	**1.1**	**2.5**	**1.1**	**0.7**	**0.9**	**1.6**	**1.7**	**1.1**	**1.9**	**2.0**	**1.8**	**1.1**
United States	0.8	1.7	0.9	1.5	1.0	1.8	2.1	0.7	1.5	2.1	1.8	0.6
Euro area[1]	1.0	1.8	1.3	–1.1	–0.5	1.1	1.7	1.5	2.3	2.2	1.9	1.4
Germany	0.9	4.2	3.7	0.5	0.3	1.5	0.6	1.0	2.1	2.4	1.9	1.3
France	0.7	1.5	1.6	–0.3	0.1	0.4	0.6	0.8	1.5	1.6	1.6	1.1
Italy	0.1	1.2	0.2	–3.2	–2.3	–0.3	0.9	1.1	1.6	1.3	1.2	0.8
Spain	1.3	–0.4	–1.4	–3.0	–1.3	1.7	3.5	3.3	3.2	2.9	2.3	1.8
Japan	0.4	4.2	–0.3	1.7	2.2	0.5	1.5	1.0	1.9	1.4	1.2	1.0
United Kingdom	1.1	0.9	0.6	0.8	1.4	2.3	1.5	1.1	1.2	1.0	0.9	1.2
Canada	1.0	1.9	2.1	0.6	1.3	1.7	0.1	0.3	1.7	0.8	1.1	0.7
Other Advanced Economies[2]	2.6	5.0	2.5	1.3	1.6	2.1	1.3	1.5	2.0	1.9	1.9	1.6
Emerging Market and Developing Economies	**4.4**	**5.9**	**4.9**	**3.7**	**3.6**	**3.2**	**2.8**	**2.8**	**3.3**	**3.6**	**3.7**	**3.7**
Commonwealth of Independent States	5.9	4.3	4.9	2.8	2.0	1.4	–2.5	0.0	1.8	1.9	1.8	2.0
Russia	5.7	4.5	5.0	3.6	1.7	0.6	–2.6	–0.3	1.5	1.7	1.5	1.7
CIS excluding Russia	7.0	4.4	5.2	1.9	3.4	2.6	–1.7	1.0	2.9	2.8	2.9	3.2
Emerging and Developing Asia	6.9	8.5	6.7	5.9	5.9	5.8	5.8	5.4	5.5	5.5	5.6	5.4
China	9.6	10.1	9.0	7.4	7.3	6.7	6.4	6.1	6.3	6.0	5.9	5.4
India[3]	5.2	8.7	5.2	4.1	5.0	6.0	6.8	5.7	5.4	6.0	6.4	6.8
ASEAN-5[4]	3.6	5.5	3.2	4.7	3.7	3.3	3.6	3.7	4.0	4.1	4.1	4.2
Emerging and Developing Europe	3.5	3.7	6.2	2.1	4.3	3.4	4.3	2.8	5.3	3.8	3.2	2.8
Latin America and the Caribbean	1.6	4.7	3.4	1.7	1.8	0.2	–0.9	–1.9	0.1	0.9	1.7	1.8
Brazil	2.1	6.5	3.0	1.0	2.1	–0.4	–4.3	–4.2	0.2	1.5	1.8	1.6
Mexico	0.2	3.8	2.4	2.4	0.2	1.7	2.2	1.8	1.0	1.3	2.1	2.0
Middle East, North Africa, Afghanistan, and Pakistan	1.9	2.5	3.9	1.0	0.1	–0.1	0.2	2.3	–0.1	1.4	1.7	1.7
Saudi Arabia	0.5	1.3	7.1	2.5	–0.1	1.1	3.3	–0.7	–2.7	–0.3	–0.1	0.3
Sub-Saharan Africa	2.7	4.2	2.4	1.3	2.6	2.4	0.7	–1.2	0.1	0.8	1.0	1.4
Nigeria	5.4	8.3	2.1	1.5	2.6	3.5	–0.1	–4.2	–1.9	–0.6	–0.8	–0.8
South Africa	2.3	1.6	1.8	0.7	1.0	0.3	–0.3	–1.0	–0.3	–0.1	0.1	0.2
Memorandum												
European Union	1.4	1.8	1.5	–0.6	0.1	1.6	2.0	1.7	2.4	2.3	2.0	1.6
Low-Income Developing Countries	3.7	5.3	3.5	1.9	3.7	3.7	1.9	0.9	2.3	2.8	3.1	3.2

Note: Data for some countries are based on fiscal years. Please refer to Table F in the Statistical Appendix for a list of economies with exceptional reporting periods.
[1]Data calculated as the sum of individual euro area countries.
[2]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.
[3]See country-specific notes for India in the "Country Notes" section of the Statistical Appendix.
[4]Indonesia, Malaysia, Philippines, Thailand, Vietnam.

References

Abdirahman, Mo, Diane Coyle, Richard Heys, and Will Stewart. 2017. "A Comparison of Approaches to Deflating Telecoms Services Output." Presented at the 5th IMF Statistical Forum. http://www.imf.org/~/media/Files/Conferences/2017-stats-forum/session-6-heys.ashx?la=en.

Adler, Gustavo, Romain Duval, Davide Furceri, Sinem Kiliç Çelik, Ksenia Koloskova, and Marcos Poplawski-Ribeiro. 2017. "Gone with the Headwinds: Global Productivity." IMF Staff Discussion Note 17/04. https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2017/04/03/Gone-with-the-Headwinds-Global-Productivity-44758.

Alichi, Ali, and others. Forthcoming. "Estimates of Potential Output and the Neutral Rate for the US Economy." IMF Working Paper, International Monetary Fund, Washington, DC.

Baldwin, Richard. 2016. "The Great Convergence: Information Technology and the New Globalization." Cambridge, MA, Belknap Press.

Berger, Helge, Thomas Dowling, Sergi Lanau, Mico Mrkaic, Pau Rabanal, and Marzie Taheri Sanjani. 2015. "Steady as She Goes—Estimating Potential Output during Financial 'Booms and Busts.'" IMF Working Paper 15/233, International Monetary Fund, Washington, DC.

Blagrave, Patrick, Roberto Garcia-Saltos, Douglas Laxton, and Fan Zhang. 2015. "A Simple Multivariate Filter for Estimating Potential Output." IMF Working Paper 15/79, International Monetary Fund, Washington, DC.

Borio, Claudio, Piti Disyatat, and Mikael Juselius. 2013. "Rethinking Potential Output: Embedding Information about the Financial Cycle." BIS Working Paper 404, Bank for International Settlements, Basel.

Byrne, David, and Carol Corrado. 2017. "ICT Prices and ICT Services: What Do They Tell Us about Productivity and Technology?" Finance and Economics Discussion Series 2017–15, Board of Governors of the Federal Reserve System, Washington, DC. https://doi.org/10.17016/FEDS.2017.015.

Byrne, David, John Fernald, and Marshall Reinsdorf. 2016. "Does the United States Have a Productivity Slowdown or a Measurement Problem?" *Brookings Papers on Economic Activity* (Spring): 109–57. https://www.brookings.edu/wp-content/uploads/2016/03/byrnetextspring16bpea.pdf.

Caldara, Dario, and Matteo Iacoviello. 2017. "Measuring Geopolitical Risk." Working Paper, Board of Governors of the Federal Reserve Board, Washington, DC.

Carney, Mark. 2017. "[De]globalization and Inflation." 2017 IMF Michel Camdessus Central Banking Lecture, September 18.

Carton, Benjamin, Emilio Fernandez-Corugedo, and Benjamin L. Hunt. 2017. "No Business Taxation without Model Representation: Adding Corporate Income and Cash Flow Taxes to GIMF." IMF Working Paper 17/259, International Monetary Fund, Washington, DC.

Carton, Benjamin, Joannes Mongardini, and Yiqun Li. 2018. "A New Smartphone for Every Fifth Person on Earth: Quantifying the New Tech Cycle." IMF Working Paper 18/22, International Monetary Fund, Washington, DC.

Cerdeiro, D. A., and R. J. Nam. 2018. "A Multidimensional Approach to Trade Policy Indicators." IMF Working Paper 18/32, International Monetary Fund, Washington, DC.

Deutsche Bank. 2017. "Lithium 101." http://www.belmontresources.com/LithiumReport.pdf.

Gartner, Inc. 2009–18. Press Release (various). https://www.gartner.com/newsroom/archive/.

Gruss, Bertrand. 2014. "After the Boom—Commodity Prices and Economic Growth in Latin America and the Caribbean." IMF Working Paper 14/154, International Monetary Fund, Washington, DC.

GSM Association. 2018. "The Mobile Economy 2018." https://www.gsma.com/mobileeconomy .

Guvenen, Fatih, Raymond J. Mataloni Jr., Dylan G. Rassier, and Kim J. Ruhl. 2017. "Offshore Profit Shifting and Domestic Productivity Measurement." NBER Working Paper 23324. www.nber.org/papers/w23324.

IDC Research, Inc. 2009–18. Press Release (various). https://www.idc.com/.

International Data Corporation (IDC). 2018. "Apple Passes Samsung to Capture the Top Position in the Worldwide Smartphone Market while Overall Shipments Decline 6.3% in the Fourth Quarter, According to IDC." February 1. https://www.idc.com/getdoc.jsp?containerId=prUS43548018.

International Monetary Fund (IMF). 2010. "Reference Note on Trade Policy, Preferential Trade Agreements, and WTO Consistency." Washington, DC, September 2010.

Jacks, David S. 2013. "From Boom to Bust: A Typology of Real Commodity Prices in the Long Run." NBER Working Paper 18874, National Bureau of Economic Research, Cambridge, MA.

Nakamura, Leonard, Jon Samuels, and Rachel Soloveichik. 2017. "Measuring the 'Free' Digital Economy within the GDP and Productivity Accounts." http://www.imf.org/~/media/Files/Conferences/2017-stats-forum/session-1-oloveichik.ashx?la=en.

Olivetti, Elsa A., Gerbrand Ceder, Gabrielle G. Gaustad, and Xinkai Fu. 2017. "Lithium-Ion Battery Supply Chain Considerations: Analysis of Potential Bottlenecks in Critical Metals." *Joule* 1 (2): 229–43.

Reinsdorf, Marshall, and Paul Schreyer. 2017. "Measuring Consumer Inflation in a Digital Economy." http://www.imf.org/~/media/Files/Conferences/2017-stats-forum/session-1-schreyer-and-reinsdorf.ashx?la=en.

CHAPTER 2

LABOR FORCE PARTICIPATION IN ADVANCED ECONOMIES: DRIVERS AND PROSPECTS

Despite the acceleration in population aging in almost all advanced economies over the past decade, aggregate labor force participation rates show divergent trajectories. Headline numbers also hide strikingly different shifts in the labor force attachment of different groups of workers: participation has increased among prime-age women and, more recently, older workers, but it has fallen among the young and among prime-age men. This chapter finds that aging and the drag from the global financial crisis can explain a significant share of the decline in the participation of men during the past decade. However, the rising participation of women underscores the importance of other factors in shaping participation decisions. The analysis suggests that labor market policies and institutions, together with structural changes and gains in educational attainment, account for the bulk of the dramatic increase in the labor force attachment of prime-age women and older workers in the past three decades. At the same time, technological advances such as automation, while beneficial for the economy as a whole, have weighed moderately on participation rates. These findings highlight the considerable scope for policies to counteract the forces of aging by enabling those who are willing to work to do so. Investing in education and training, reforming the tax system, and reducing incentives to retire early—along with stronger policies that improve the job-matching process and help workers combine family and work life—can encourage people to join and remain in the workforce. Ultimately, however, the dramatic shifts in demographic structure could overwhelm the ability of policies to mitigate the effects of aging on labor force participation, which underscores the need to rethink migration policies to boost labor supply in advanced economies.

The main authors of this chapter are Francesco Grigoli, Zsóka Kóczán, and Petia Topalova (lead), with support from Benjamin Hilgenstock, Christopher Johns, and Jungjin Lee and contributions from John Bluedorn, Benjamin Hilgenstock, and Davide Malacrino. We are grateful to Mitali Das, Romain Duval, and Davide Furceri for sharing their data on routinization and labor market policies. The chapter benefited from comments and suggestions by Stephanie Aaronson.

Introduction

Population growth in advanced economies is slowing, life expectancy is rising, and the number of elderly people is soaring. As these trends gather steam, the United Nations projects that by the middle of this century, total population will be shrinking in almost half of advanced economies (Figure 2.1). The burden will fall on those currently considered to be of working age, who in a few decades will support close to double the number of elderly people they do now. Unless more people participate in labor markets, aging could slow advanced economies' growth and, in many cases, undermine the sustainability of their social security systems (Clements and others 2015). Increases in labor supply accounted for a significant share of advanced economies' potential growth during 1985–2000, but their contribution has since fallen (Chapter 3 of the April 2015 *World Economic Outlook* [WEO]).

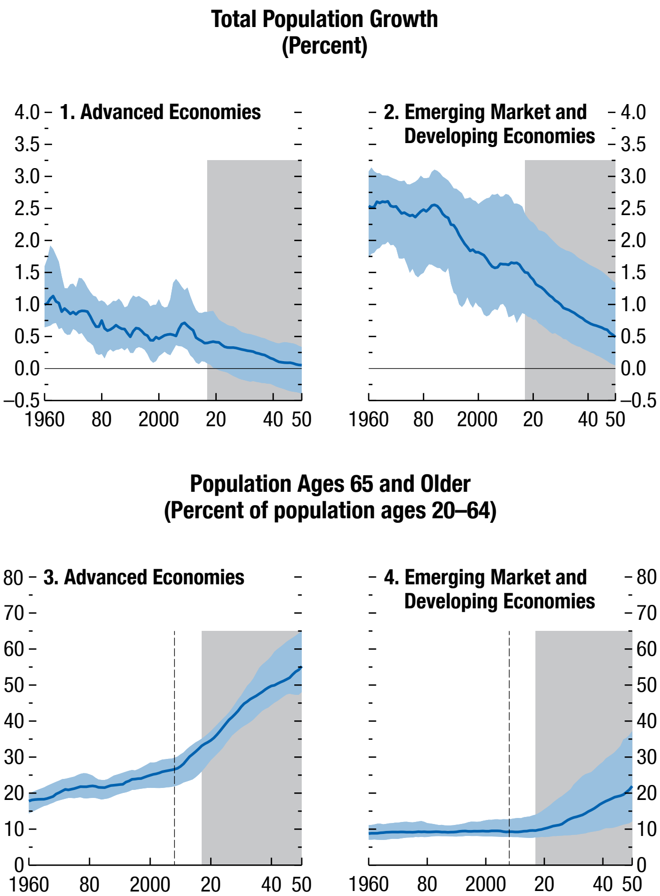
Even though population aging is already exerting pressure on labor supply, considerable differences in the evolution of overall labor force participation are evident throughout the world's advanced economies (Figure 2.2).[1] In half of those economies, the aggregate participation rate has actually increased since the global financial crisis of a decade ago, which coincided with an acceleration of the demographic transition. Headline numbers also hide stark differences in the participation rates of different groups of workers. For example, male participation has declined almost everywhere, while female participation has increased (see Box 1.1 of the October 2017 WEO).

What underlies these strikingly divergent trajectories across countries and for different workers? Various forces are likely at play. Differences in the exact timing and pace of the demographic transition may explain some of the divergence. However, the disparity in participation trends across specific groups of workers suggests a potentially important role for policies and institutions that influence people's decisions to join,

[1]The labor force participation rate is the fraction of the adult population (ages 15 and over) either working or looking for work. In this chapter, labor force participation and workforce attachment are used interchangeably.

Figure 2.1. Demographic Transition: Recent Trends and Projections

Population growth is slowing in both advanced and emerging market and developing economies. In advanced economies, the number of elderly is rising precipitously relative to the working-age population, a process that accelerated significantly after 2008.



Sources: United Nations; and IMF staff estimates.
Note: Solid lines show median; and blue shaded areas show interquartile range. Gray shaded areas indicate projections. Dashed vertical lines in panels 3–4 show year 2008.

remain in, or reenter the labor force. Differences in exposure and resilience to global forces such as technological advances and trade may have depressed long-term demand for workers with certain skill sets.[2] Identifying and ranking the key drivers of participation across population groups is necessary in designing policies that could enable those willing to work to do so and counteract the forces of aging. Indeed, the analysis in this chapter suggests that strengthening specific groups of workers' attachment to the labor force has helped many countries defuse the effects of an aging population on aggregate labor force participation.

Accordingly, this chapter addresses the following questions:

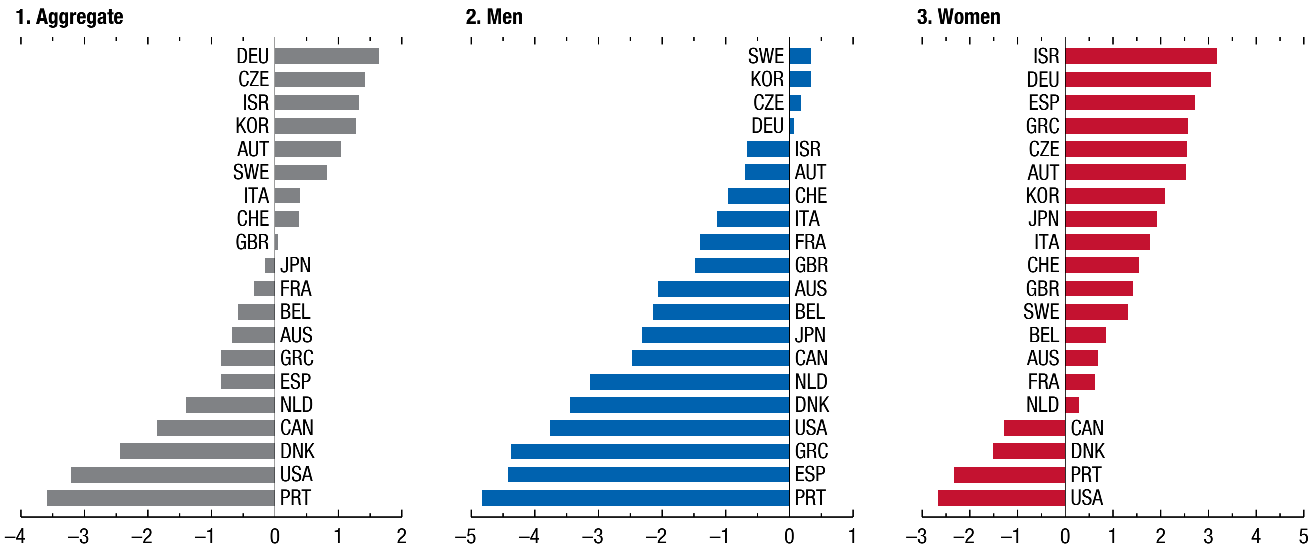
- How have labor force participation rates evolved across advanced economies? Do the dynamics differ systematically by worker characteristics? Have trends in participation changed in the aftermath of the global financial crisis?
- What are the key drivers of changes in aggregate participation rates and the attachment of various groups of workers to the labor force? More specifically:
  - How much of the changes seen in aggregate rates in the past decade can be attributed to the acceleration in demographic shifts and cyclical effects, including the severe recessions associated with the global financial and European debt crises?
  - Historically, what has been the role of policies and institutions that shape individuals' decisions to work, compared with forces that may have shifted the demand for certain types of workers, such as automation and structural transformation?
- What are the prospects for labor force participation?

The chapter starts by taking stock of the changes in the labor force participation of different groups of workers in advanced economies over the past three decades. Several considerations justify the focus on participation. First, the availability of factors of production, including labor, is an important determinant of actual and potential growth in the long term. The participation rate, together with population growth, is the key determinant of labor supply. Second, labor force participation data have good coverage geographically and temporally, by gender and age group, and capture the pent-up supply of people who work part time but want to work full time and those currently unemployed but willing to work (Burniaux, Duval, and Jaumotte 2004). Finally, economic theory provides clear guidance for the evolution of people's labor force participation over the course of their lives. The chapter then uses complementary analytical approaches to assess the forces shaping participation trends. The first part quantifies the change in country-level participation rates that would be consistent with demographic shifts since the mid-2000s, when aging accelerated significantly in many advanced economies. The second part assesses

[2]See, for example, Acemoglu and Autor (2011); Autor and Dorn (2013); Goos, Manning, and Salomons (2014); Autor, Dorn, and Hanson (2016); Chapter 3 of the April 2016 WEO; and Chapter 2 of the October 2017 WEO.

Figure 2.2. Change in Labor Force Participation Rates, 2008–16
(Percentage points)

Changes in aggregate participation rates between 2008 and 2016 show considerable heterogeneity across advanced economies, with participation rates of men (women) generally decreasing (increasing).



Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The panels show the 20 largest advanced economies by 2017 total population. Data labels in the figure use International Organization for Standardization (ISO) country codes.

in more detail the drivers of participation among specific groups of workers by examining differences in these trends across countries and over time. The third part hones in on the predictors of individuals' participation decisions, shedding light on the role of such characteristics as education, family composition, and exposure to technological advances. Finally, the long-term prospects for labor force participation are evaluated using a cohort-based model.

These are the chapter's main findings:

- Although aggregate labor force participation rates in advanced economies show divergent trajectories, surprisingly similar trends emerge across countries for specific groups of workers. The magnitude of change varies from country to country, but participation by women has increased dramatically since the mid-1980s. More recently, participation has picked up considerably among older workers and has fallen among the young. In almost all advanced economies, prime-age men (ages 25–54), particularly those with lower educational attainment, have become increasingly detached from the labor force over the past 35 years, although participation rates are still high and vary little across countries.
- Aging and the drag from the global financial crisis can explain a significant share of the decline in the aggregate participation rate of men during the past decade. However, the rise in the participation rate of women, even as women's average ages increased and despite unfavorable cyclical developments, underscores the important role of policies and other factors in shaping labor supply decisions and mitigating the effect of aging.
- The analysis suggests that policies and institutions, such as the tax-benefit system, public spending on active labor market programs, and policies targeted to encourage specific groups to participate, together with structural changes and gains in educational attainment, account for the bulk of the dramatic increase in the labor force attachment of prime-age women and older workers in the past three decades.
- On the other hand, technological advances, such as routinization—the automation of tasks for which labor can be easily substituted by capital—have weighed on the participation rates of most groups of workers. The decrease in the relative price of investment is associated with larger declines in participation in countries that are more exposed to

routinization because of the mix of their workers' occupations, which may partially explain lower prime-age male participation.

- While analysis of micro data confirms the significant impact of exposure to routinization on people's detachment from the labor force, it also suggests that policy efforts aimed at enhancing connective networks in labor markets can partially offset this effect. Higher spending on active labor market programs and education is associated with a lower likelihood that a person previously employed in a routinizable occupation will drop out of the labor force. This likelihood is also significantly lower in urban areas, pointing to the importance of access to diverse pools of jobs.

The findings in the chapter suggest that many countries have so far successfully counteracted the negative forces of aging on aggregate labor force participation by strengthening the attachment of specific groups of workers to the labor force. Policies that reduce disincentives for joining or remaining in the labor force and policies that help workers combine family and work life can broaden these gains by enabling people who are willing to work to do so.[3] Further investment in education, training, and activation policies can not only encourage individuals to be active in the labor market but also make the workforce more resilient to global developments, such as technological progress or globalization, that may obviate the need for certain skills.

Ultimately, however, dramatic shifts in demographic structure projected in advanced economies could overwhelm the ability of policies to offset the forces of aging. The chapter's illustrative simulations suggest that aggregate participation will eventually decline—even if gender gaps are fully closed—and that the participation of older workers must rise significantly to stem the decline in aggregate participation. Unless technology delivers offsetting productivity gains, these findings highlight the need for many advanced economies to rethink immigration policies to boost their labor supply, alongside policies to encourage older workers to postpone retirement. Although receiving migrants can pose challenges, potentially prompting a political backlash, it can also be a boon for host countries. The chapter analysis suggests that net migration accounts for roughly half of the population growth in advanced economies over the past three decades. Migration can relieve the strain of population aging and contribute to other long-term gains, such as higher growth and productivity, documented elsewhere (see Chapter 4 of the October 2016 WEO).

It is important to emphasize from the outset that this chapter seeks to identify patterns and correlations rather than to establish causality between various policies, structural characteristics, and individual characteristics on one hand and labor force participation on the other. Many of the variables explored when looking at individuals—including choices about education, marriage, and fertility—coincide with decisions about participating in the labor force. Changes in national labor market policies and institutions may also reflect the evolution of societal and cultural attitudes toward work that influence observed trends in labor supply beyond their impact on policies.[4] Sorting out these possibilities is beyond the scope of this chapter, which aims to present a rich description of the patterns of labor force participation across countries and over time and their association with a broad set of drivers, thus offering valuable guidance on potential areas for policy action.

Patterns of Labor Force Participation in Advanced Economies

An investigation into the long-term trends of aggregate labor force participation and the workforce attachment of individual groups of workers in advanced economies reveals several striking patterns.[5]

[3]Beyond the obvious contribution to potential output from an increase in the labor supply, higher female labor force participation has been shown to bring about other macroeconomic benefits, such as greater economic diversification (Kazandjian and others 2016), lower inequality (Gonzales and others 2015b), and growth that is less sensitive to inequality (Grigoli and Robles 2017). Greater representation of women in senior corporate positions is associated with higher firm profitability (Christiansen and others 2016a), while appointing more women to bank supervisory boards is correlated with enhanced bank stability and financial sector resilience (Sahay and others 2017). Evidence also suggests that later-life employment improves nonfinancial outcomes, such as a person's sense of identity, social integration, and support (Erikson, Erikson, and Kivnick 1986; Cohen 2004), as well as emotional and physical well-being (for example, Cohen 2004; and Calvo 2006).

[4]For example, the evolution of social norms toward more egalitarian gender roles may induce both family legislation and higher female labor force participation. Female labor supply shifts may also create political support for more family-friendly policies, leading simultaneously to higher female employment and greater parental leave rights (Olivetti and Petrongolo 2017).

[5]The discussion of the long-term trends is based on the analysis of participation rates in 21 advanced economies for which 1985–2016 data are available to ensure sample consistency. The patterns described are qualitatively identical if all advanced economies are included in the analysis.

Aggregate Participation Rates

Over the past 30 years, the *aggregate* average labor force participation rate in advanced economies as a group has barely changed (Figure 2.3, panel 1). However, the group aggregate masks significant differences in the experience of individual countries. While in a large share of advanced economies aggregate labor force participation in 2016 was within a couple of percentage points of what it was in 1985, several countries saw very significant increases in the workforce attachment of their populations, with aggregate participation rates gaining more than 5 percentage points in such countries as Germany, Korea, the Netherlands, and Spain (Figure 2.3, panel 2). Moreover, there has been a remarkable narrowing of the distribution of participation rates across advanced economies.

Participation of Specific Groups of Workers

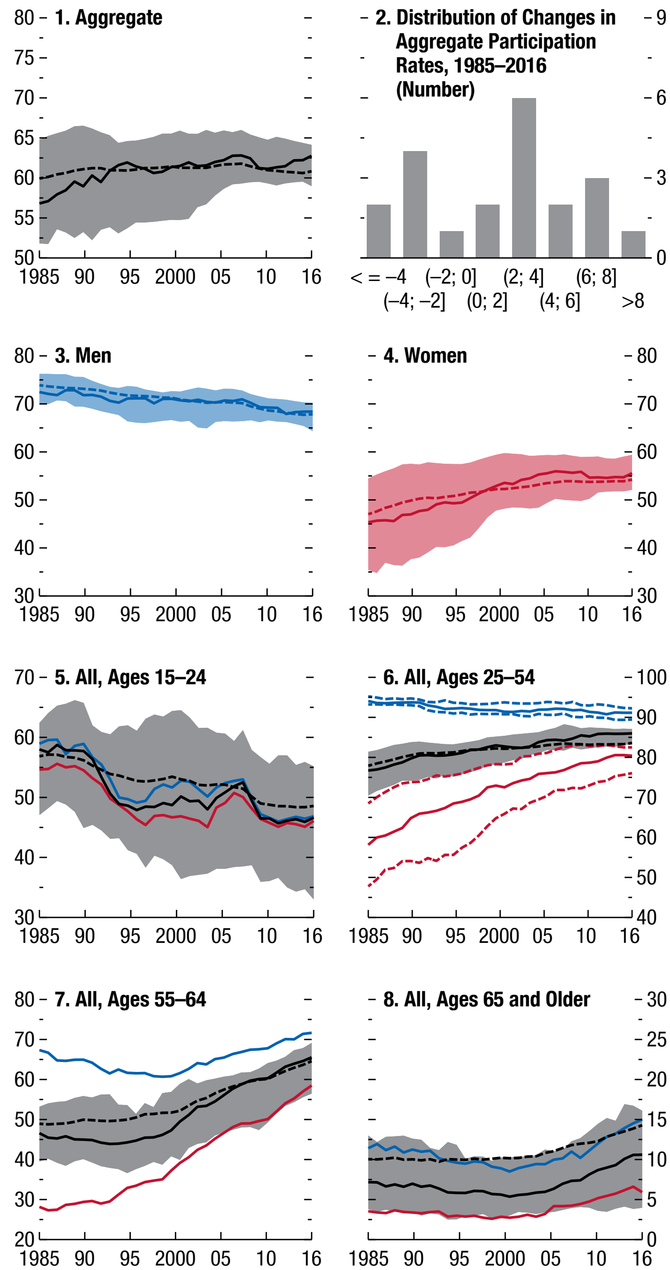
Even more striking is the divergence in the trends in labor force participation of *different groups of workers* (Figure 2.3, panels 3–8). Across advanced economies, the share of women who are employed or actively looking for work has increased dramatically. For the median advanced economy, the female labor force participation rate has increased by close to 10 percentage points. Gains in female participation were substantially larger in countries where women were historically less likely to be part of the workforce (see Annex Figure 2.2.1), a convergence that has significantly narrowed the dispersion in women's participation across advanced economies since 1985. The rise in women's labor force participation is also consistent with the increasing share of two-earner households (see Annex Figure 2.2.2). Conversely, participation rates of men, which are significantly higher and tend to be much more similar across countries, have come down almost across the board. For the median advanced economy, the participation rate among men was more than 4 percentage points lower in 2016 than in 1985. These divergent trends have narrowed gender gaps.

Significant differences also exist in how participation rates have evolved across individuals of different ages (Figure 2.3, panels 5–8). The young (between ages 15 and 24) were significantly less likely to be part of the labor force in 2016 than in 1985, with similar trends observed for men and women (see Box 2.1 for trends in youth labor force participation across advanced and emerging market and developing economies). To a significant extent, declining labor force attachment

Figure 2.3. Labor Force Participation Rates by Gender and Age

(Percent, unless noted otherwise)

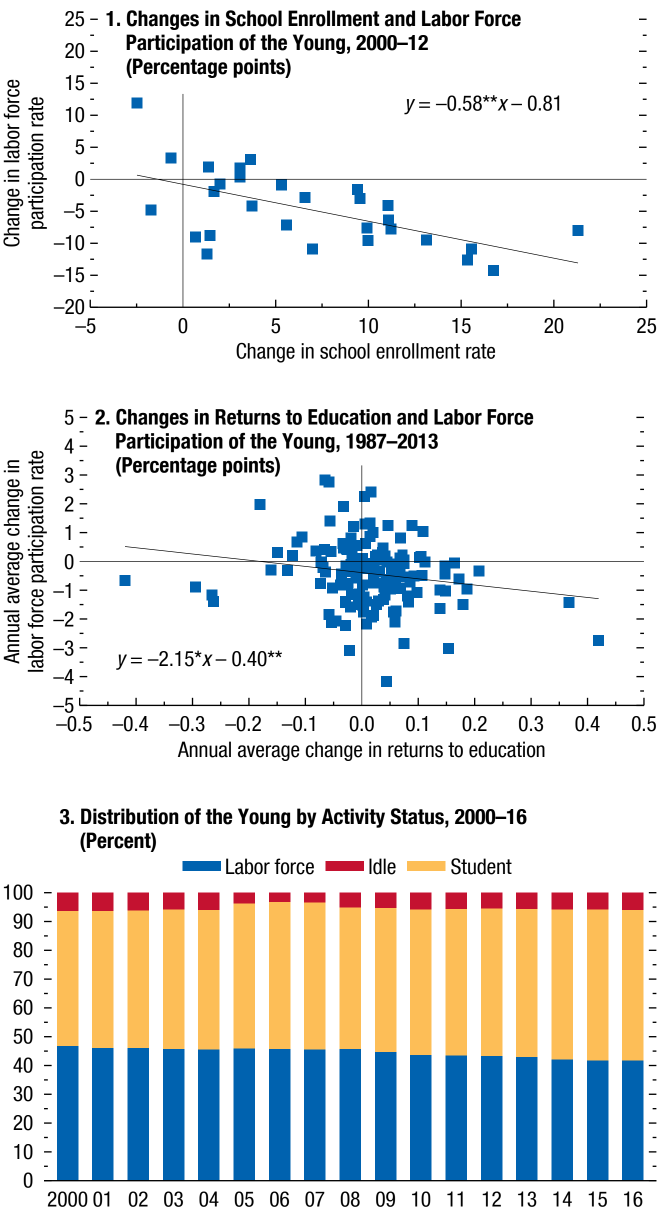
Trends in participation rates in advanced economies also differ dramatically by gender and age groups.



Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: In panels 1, 3, and 4, lines show median; shaded areas show interquartile range; and dotted lines denote population-weighted average. In panels 5–8, black lines show median; gray shaded areas show interquartile range; and black dotted lines show population-weighted average for total age group, respectively. Blue and red lines show median for men and women, respectively. In panel 6, dotted blue and red lines show interquartile range for men and women, respectively. Figure is based on a balanced panel of 21 advanced economies.

Figure 2.4. Labor Force Participation and School Enrollment of the Young

Labor force participation of the young (ages 15–24) in advanced economies is falling, while their school enrollment is rising.



Sources: Eurostat, European Union Labour Force Survey; Luxembourg Income Study Database; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Markers in panel 2 refer to annualized changes between year pairs. Intervals can be of different lengths due to limited data availability. Reported statistics in panel 3 are estimated from the European Union Labour Force Survey at the country level over the period 2000–16. The panel reports the youth population-weighted average across countries. In panel 3, "idle" youth includes those who are neither employed, unemployed, nor enrolled in school.

reflects the secular trend toward greater investment in human capital and higher school enrollment rates (Figure 2.4).[6] In fact, the share of "idle" youth—defined as those who are neither employed, unemployed, nor enrolled in school—is quite small and has been stable since the early 2000s.[7] Given the increase in the returns to schooling in many advanced economies, the decline in labor force participation among the young could in part reflect an expected response to economic incentives (Krueger 2017). Indeed, there is a negative correlation between changes in youth labor force participation and changes in returns to tertiary education relative to the returns to primary education across countries.[8]

At the same time, participation rates of older men and women (ages 55 and older) have increased significantly since the mid-1990s, following decades of steady decline.[9] The increase is particularly pronounced for the 55–64 age group, but in the past decade, even individuals older than 65 have been remaining in the labor force longer.[10] The gains in participation among older workers should be viewed in the context of significantly longer lives. Life expectancy at birth has increased by about seven years, and at age 50 by more than five years, since 1985, prompting many countries to adopt policies to encourage longer working lives through later retirement.[11]

Among prime-age workers, the most notable pattern is diverging trends of the labor force attachment of

[6]While some in this age group are in school and in the labor force, there is a significant association between increasing enrollment rates and declining participation rates across countries. See Canon, Kudlyak, and Liu (2015) for evidence from the United States.

[7]The concept of idle youth is distinct from that of NEETs (defined as those not in employment, education, or training), given that the latter includes unemployed individuals. Youth unemployment increased and remains high since the global financial crisis in many advanced economies (Banerji, Lin, and Saksonovs 2015).

[8]Returns to education are proxied by the ratio of the average labor income of prime-age men with higher education relative to the average labor income of prime-age men with only primary education and are computed from the Luxembourg Income Study Database during 1987–2013. More recent evidence suggests that skill premiums have stagnated or marginally declined during the past decade across most advanced economies (see Box 2.1 of the October 2017 WEO).

[9]For a discussion of earlier trends in retirement, see Blöndal and Scarpetta (1999), Gruber and Wise (1999), and OECD (2001).

[10]For men, the observed increase in workforce attachment at older ages reflects reduced retirement rates (higher participation among the 55 and older age group) amid stable or slightly declining labor force participation at younger ages (those below 55). For women, the observed increase is the result of a growing pool of working women reaching those ages, as well as changes in retirement behavior.

[11]Gains in life expectancy have been generally accompanied by increases in healthy life expectancy as documented by Salomon and others (2012).

men versus women, as discussed. The small decline in participation rates of prime-age men, which remains very high and varies little across countries, has been more than offset by the dramatic entry of prime-age women into the labor force, leading to overall gains in the participation rates of prime-age workers in most advanced economies. While it is possible that higher female participation has allowed some men to drop out of the labor force, there is little evidence to that effect at the country level. Correlations between changes in prime-age female and male participation rates are, if anything, positive (see Annex Figure 2.2.3), and participation of married men has declined less than participation of single men (Figure 2.5, panel 2).[12]

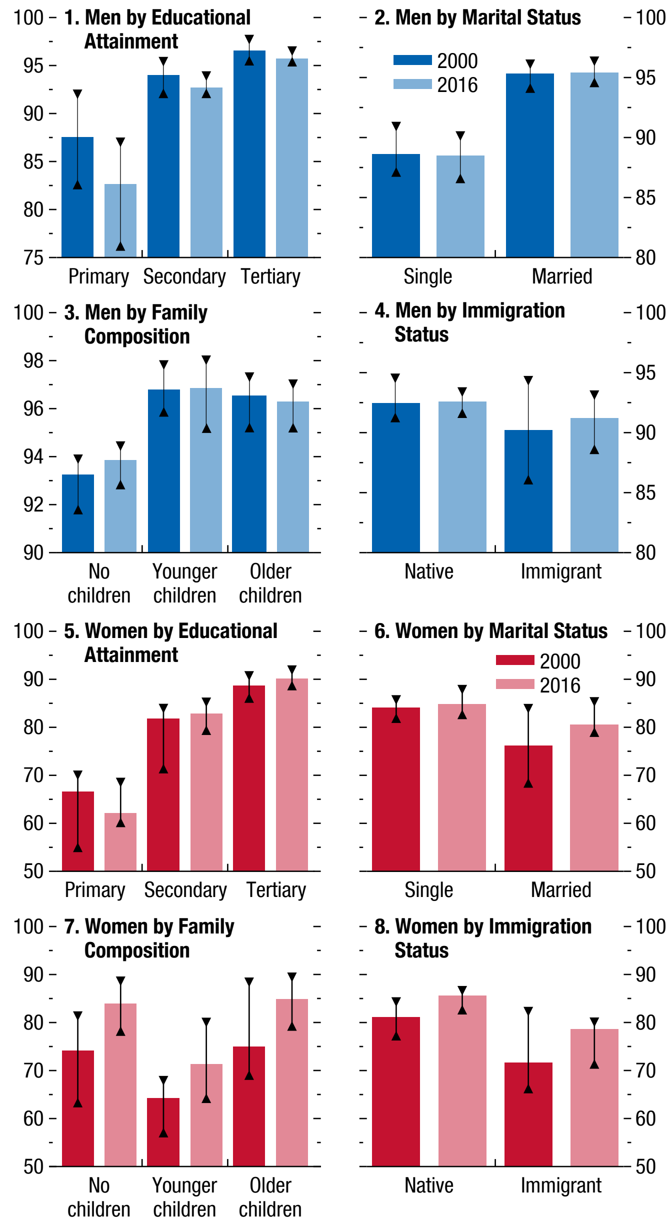
Because labor force participation patterns could reflect significant shifts in the characteristics of prime-age populations—such as education, fertility, marriage, and immigration status—Figure 2.5 provides a more granular picture of the changes in the participation of subgroups since 2000 for most advanced economies (panels 1 and 5) and advanced European economies (panels 2–4, 6–8).[13] With the notable exception of relatively less-educated women, the rise in female labor force participation has been remarkably widespread. Across Europe, single and married women, those with young children (below the age of 6) or older children (below the age of 15), natives and immigrants, were significantly more likely to be employed or looking for work in 2016 than in 2000. For prime-age men, the decline in participation has been the deepest for those with the lowest educational attainment. Across all remaining groups, there has been a small decline or stagnation in the median advanced economy. This suggests that changes in population characteristics toward groups with lower participation, such as the falling share of married prime-age men,

[12]The Council of Economic Advisers (2016) similarly finds limited evidence that reliance on spousal income has contributed significantly to the decline in prime-age male labor force participation in the United States. Rising participation among prime-age women may be driven by falling household income; although this is difficult to examine in country-level analysis due to endogeneity concerns, this issue is examined in greater detail when looking at people's decision to participate.

[13]Data availability constraints allow analysis on participation by various demographic characteristics only for a significantly shorter time span and a smaller sample of countries. The analysis relies on individual-level data from the European Union Labour Force Survey to construct country-level participation rates for subgroups of workers by marital status, number of children, and immigration status, and on Eurostat data, complemented with data from national authorities, to build a picture of participation by educational attainment.

Figure 2.5. Labor Force Participation Rates of Prime-Age Men and Women by Demographic Characteristics, 2000 and 2016
(Percent)

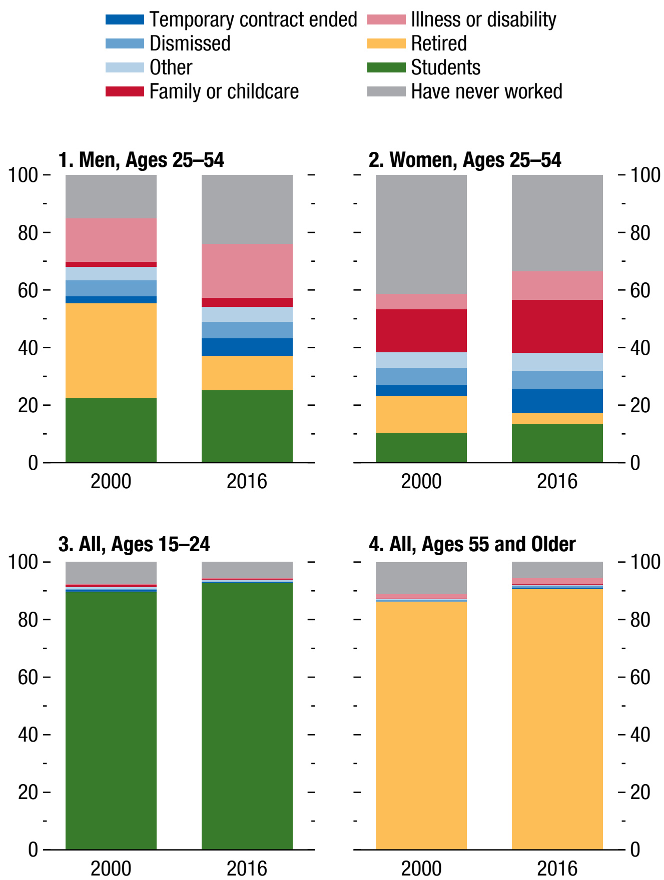
Women's participation has increased almost across the board in advanced economies, while men's participation has stagnated or declined, especially for the less educated.



Sources: Eurostat, European Union Labour Force Survey; national authorities; and IMF staff calculations.
Note: Bars show median and lines show interquartile range. Panels 1 and 5 are based on data from most advanced economies, while panels 2–4 and 6–8 are based on data from advanced European economies. Panels 3 and 7 report statistics for married individuals. In panels 4 and 8, dark bars show data for 2004 instead of 2000. Prime age is defined as 25–54. Young children are those below the age of 6; older children are those ages 6–14. Level of educational attainment is defined according to the International Standard Classification of Education (ISCED). Primary education contains ISCED 2011 levels 0–2; secondary education contains ISCED 2011 levels 3–4; and tertiary education contains ISCED 2011 levels 5–8.

Figure 2.6. Subgroups of the Inactive, 2000 and 2016
(Percent)

Nonparticipants consist of very different subgroups, including students, retired, those taking care of children ("voluntarily inactive"), as well as those inactive for economic reasons ("involuntarily inactive").



Sources: Eurostat, European Union Labour Force Survey; and IMF staff calculations.
Note: Reported statistics are estimated from a random sample of 10,000 respondents per country per year from the European Union Labour Force Survey. Categories in blue and red are subgroups of those who have worked before and are not retired. Retired includes early retirement.

have been sizable. The United States stands out, with particularly deep declines in participation for both women and men in the prime-age category across all levels of educational attainment.

Although the decline in labor force participation of prime-age men appears small for the median advanced economy, it is worrisome for several reasons. First, the decline is broad-based, occurring in almost all advanced economies. Second, given that prime-age men are still the largest segment of the labor force in advanced economies and have traditionally been the main income earners for their families, even a small decline in their labor supply could have sizable macroeconomic consequences.[14] Finally, detachment from the labor force during a person's peak productive years is associated with lower happiness and life satisfaction for men (Winkelmann and Winkelmann 1995; Lucas and others 2004; Knabe and Ratzel 2011; Krueger 2017), poorer health and higher mortality (Gerdtham and Johannesson 2003; Eliason and Storrie 2009; Sullivan and von Wachter 2009), and depressed employment prospects (Arulampalam, Booth, and Taylor 2000; Arulampalam, Gregg, and Gregory 2001).

The Nonparticipants

Interesting insights can be gleaned from the reasons workers give for being out of the labor force. Figure 2.6 uses data from millions of workers surveyed across 24 countries in Europe to break down nonparticipants into those who are students, retired, not retired but have never worked, and were previously but are no longer employed. It further breaks down the last group of nonparticipants according to the reason they reported for their detachment from the labor force.

Comparing the responses of prime-age men and prime-age women points to important gender differences in reasons for inactivity: for instance, women are still more likely to drop out of the labor force to look after children, while a higher fraction of men report illness and disability as reasons for not being employed.

The responses also suggest that a nontrivial share of those out of the labor force may be "involuntarily inactive": they used to work but stopped as a result of economic (demand-side) factors, rather than because of a personal decision. Those reporting being dismissed from their previous job as a reason for inactivity can be seen as a lower bound for this group.[15]

[14]In 2015, the composition of the labor force of the average advanced economy was as follows: 37 percent of workers were prime-age men, 31 percent were prime-age women, 11 percent were ages 15–24, and 21 percent were older than 55. The composition of the population of the average advanced economy was as follows: 20 percent were prime-age men, 20 percent were prime-age women, 12 percent were ages 15–24, and 31 percent were older than 55.

[15]In line with the stylized facts already discussed, comparing the years 2000 and 2016 suggests that, over time, the share of students increased, among both the young and those of prime working age, while the share of those in (early) retirement among prime-agers fell, as did the share of those who never worked among prime-age women and those 55 and older. Illness and disability became relatively more important over time as a reason for nonparticipation.

Involuntary nonparticipants drop out disproportionately from certain sectors of the economy (Figure 2.7, panel 1). Wholesale and retail trade, manufacturing, mining and quarrying, and utilities together account for more than half of the involuntarily inactive, even though fewer than one-third of active workers (including the employed and unemployed) are attached to these sectors. Excess involuntary inactivity—measured as the difference between the inactive individuals attached to a sector as a share of all nonparticipants and the active workers attached to the same sector as a share of the labor force—tends to be concentrated precisely in sectors that have a greater share of routine jobs that are vulnerable to automation (Figure 2.7, panel 2).

These stylized facts provide suggestive evidence of the potential harm of technological progress to participation rates of certain types of workers, an issue this chapter examines in greater detail. They also highlight potentially important income distributional consequences of involuntary inactivity. Displacement of workers tends to occur disproportionately among lower- and middle-skill occupations (Figure 2.7, panel 3), and vulnerability to routinization is especially pronounced in the middle and lower parts of the income distribution (Figure 2.7, panel 4).

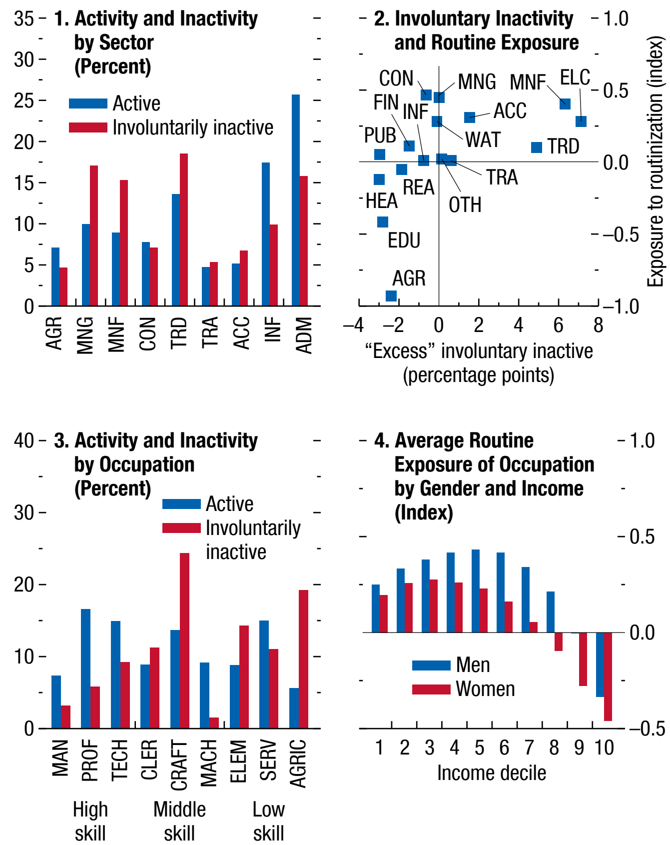
Participation after the Global Financial Crisis

The extent to which trends in labor force participation have changed since the global financial crisis varies depending on the groups of workers considered (Figure 2.8). For young and older workers, there is little difference in the trends in participation rates for the median economy. However, the decline in participation accelerated for prime-age men, and the rate at which prime-age women joined the labor force fell after 2008. It is difficult, however, to isolate the effect of the crisis from the steady decline in the gains in women's participation over the past three decades. These patterns are broadly similar in countries that experienced relatively large output losses as a result of the global financial and European debt crises and those that were relatively shielded from their adverse effects (see Annex Figure 2.2.4).

Employment rates increased in most advanced economies before the global financial crisis, but have since declined in over half of them. Figure 2.9 decomposes changes in employment into changes in unemployment and participation and shows that, before the crisis, employment gains were matched by unemployment declines and increases in participation in most

Figure 2.7. The Role of Exposure to Routinization

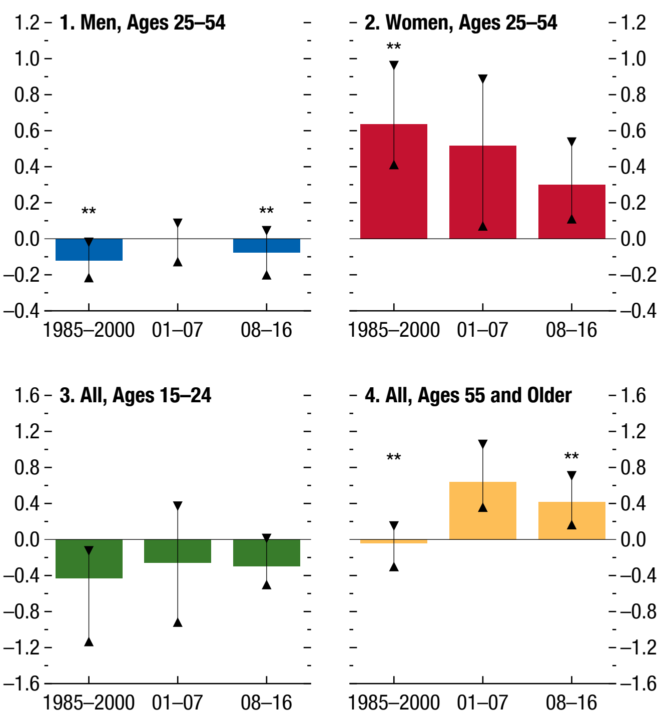
The involuntarily inactive drop out disproportionately from highly routinizable sectors and occupations. Vulnerability to routinization is especially pronounced for men in the middle of the income distribution.



Sources: Das and Hilgenstock (forthcoming); Eurostat, European Union Labour Force Survey; and IMF staff calculations.
Note: Reported statistics are estimated from a random sample of 10,000 respondents per country per year from the European Union Labour Force Survey over the period 2000–16. In panels 1 and 3, active includes employed and unemployed, and involuntarily inactive refers to people inactive due to dismissal. For the inactive, sector or occupation is that of last employment. In panel 2, "excess" involuntarily inactive refers to the difference between inactive individuals in a sector as a share of all nonparticipants and the active individuals attached to the sector as a share of the labor force. In panel 2, routine exposure is a proxy for the share of jobs in a given sector that are at risk of being automated based on Das and Hilgenstock (forthcoming). Panel 4 in turn shows how automatable given occupations are. ACC = accommodation and food service activities; ADM = administrative and support service activities; AGR = agriculture, forestry, and fishing; AGRIC = skilled agricultural workers; CLER = clerical workers; CON = construction; CRAFT = craft workers; EDU = education; ELC = electricity, gas, steam, and air-conditioning supply; ELEM = elementary occupations; FIN = financial and insurance activities; HEA = human health and social work activities; INF = information and communication; MACH = plant and machine operators; MAN = managers; MNF = manufacturing; MNG = mining and quarrying; OTH = other services; PROF = professionals; PUB = public administration and defense; REA = real estate activities; SERV = sales and service workers; TECH = technicians; TRA = transportation and storage; TRD = wholesale and retail trade; WAT = water supply, sewerage, waste management, and remediation activities.

Figure 2.8. Average Annual Changes in Labor Force Participation Rates
(Percentage points)

The decline in prime-age men's participation in advanced economies became more pronounced after the global financial crisis, while gains in prime-age women's participation slowed.



Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Bars denote median; and vertical lines show interquartile range. Asterisks denote statistically significant difference from 2001–07 at the 10 percent level.

countries, yet in about half of the sample postcrisis employment declines translated into both rising unemployment and falling participation.

Flows into inactivity suggest that the share of discouraged workers (inactive now, but unemployed the previous year) has been increasing since the crisis and is approaching the precrisis peak (Annex Figure 2.2.5).

Understanding Trends in Participation Rates

Conceptual Framework and Research Design

Assessing the appropriate policy responses to counteract downward pressure on the labor supply as a result of aging requires a clear understanding of the drivers of the aggregate labor force participation rate and individuals' decisions to be in the job market.

Two key factors underpin changes in aggregate participation rates: shifts in the age structure of the population and changes in the labor force attachment of individuals of different ages. Labor force participation varies considerably over a person's life, rising rapidly in adolescence, flattening through the working years, and falling with age and retirement. Hence, shifts in the age distribution are an important driver of movements in the aggregate participation rate. These shifts have become particularly pronounced in the past decade in advanced economies (Figure 2.1, panel 3) as the exceptionally large cohort of people born in the years following World War II began reaching retirement age.

In turn, numerous interrelated factors influence individuals' decisions to supply labor at various points in their life as they assess the expected return to market work relative to nonparticipation. Individual characteristics, such as gender, educational attainment, previous occupation, and household structure, clearly shape such decisions, because they determine potential earnings in the marketplace relative to nonparticipation.

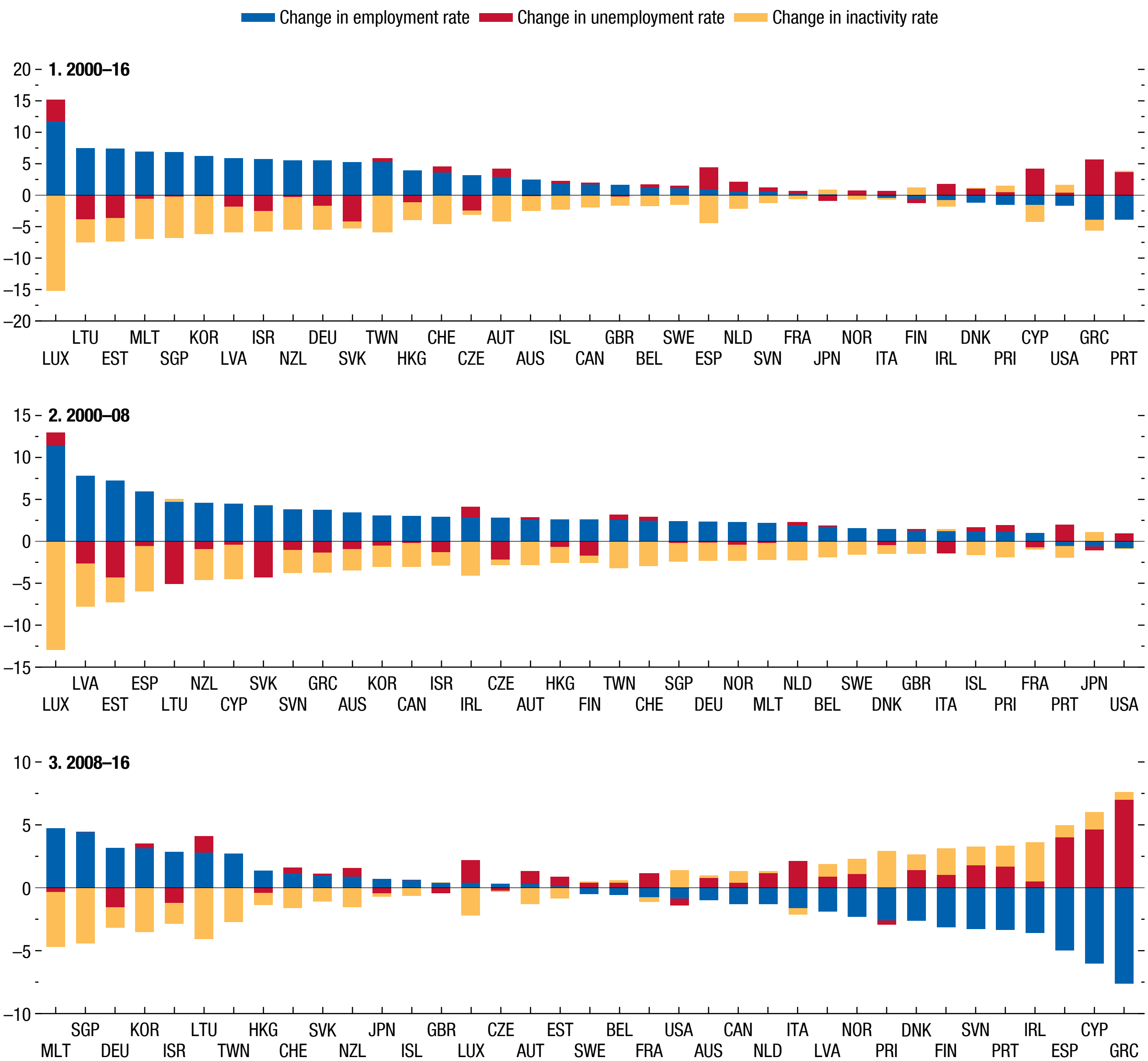
But labor market policies, institutions, and noneconomic factors that govern the prospect of finding (or retaining) a job and the relative benefit from working can also affect participation. Some of these policies, such as the tax-benefit system, directly affect the incentive to supply labor; others, such as wage-setting institutions, may shape supply indirectly through reduced labor demand. For example, an increase in the labor tax wedge could reduce the incentive to work or seek employment, both by reducing net wages and suppressing firms' labor demand as a result of higher labor costs. Conversely, active labor market programs that support jobseekers in finding vacancies may induce individuals to join the labor force and prevent those who temporarily lose employment from becoming permanently detached. Cultural attitudes toward people's role in society are also important because they determine the disutility of market work—for example, through social norms or personally held beliefs (Fernandez 2013).

Policies tailored to addressing the challenges faced by specific workers can also influence their labor supply decisions. For example, provision of childcare, as well as family-friendly policies that make work more flexible, make it easier for women to combine paid employment and motherhood and may discourage exit from the labor market.[16] For older workers, financial

[16]In a simple static labor supply model, parents could choose to stay home and take care of an infant or a young child at the cost of their hourly wage (forgone earnings) minus the price of childcare. A more generous childcare subsidy would increase the parent's wage net of childcare costs, thus raising the opportunity cost of staying home and increasing labor supply on the extensive margin.

Figure 2.9. Decomposition of Labor Market Shifts
(Percentage points)

Employment declines became more pronounced after the global financial crisis and increasingly translated into lower participation alongside rising unemployment.



Source: IMF staff calculations.
Note: Employment rate, unemployment rate, and inactivity rate are defined as total employment, total unemployment, and total inactive population as a percentage of total population, respectively. Data labels in the figure use International Organization for Standardization (ISO) country codes.

incentives embedded in pension systems and other social transfer programs are important considerations in retirement decisions. Policies that enable immigrants' swift integration into labor markets, such as authorization to work, access to language and active labor market programs, and the like, can help them overcome their many disadvantages, including lack of information, poor access to informal networks, lack of transferable skills and qualifications, and low language proficiency (Aiyar and others 2016).

Long-lasting changes in the demand for workers' skills could also influence individuals' workforce attachment. For example, the secular expansion of the service sector in many advanced economies (see Chapter 3 of this report) may have created significant employment opportunities for women, who are seen to have a comparative advantage in services, thus raising female participation.[17] On the other hand, technological progress that enabled routine jobs to be automated may have reduced the demand for less-skilled labor in advanced economies and made certain jobs obsolete. While these global developments benefit the economy as a whole, and create new opportunities in other sectors, workers may be unable to take advantage of these opportunities due to lack of relevant skills and training, preferences, hardship involved in relocating geographically, or an inadequate return compared with their previous earnings.

Participation decisions are also shaped by even more short-lived changes in labor demand, such as those caused by cyclical fluctuations (for example, Elsby, Hobijn, and Sahin 2015). The rise in unemployment during recessions may lead some workers to drop out of the labor force permanently. Diminished job prospects during recessions may also induce students to remain in school longer or lead parents (women especially) with young children to stay at home instead of seeking jobs.[18]

The chapter uses several complementary approaches, each one tailored to measure a distinct set of potential drivers. It starts by quantifying the contribution of shifts in the age structure to aggregate participation changes in the past decade, using a standard shift-share decomposition.

Given that both the shift-share analysis and the stylized facts presented previously point to sizable changes in the workforce attachment of specific groups of workers, the analysis uses cross-country panel regressions to disentangle the influence of labor policies and other factors on the participation of different population segments. While the potential set of drivers is large, the analysis focuses on the variables most commonly discussed in the policy debate: the tax-benefit system, activation policies, wage-setting institutions, and the role of structural changes and exposure to routinization. The cross-country panel approach has the advantage of capturing the general equilibrium effects of various drivers and quantifying their role in a unified framework. However, the measurement of policies is often imperfect, and the identification of causal impacts can be problematic.

Alongside the analysis of macro data, individual-level data from 24 European economies allow for a deeper look at the effect of individual characteristics, including the extent to which (past) occupation can be automated, on workforce attachment, and the potential for policies to shape this relationship.

The Role of Aging and Cyclical Conditions

To quantify the effect of aging, this section performs a standard shift-share analysis of aggregate participation of men and women. It decomposes observed changes in aggregate male and female participation since 2008 into changes in participation rates within each age group while holding population shares fixed ("within changes"), a shift in the relative sizes of age groups while holding participation rates fixed ("between changes"), and an interaction term. The role of aging can be approximated by the "between changes"; in other words, the imputed change in participation if participation rates for each age group had remained at their 2008 levels.[19]

Because the demographic inflection point coincided with the global financial crisis, the analysis also quantifies the role of the unusually severe recessions in many advanced economies. The cyclical component of participation changes is estimated from the historical relationship between detrended aggregate participation rates and output (or unemployment) gaps, allowing for

[17]See, for example, Ngai and Petrongolo (2017) for a model of structural transformation in which relative gains in women's labor market outcomes are driven by changes toward the service-producing sector, as well as Olivetti and Petrongolo (2016) for empirical evidence on the role of the industrial structure in accounting for cross-country differences in gender outcomes. For a discussion of gender-based comparative advantage, see Feingold (1994); Galor and Weil (1996); Baron-Cohen, Knickmeyer, and Belmonte (2005); Christiansen and others (2016a); Rendall (2017); and Cortes, Jaimovich, and Siu (2018), among others.

[18]Increasing evidence suggests that adverse initial labor market conditions can have substantial long-term effects on the earnings of college graduates. See, for example, Genda, Kondo, and Ohta (2010); Kahn (2010); and Oreopoulos, von Wachter, and Heisz (2012).

[19]See Box 1.1 of the October 2017 WEO for a shift-share analysis of labor force participation for selected advanced economies and Aaronson and others (2006) and Council of Economic Advisers (2014) for the United States.

a differential response of labor force participation to severe recessions.[20,21]

On average, the observed changes in participation of men are broadly consistent with shifts in the population age profile since 2008 and the drag from the global financial crisis (Figure 2.10). Women, however, have become significantly more likely to work or seek employment, despite aging, in the average advanced economy (although not in the United States), suggesting that policies and other factors are also at play. For both men and women, there are notable differences across geographical regions. In the United States, participation has declined significantly more than aging alone would have predicted. In the average European and other advanced economy, on the other hand, gains in participation within each demographic group have partially offset, and in some cases exceeded, the drag from aging.

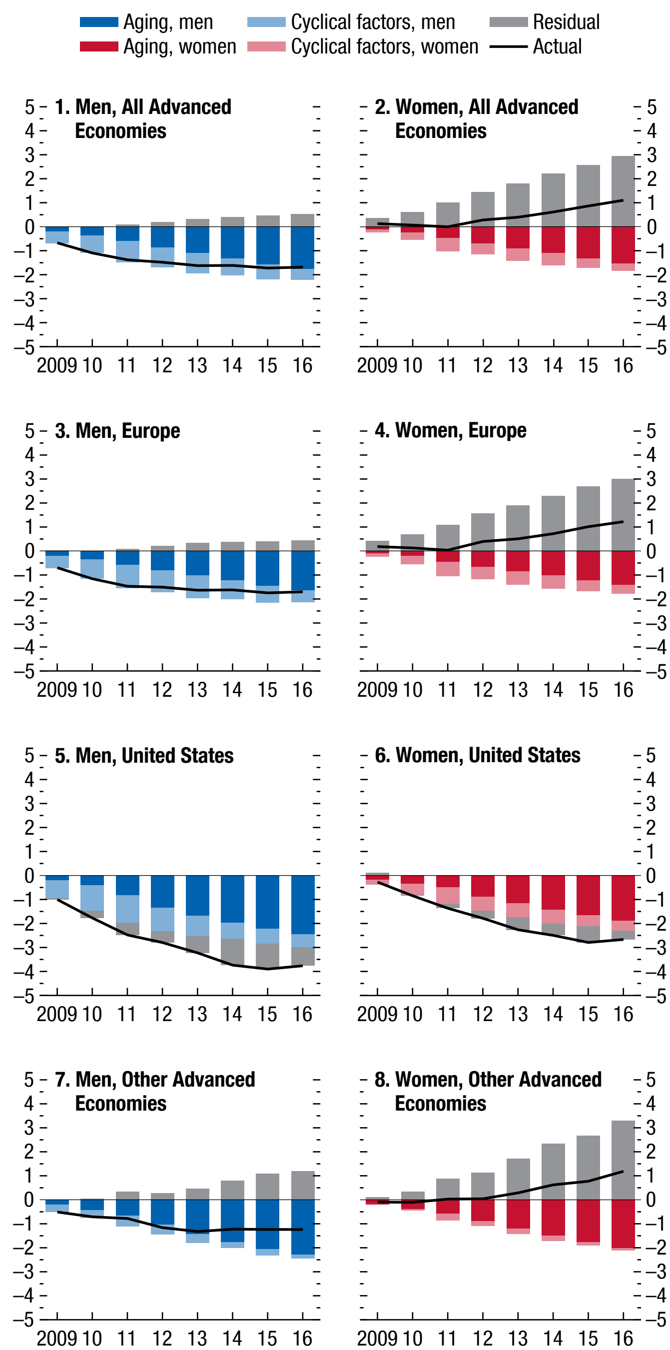
The role of cyclical developments is also evident. High unemployment and poor job prospects after the crisis depressed participation, especially in Europe and the United States. But as the recovery has taken hold, the drag from cyclical developments has diminished.

Drivers of Participation Rates of Specific Groups of Workers

The finding that changes in aggregate participation cannot be fully explained by demographic shifts or cyclical effects in some countries and the wide cross-country heterogeneity in participation rates point to a potentially important role for policies and other factors influencing the decision to keep working or seek employment. This section examines the historical relationship between the participation of individual groups of workers and potential drivers since 1980 across 23 advanced economies. It then uses the estimated associations to provide an illustrative quantifi-

Figure 2.10. Changes in Participation Rates, 2008–16
(Percentage points)

Aging can explain the bulk of the decline in men's participation since 2008. In most regions, women's participation increased, despite the forces of aging.



Source: IMF staff calculations.
Note: Panels 1–4 and 7–8 show simple averages across countries. Other advanced economies comprise Australia, Canada, Japan, Korea, and New Zealand.

[20]The estimates of the cyclical effect for the United States are in line with those of other studies (Erceg and Levin 2014; Aaronson and others 2014; Council of Economic Advisers 2014; Hall 2015; Balakrishnan and others 2015), despite differences in specifications and revisions to estimates of potential output (Grigoli and others 2015).

[21]Duval, Eris, and Furceri (2011) document that severe recessions have significant and persistent impacts on participation, while moderate downturns do not. The econometric analysis relates detrended aggregate participation rates to measures of the cyclical position in a distributed lag specification, allowing for the sensitivity of participation rates to differ in crisis episodes. See Annex 2.3 for details.

cation of these drivers' contributions to the observed changes in labor supply.[22]

The chapter estimates a reduced-form model of labor force participation, looking separately at the young, prime-age men, prime-age women, and older workers. The model links their participation rates to factors that may affect the decision to supply labor, controlling for all differences across countries that are constant over time and all shocks that affect countries equally.[23] The choice of the predictors is guided by the conceptual framework outlined previously and data availability constraints.

The analysis examines the tax-benefit system, as captured in the labor tax wedge and generosity of unemployment benefits, and looks at policies specifically geared toward improving the job-matching process: spending on active labor market programs (for example, training programs, job-search assistance, and so forth) and major policy changes that help migrants integrate in a host country. When studying women's participation decisions, the analysis expands the set of policies to include public spending on early childhood education and care, length of job-protected maternity leave, and opportunities for part-time employment.[24] For older workers, the analysis considers the statutory retirement age and the generosity of pension plans.[25] Wage-setting institutions and frameworks are proxied by union density and the level of coordination in wage bargaining.

Changes in the demand for different types of workers due to structural transformation and globalization are captured in the ratio of services to manufacturing employment, the degree of urbanization, and trade openness. Following Chapter 3 of the April 2017 WEO and Das and Hilgenstock (forthcoming), the potential for technology to displace workers is proxied by the "routinizability" of a country's initial occupation mix interacted with the relative price of investment goods in advanced economies—that is, the automation of routine tasks. The empirical specification controls for the output gap, while education, measured as the share of population in the age-gender group with secondary and tertiary education, is included as a proxy for workers' potential returns to work.[26]

The analysis indicates that education, cyclical and long-lasting shifts in labor demand, and labor market policies are strongly associated with participation rates (Table 2.1). However, there are significant differences in the responsiveness of workforce attachment to these factors across groups of workers.

In line with economic theory, education is a powerful predictor of labor force participation. An increase in the share of workers with secondary and especially tertiary education is associated with significantly higher participation, particularly for prime-age women and older workers. Higher education is also positively associated with participation of prime-age men, but to a smaller degree, in line with the much

[22]The baseline results are based on the set of countries classified as advanced in the WEO for most of the time period, thus excluding the eight countries that became advanced after 2006. The chapter's findings are robust to using the full set of countries currently classified as advanced.

[23]The empirical specification is

$$LFP^g_{i,t} = \beta^{X,g} X^g_{i,t} + \beta^{D,g} D_{i,t} + \beta^{GAP,g} GAP_{i,t-1} + \beta^{Z,g} Z_{i,t} + \pi^g_i + \tau^g_t + \varepsilon^g_{i,t},$$

in which *LFP* denotes the participation rates of worker group *g* in country *i* at time *t*, *GAP* is the cyclical position of the economy, *X* represents the set of policies and institutions (some of these are specific to group *g*), *D* are factors that may shift the demand for worker group *g*, *Z* comprises other determinants of labor supply (education), and π_i and τ_t are country and time fixed effects. See Annex 2.4 for further details on the empirical estimation and robustness tests, and a full description of the variables used and their sources.

[24]Data availability on taxes on the secondary earner in the household is limited, thus the variable is not included in the empirical specification.

[25]In the baseline specification, the generosity of pension plans is measured as old-age and incapacity spending as a percent of GDP, purged of fluctuations resulting from cyclical and demographic factors. Conceptually more appropriate measures of incentives for early retirement, such as the change in net pension wealth from an additional year in the labor force, or pension replacement rates, would severely restrict the sample, but are examined in robustness tests.

[26]The empirical approach in the chapter is widely used in the cross-country literature. Blanchard and Wolfers (2000); Genre, Gómez-Salvador, and Lamo (2005); Bertola, Blau, and Kahn (2007); Bassanini and Duval (2006, 2009); de Serres, Murtin, and Maisonneuve (2012); Murtin, de Serres, and Hijzen (2014); and Gal and Theising (2015) examine determinants of employment and unemployment, among others. See, for example, Jaumotte (2003); Genre, Gómez-Salvador, and Lamo (2010); Blau and Kahn (2013); Cipollone, Patacchini, and Vallanti (2013); Thévenon (2013); Dao and others (2014); and Christiansen and others (2016b) for cross-country analysis of female labor force participation and employment and Blöndal and Scarpetta (1999) and Duval (2004) for cross-country analysis of retirement decisions. Relative to the literature, the chapter expands the temporal coverage of the analysis, capturing the last decade during which significant changes in participation occurred. The chapter's focus on the effects of long-lasting shocks to labor demand, such as those stemming from technological advances, and on migrant integration policies is also new.

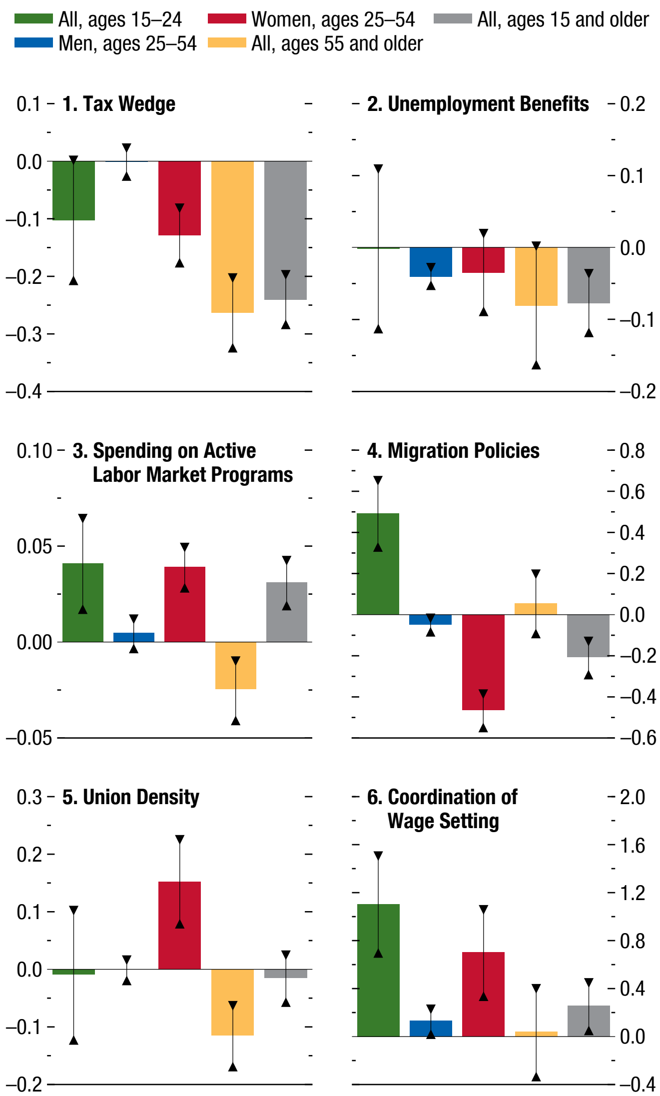
Table 2.1. Drivers of Labor Force Participation Rates

		(1) All, Ages 15–24	(2) Men, Ages 25–54	(3) Women, Ages 25–54	(4) All, Ages 55+	(5) All, Ages 15+
Other Factors	Lag of Output Gap	0.360***	0.072***	0.170*	–0.006	0.183***
		(0.112)	(0.020)	(0.092)	(0.068)	(0.044)
	Routinization × Relative Price of Investment	0.303	0.302***	1.793***	0.505*	0.536***
		(0.299)	(0.048)	(0.206)	(0.288)	(0.175)
	Lag of Trade Openness	0.059***	–0.005	0.010	–0.059***	0.012*
		(0.022)	(0.005)	(0.014)	(0.009)	(0.007)
	Relative Service Employment	–0.002	–0.002	0.015***	0.009	0.010**
		(0.010)	(0.002)	(0.005)	(0.006)	(0.004)
	Urbanization	0.668***	0.101***	0.355***	0.194	0.249***
		(0.142)	(0.019)	(0.071)	(0.115)	(0.047)
	Education (percent secondary)	–0.050	0.019***	0.211***	0.038*	0.063***
		(0.042)	(0.007)	(0.017)	(0.021)	(0.017)
	Education (percent tertiary)	–0.275***	0.019	0.332***	0.389***	0.135***
		(0.057)	(0.015)	(0.030)	(0.050)	(0.031)
Policies	Tax Wedge	–0.103	–0.002	–0.129***	–0.263***	–0.240***
		(0.064)	(0.015)	(0.029)	(0.037)	(0.026)
	Unemployment Replacement Ratio	–0.002	–0.041***	–0.035	–0.081	–0.078***
		(0.068)	(0.007)	(0.033)	(0.050)	(0.025)
	Public Spending on ALMP	0.041***	0.005	0.039***	–0.025**	0.031***
		(0.014)	(0.005)	(0.006)	(0.009)	(0.007)
	Restrictiveness of Migrant Integration Policies	0.491***	–0.047**	–0.462***	0.056	–0.207***
		(0.098)	(0.020)	(0.049)	(0.088)	(0.049)
	Union Density	–0.009	–0.001	0.153***	–0.115***	–0.015
		(0.068)	(0.011)	(0.044)	(0.032)	(0.025)
	Coordination of Wage Setting	1.104***	0.131**	0.701***	0.040	0.256**
		(0.245)	(0.063)	(0.219)	(0.222)	(0.120)
	Public Spending on Early Childhood Education and Care			3.708***		
				(1.210)		
	Share of Part-Time Employment			0.946***		
				(0.118)		
	Job-Protected Maternity Leave			0.025***		
				(0.006)		
	Statutory Retirement Age				0.661***	
					(0.174)	
	Public Spending on Old-Age Pensions				–0.750***	
					(0.154)	
	Public Spending on Incapacity				–0.421	
					(0.562)	
	Number of Observations	571	571	489	568	570
	Countries	23	23	23	23	23
	R^2	0.515	0.606	0.887	0.686	0.578

Source: IMF staff calculations.
Note: The table presents results from the estimation of equation (2.3) with separate regressions for the participation rate for each group of workers on a sample of 23 advanced economies during 1980–2011 using annual data. See Annex 2.4 for the construction of the explanatory variables and Annex Table 2.1.2 for the countries in the sample. All specifications include country and year fixed effects. Driscoll-Kraay standard errors are in parentheses. ALMP = active labor market programs.
*$p < .10$; **$p < .05$; ***$p < .01$.

Figure 2.11. Drivers of Participation Rates: Policies
(Percentage points)

Higher tax wedges and more generous unemployment benefits depress participation, while spending on active labor market programs and higher levels of wage-setting coordination are associated with higher participation. Policies that encourage the integration of migrants are associated with higher participation of prime-age workers.



Source: IMF staff calculations.
Note: The bars denote the estimated change in participation from a one-unit increase in the policy variable, while the vertical lines show the 90 percent confidence interval. See Annex 2.4 for variable definitions and specification details. Tax wedge is measured in percent of labor costs. The unemployment benefits gross replacement rate is measured in percent of work income. Public spending on active labor market policies is measured per unemployed person and as percent of per capita GDP. Union density is measured as net union membership as a proportion of wage earners in employment. Migration policy is an index constructed by cumulating major changes in policies and regulations guiding the postentry rights and other aspects of migrants' integration, with a higher value denoting more restrictive policies. Coordination of wage setting is an index, ranging from 1 (decentralized) to 5 (centralized).

smaller variability in their participation rates seen in Figure 2.5.[27]

For most groups of workers, participation rates depend on the state of the business cycle. As expected, the association is significantly higher for those more marginally attached to the workforce, such as the young and women.

The analysis also confirms that structural transformation that may shift the demand for certain types of workers affects their labor market involvement. A relative increase in service sector employment is typically followed by the entry of prime-age women into the labor force, while urbanization brings gains in the participation of all groups, potentially by exposing them to a larger set of job opportunities.

Conversely, although technological change can benefit the economy as a whole and create new opportunities in other sectors, it may not be fully benign from the point of view of some workers. A decline in the relative price of investment is associated with lower participation rates in countries where the initial occupation mix is tilted toward routine-task occupations, highlighting the difficulties of workers displaced by automation in finding alternative employment (see Box 2.2 and Box 2.3 for subnational evidence from the United States and Europe, respectively).[28]

Participation rates are also responsive to labor market policies and institutions (Table 2.1; Figures 2.11–12). In particular:

- The tax-benefit system has a robust relationship with participation rates. Higher labor tax wedges and more generous unemployment benefits are associated with lower labor force attachment for most groups of workers, in line with findings in the cross-country literature on their effect on employment (see, for example, Gal and Theising 2015 and its references).[29]

[27]The negative association between labor force participation and the share of population ages 15–24 with partial or completed tertiary education likely reflects that they are still in school.

[28]This finding is consistent with the role of technological progress, along with varying exposure to routine occupations, in the decline in the labor share in advanced economies documented in Chapter 3 of the April 2017 WEO and Dao and others (2017). Acemoglu and Restrepo (2017) provide evidence of significant employment losses in local US labor markets with greater exposure to robots; Autor and Dorn (2013) examine the impact of the falling cost of automating routine jobs on polarization and jobs of different skill levels.

[29]In theory, the net effect of higher taxes on labor supply is ambiguous. If higher labor taxes lower net wages, individuals may respond by working more to maintain their income. On the other hand, by lowering the relative return to market work, higher taxes may lead to lower participation. The negative relationship between

- On the other hand, policies specifically geared toward improving the job-matching process are generally associated with stronger participation rates.[30] Higher public spending on active labor market programs tends to raise the share of young and prime-age women working or seeking employment. The analysis also indicates that policies that encourage the integration of migrants can help boost prime-age workers' participation, with more pronounced effects on women. The positive association likely reflects the success of these policies in narrowing the sizable participation gaps between native and immigrant workers, which are especially wide for women. However, other channels are possible. A more migrant-friendly policy stance may bring in more immigrants. Although migrants have a lower propensity to work than natives when they arrive, they are more likely to be prime age than the native population and may boost aggregate participation rates through compositional shifts (see Box 2.4). Several recent studies have also emphasized the complementarity of migrants' skills to those of the native population, which has helped boost natives' labor market outcomes, especially women's.[31] The negative association between more friendly migration policies and youth labor force participation is not surprising, given that integration measures include giving migrants access to education and training, which could lead to more foreign students and increase school enrollment of nonnative young people.
- Women's willingness to work or seek employment is significantly influenced by policies that help them reconcile work inside and outside the house-

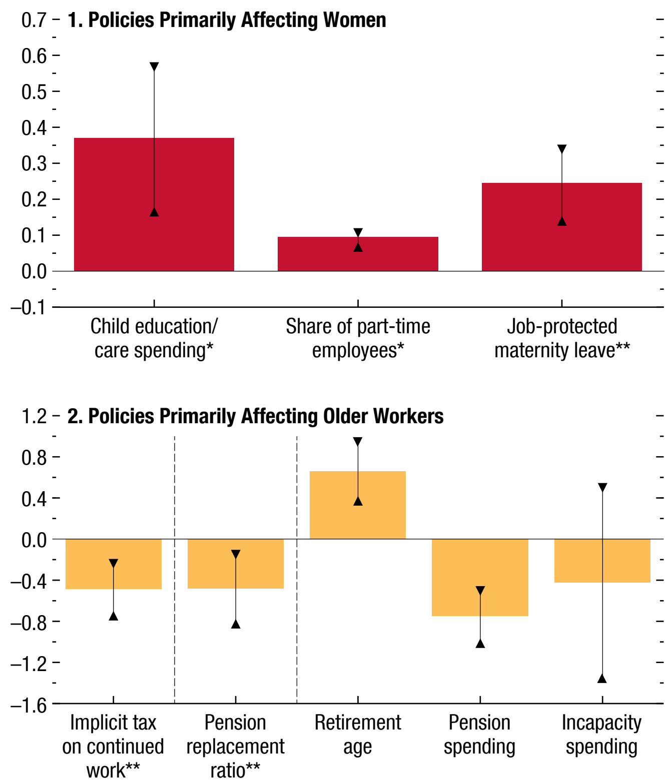
participation rates and the generosity of unemployment benefits, measured as the gross benefit replacement rate, is consistent with (1) the positive correlation found in cross-country data between generosity of unemployment benefits and unemployment levels, which could depress participation through a discouragement effect; and (2) the fact that in many countries the unemployment insurance system provides a path to early retirement for older workers.

[30]Activation policies are proxied by spending on active labor market programs per unemployed person as a share of GDP per capita. To measure migrant integration policies, the chapter constructs an index based on major policy changes in rules governing the integration of migrants, such as their postentry access to language, housing, and cultural integration programs; social benefits; health, education, and unemployment benefits; and the like from the DEMIG POLICY database (de Haas, Natter, and Vezzoli 2014).

[31]See, for example, Carrasco, Jimeno, and Ortega (2008); D'Amuri and Peri (2014); Cattaneo, Fiorio, and Peri (2015); Foged and Peri (2015); Aiyar and others (2016); and Chapter 4 of the October 2016 WEO.

Figure 2.12. Drivers of Participation Rates: Additional Policies
(Percentage points)

Family-friendly policies are associated with higher participation among women, while retirement incentives significantly affect the participation decisions of older workers.



Source: IMF staff calculations.
Note: The bars denote the estimated change in participation from an increase in the policy variable, while the vertical lines show 90 percent confidence intervals. See Annex 2.4 for variable definitions and specification details. * indicates an increase in the variable by 0.1 unit. ** indicates an increase in the variable by 10 units. Public spending on childcare and education is measured as percent of GDP. Job-protected maternity leave is measured in weeks. Statutory retirement age is measured in years. Implicit tax on continued work is the change in the present value of the stream of future pension payments net of contributions to the system from working five more years, while the pension replacement ratio is the ratio of mean disposable income of those ages 65–74 to the mean disposable income of those ages 50–59. Spending on old-age pensions and incapacity are measured as percent of GDP and are purged of fluctuations due to cyclical and demographic factors. Dotted vertical lines in panel 2 denote results from different regressions.

hold (Figure 2.12). Consistent with the findings of a large body of literature, the chapter's analysis suggests that better access to childcare, longer maternity leave, and greater flexibility in work arrangements are associated with higher female labor force participation.[32]
- For older workers, incentives for retirement have a powerful effect on labor force attachment.[33] Raising the statutory retirement age is associated with delayed exit from the labor market, whereas greater pension plan generosity seems to encourage early retirement. The latter finding is robust to using conceptually more appropriate, but less widely available, measures of incentives for early retirement, such as the implicit tax on continued work or pension replacement rates (Figure 2.12).
- Finally, the evidence on the role of wage-setting institutions—unionization and the degree of wage bargaining coordination—is mixed (Figure 2.11). Higher coordination of wage setting is associated with greater labor force participation for most groups of workers, consistent with the idea that more coordinated bargaining systems may lead to faster wage moderation during downturns as unions internalize the potentially detrimental effects that excessive wage pressure may have on overall employment (Soskice 1990; Bassanini and Duval 2006).[34] However, the correlation between unionization and participation is less robust to changes in the sample or the inclusion of other policies.

Overall, these results suggest that policies can influence labor force participation decisions. But can they help explain the sizable cross-country differences in observed changes in participation rates? To answer this question, the chapter examines the change in the workforce attachment of different groups of workers between 1995 and 2011—for which data are available for almost every policy and every country—against the changes in labor force participation predicted by two empirical models: one that deliberately excludes policies and institutions as determinants of participation and one that includes them. A comparison of how well these models account for the observed changes in participation across countries indicates that changes in labor market policies and institutions can explain a quantitatively meaningful fraction of the observed changes in labor force participation across countries (Figure 2.13). The correlation between actual and predicted participation is substantially higher for a model that includes labor market policies compared with a model that does not. However, there are sizable differences in how well the empirical model can explain cross-country variation in participation trends across population groups. Notably, a very large fraction of the observed change in labor force participation of the young remains unexplained by the factors considered in the analysis.

Combining policies, education, structural shifts, and technology, Figure 2.14 examines the contributions of these factors to changes in participation rates between 1995 and 2011. Supportive policies and educational gains have been key factors behind the dramatic increase in the participation of prime-age women and older workers, with structural transformation contributing positively as well. On the other hand, technological advances have weighed on participation for all groups of workers except the young.

For the young, and to a certain extent prime-age male workers, a significant share of the decline in participation is attributed to a common component across advanced economies, captured by the time effects in the regressions. This common factor could reflect the common influence of global forces, such as technological progress or globalization, concurrent changes in policies, structural transformations, or other factors that may affect labor supply decisions across the advanced world, such as changing returns to education, rising life expectancy, or common scars from the global financial crisis. For older workers, the latter may have delayed retirement, as captured in the positive common component, as a result of suppressed returns on retirement savings as global interest rates fell, losses in financial wealth, and potentially higher debt.

Comparing how the various factors relate to participation changes across geographic regions can shed light on the reasons behind their (sometimes) divergent trends. For example, the analysis reveals that the striking difference in the participation trend for

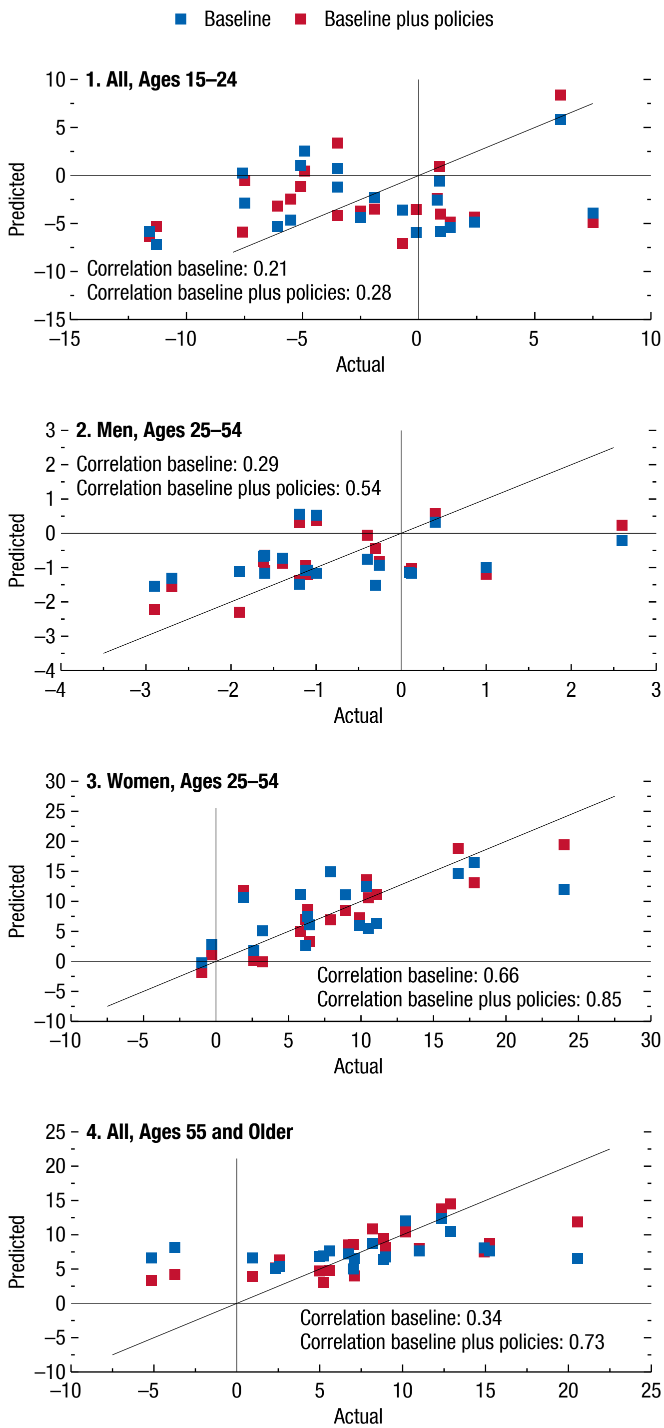
[32]See Olivetti and Petrongolo (2017) and its references for a recent review of evidence on the economic consequences of family policies as well as, for example, Jaumotte (2003); Genre, Gómez-Salvador, and Lamo (2010); Blau and Kahn (2013); Cipollone, Patacchini, and Vallanti (2013); Thévenon (2013); Dao and others (2014); Chapter 3 of the April 2016 WEO; and Christiansen and others (2016b).

[33]See Blundell, French, and Tetlow (2016) and its references for a review of the literature on retirement incentives and labor supply.

[34]Janssen (2018) similarly finds that the costs of worker displacement are higher in a more decentralized wage bargaining system, by studying a major reform of the wage bargaining system in Denmark.

Figure 2.13. Changes in Participation Rates, Actual versus Predicted, 1995–2011
(Percentage points)

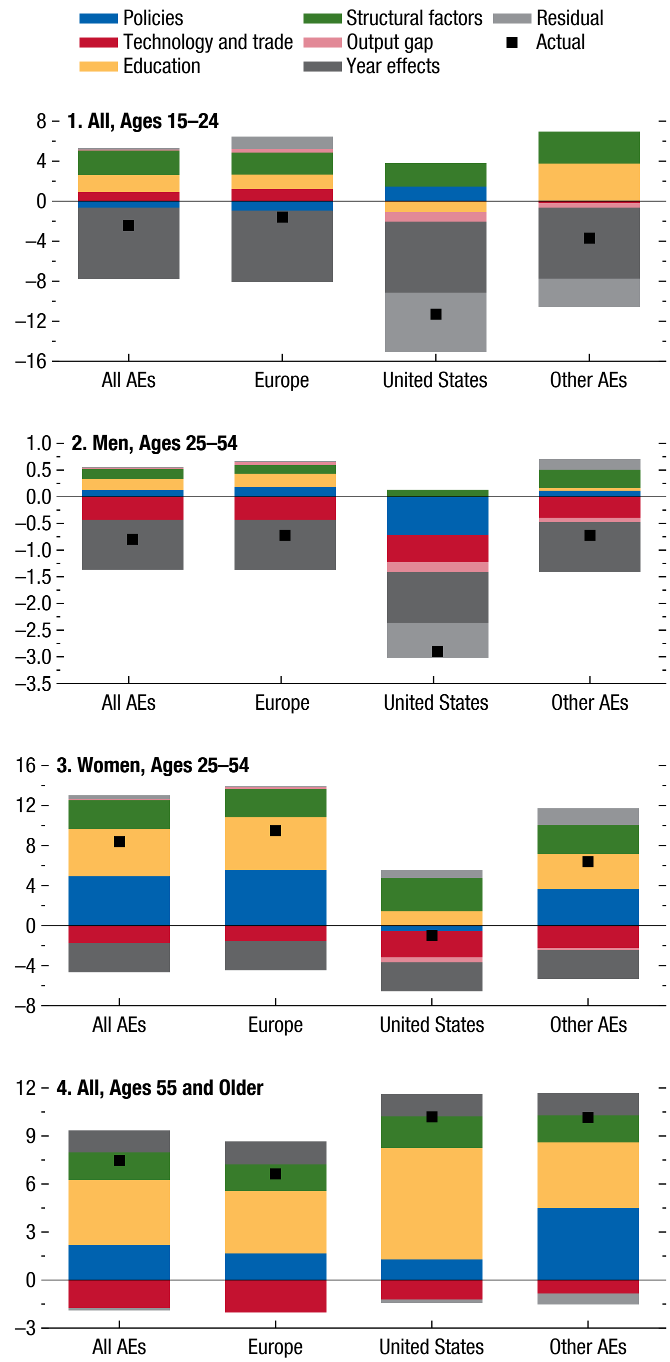
Policies help explain observed differences in changes in labor force participation across advanced economies.



Source: IMF staff calculations.
Note: See Annex 2.4 for variable definitions and specification details.

Figure 2.14. Average Contributions to Changes in Participation Rates, 1995–2011
(Percentage points)

Technological change weighs on labor force participation. Gains in education and policies have, however, more than offset this effect for prime-age women and older workers.



Source: IMF staff calculations.
Note: See Annex 2.4 for variable definitions and specification details.
AEs = advanced economies. Other AEs comprise Australia, Canada, Japan, Korea, and New Zealand.

US women relative to the average European trend can be attributed to the more supportive policy changes in Europe and larger gains in educational attainment among prime-age European women. The factors behind the rise in participation among older workers are very similar across all regions: gains in education, structural transformation, and the introduction of policies that discourage early retirement.[35] However, the reason that US prime-age men and youth became so much more disconnected from the labor market than their European counterparts remains puzzling, as evidenced by the sizable residual in the decomposition of the change. Many hypotheses regarding this decline are specific to the United States and, consequently, cannot be evaluated in a cross-country setting—for example, the role of rising disability, opioid use, higher incarceration, and improved leisure technology.[36] Evidence from subnational data presented in Boxes 2.2 and 2.3 also suggests longer-lasting harm to participation from technological progress in the United States than in Europe.

Drivers of Individual Participation Decisions

The final step of the analysis complements the cross-country findings by examining evidence from millions of individuals in Europe. The use of micro data offers important advantages relative to the cross-country results discussed so far. It allows for a deeper exploration of individual and household-level determinants of participation, thus mitigating the endogeneity bias arising from omitted variables and reverse causality in regressions relying on aggregate data. The analysis also zooms in on the impact of technology and the extent to which policies can help offset its effect on individuals' decisions to drop out of the labor force.

The empirical analysis models the decision of an individual to participate in the labor market as a function of personal characteristics (education, immigration status, location), family composition (single versus living as part of a couple, with and without children), and exposure to routinization. To measure vulnerability to automation, the analysis uses information on the occupation of currently employed individuals, as well as on the most recent occupation of those unemployed or inactive, and assigns each a routinizability score based on their (most recent) occupation, following Chapter 3 of the April 2017 WEO and Das and Hilgenstock (forthcoming).[37]

In line with the aggregate findings, the analysis points to large and significant effects of higher education (Figure 2.15). Tertiary education roughly doubles the odds of being active over attainment of up to lower secondary education, with somewhat larger effects for women. Living in an urban area also raises participation, likely on account of access to a more diverse labor market with more opportunities. Natives are also more likely to participate than immigrants.

Family composition has a considerable influence on the decision of an individual to work or seek employment, although there are large gender differences. Relative to the baseline category of being the only adult in a household without children, being part of a couple and having children is associated with higher participation of men but lower participation of women. Similarly, more children are associated with lower participation of women but higher participation of men, consistent with the historical allocation of work across genders within a household. Interestingly, the presence of other employed adults in the household is associated with a higher likelihood of being active, likely pointing to common labor market

[35]See, among others, Blau and Goodstein (2008) and Hurt and Rohwedder (2011) for evidence from the United States and Börsch-Supan and Ferrari (2017) for evidence from Germany.

[36]See Eberstadt (2016), Council of Economic Advisers (2016), Krause and Sawhill (2017), and Abraham and Kearney (2018) for a review of the literature. Krueger (2017) discusses the poor health status of men not in the labor force and the rising use of pain medication. Case and Deaton (2017) document an increase in mortality rates as a result of addiction, depression, and suicide ("deaths of despair") among white prime-age adults and hypothesize that it may be rooted in the steady deterioration of their job opportunities. Holzer, Offner, and Sorensen (2005); Pager, Western, and Sugie (2009); and Schmitt and Warner (2010) present evidence of a dramatic increase in incarceration and the ex-prisoner population in the United States, which faces significant barriers to employment. Aguiar and others (2017) argue that the decline in the labor supply of young men may be linked to improvements in video gaming and other recreational computer activities. It should be noted, however, that the extent and direction of causality of these hypotheses are difficult to establish empirically. Abraham and Kearney (2018) offer a rough quantification of the role of various factors in US employment rate trends since 1999 based on existing studies.

[37]The model is estimated on a subsample of 18 countries relative to the sample used in the stylized facts with detailed information on family composition. Logit regressions relate a binary outcome variable capturing whether a person is in or out of the labor force to the above-mentioned participation determinants, controlling for the aggregate output gap and country and year fixed effects. Annex 2.5 provides a detailed description of the empirical methodology.

effects. These findings should, however, be treated as associations rather than causal effects as labor supply decisions and family composition are likely jointly decided.[38]

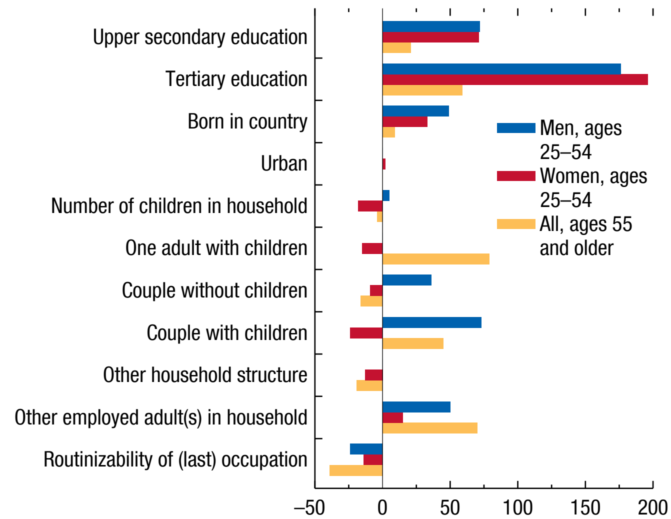
Finally, in line with the country-level results, the micro analysis points to significant negative effects of exposure to routine tasks. Working or having worked in an occupation that is more vulnerable to routinization is associated with lower odds of participation. This effect is larger for men and is especially pronounced for workers 55 and older. The effects are both statistically and economically significant: a unit change in routinization scores roughly corresponds to the difference in the routinization score of technicians and the routinization score of managers. Whereas about 87 percent of prime-age male managers are active, about 84 percent of prime-age male technicians are in the labor force—the difference in their routinization scores alone can explain about one-third of this 3 percentage point difference in participation rates.[39]

Can policies help those vulnerable to losing their jobs to technology remain active in the labor market? To answer this question, the analysis examines whether various country-level labor market policies, such as spending on active labor market programs or employment protection, can offset some of the negative effect of routinization on participation. It augments the logit model described earlier in this chapter with an interaction between the routinization score and the relevant policy measure. Figure 2.16 plots the effect of a unit change in the routinization score, estimated at the 75th and 25th percentiles of the distribution of policies (in other words, in countries with relatively high versus relatively low spending on active labor market programs, and the like).

Policies can offset at least some of the negative association between routinization and participation.

Figure 2.15. Change in the Odds of Being Active
(Percent)

Higher education is associated with higher odds of being active, while being married and having children is associated with lower labor force participation of prime-age women. Those in more routinizable occupations are more likely to become detached from the labor force.



Sources: Das and Hilgenstock (forthcoming); Eurostat, European Union Labour Force Survey; and IMF staff calculations.
Note: Logit regressions are based on a random sample of 10,000 respondents per country per year from the European Union Labour Force Survey over the period 2000–16 and for 18 countries. Only effects significant at the 10 percent level are shown. The base category for education is "up to lower secondary education." For family composition, the base category is "one adult without children." Changes in odds ratios are shown. See Annex 2.5 for specification details.

In particular, higher spending on active labor market programs seems to attenuate the link between participation and routinizability of occupation. The negative association between routinizability and participation is about one-third as large in countries at the 75th percentile of active labor market spending as in countries at the 25th percentile. Disaggregated data on different active labor market programs suggest that the finding is driven by spending on training, which mitigates some of the negative effect for prime-age women.[40]

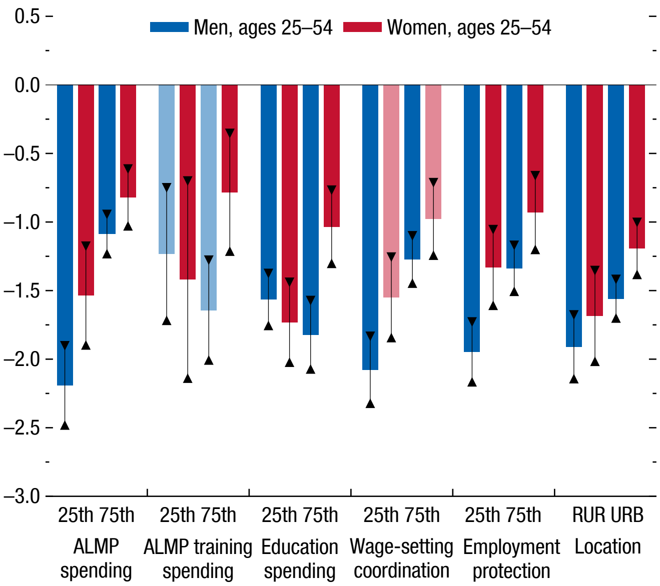
[38]While baseline specifications do not control for household income due to data limitations, once a predicted income decile is included, the effect of being part of a couple and having children on the participation of women turns positive, the effect of other employed adults in the household turns negative, and income itself has a negative effect. This suggests that individuals in upper deciles may be able to afford to drop out of the labor force, or, alternatively, that some of the rise in women's participation could be explained by declining household income (see Annex 2.5).

[39]While the baseline specification relies on a cross-country panel, country-by-country estimates confirm these findings: the effects of vulnerability to routinization are significant and negative in most countries and are typically more pronounced for men than for women.

[40]It should, however, be added that active labor market programs can be expensive; their success hinges crucially on specific design features, and evidence on their effectiveness more broadly is mixed (see IMF/WB/WTO 2017 for a recent literature review). Surveying the evidence from North American and European studies, Heckman, Lalonde, and Smith (1999) conclude that public employment and training programs had at best a modest positive impact on earnings by raising employment probabilities. Card, Kluve, and Weber (2010) find substantial variation in estimated program effectiveness across studies.

Figure 2.16. Policies and the Effect of Routine Exposure on Labor Force Participation
(Percent)

Policies, such as spending on active labor market programs and education, can help mitigate some of the negative effects of exposure to routinization on labor force participation, especially for women. The negative effects of automation are also smaller in urban areas.



Sources: Das and Hilgenstock (forthcoming); Eurostat, European Union Labour Force Survey; and IMF staff calculations.
Note: Bars show the effect of a one-unit increase in routine exposure on the probability of being active for policies at given percentiles, based on logit regressions on a random sample of 10,000 respondents per country per year from the European Union Labour Force Survey over the period 2000–16 for 24 countries. Lines show 95 percent confidence interval. Lighter colors denote that the effects are not statistically significantly different from each other at the 10 percent level. See Annex 2.5 for specification details. ALMP = active labor market programs; RUR = rural; URB = urban.

For both men and women, stricter employment protection (making hiring and firing more difficult) also offsets some of the adverse individual participation effect of being in a routinizable occupation, though possibly at the cost of reduced labor market flexibility at the country level and fewer job market prospects for some other groups, such as youth (see, for example, OECD 2004, 2010; Betcherman 2012). For prime-age men, a higher level of wage-setting coordination is associated with a smaller negative effect of routinization, as more coordinated wage bargaining may internalize some of the negative shocks to employment.

The negative effect of routinization is smaller in urban than in rural areas, as cities may offer more diverse labor markets and hence more opportunities for displaced workers to find other employment. This finding underscores the importance of easing geographical mobility to help workers adjust to local labor demand shocks.[41]

Finally, while the negative effects of routinization are larger for older workers, policies also provide less of an offset.

Prospects for Labor Force Participation

To conclude its analysis, this chapter examines the long-term prospects for labor force participation. Using a cohort-based model, this section estimates trend labor force participation for finely disaggregated age groups of men and women across 17 advanced economies, accounting for all age-gender-specific and birth-year-gender-specific determinants of labor supply. These estimates are combined with projections on the demographic distribution over the next 30 years to forecast the aggregate trend labor force participation rate. Finally, the analysis presents three illustrative simulations of how these trends would evolve under the assumption of significantly higher labor market participation of women and older workers and of the implementation of policies to boost participation.

A Cohort-Based Analysis

A cohort-based analysis of labor force participation is a widely used tool to model trend participation rates and forecast labor supply.[42] This approach exploits variation in participation across age and gender groups and over time for each country to uncover the underlying age participation profile (age effects) and the shifts from these profiles as a result of new cohorts entering the labor force (cohort effects).[43] These cohort effects

[41]Encouraging people to move where there are more employment opportunities could, however, further worsen the situation for those staying behind and increase geographic polarization.

[42]See, for example, Fitzenberger and Wunderlich (2004) for Germany; Aaronson and others (2006, 2014), Fallick and Pingle (2007), and Balakrishnan and others (2015) for the United States; Chapter 3 of the April 2015 WEO; Euwals, Knoef, and van Vuuren (2011) for the Netherlands; Balleer, Gómez-Salvador, and Turunen (2014) for selected European countries; and Blagrave and Santoro (2017) for Chile. Annex 2.6 provides further details on the estimation methodology.

[43]More precisely, the cohort-based model consists of estimating a country- and gender-specific system of equations in which the participation rate of each five-year group between ages 15–64, and of those ages 65 and older is regressed on a constant, dummies for different birth cohorts, and a proxy for the cyclical position of the economy. Given that a key goal of the analysis is the estimation

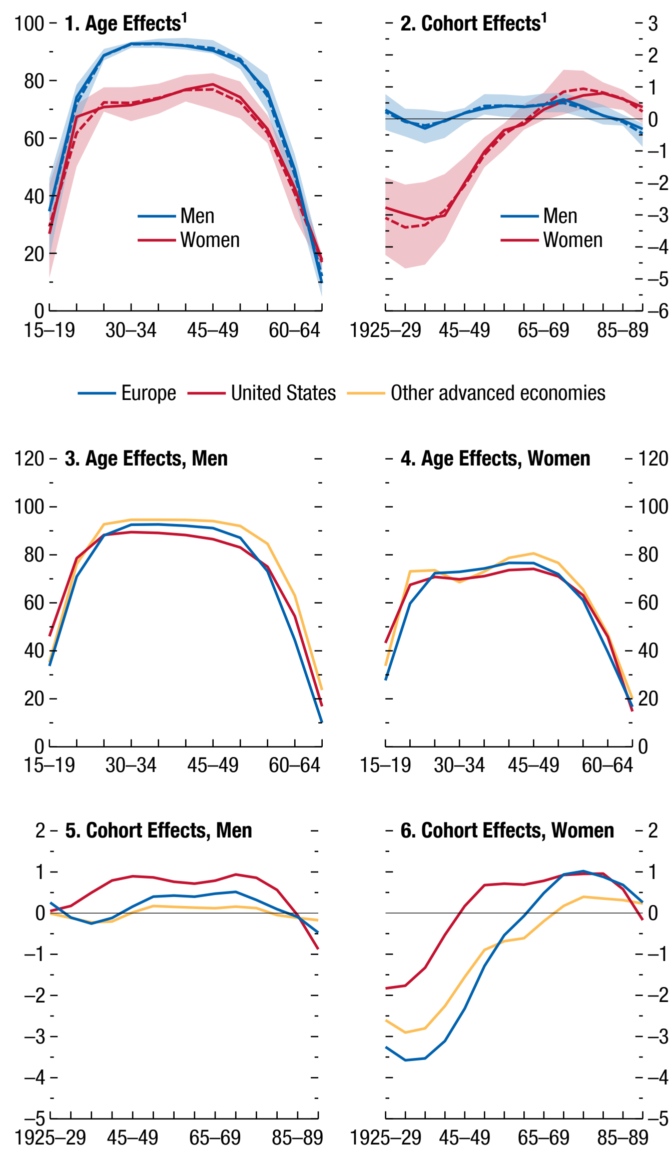
include all factors associated with a particular year of birth, such as the impact of choices made early in life (for example, investment in education, and decisions regarding marriage and children) that have persistent effects on labor supply as well as slowly changing social norms, institutions, and preferences toward work. Future aggregate participation is forecast by combining the estimated age effects with projections of the distribution of population across age groups.

Before turning to the forecast, it is useful to examine the estimated age and cohort effects. Labor force attachment of both men and women exhibits a well-known hump shape over the life cycle, with important gender differences (Figure 2.17, panels 1, 3, and 4). Across all ages, men are more likely to be part of the labor force than women, but the gender gap is particularly pronounced during the prime-age years.

How these age profiles have shifted from cohort to cohort is also vastly different for men and women. Trend male participation rates have not changed significantly across cohorts, except for the slight dip in the participation of recent cohorts, which is notably deeper in the United States. For women, there has been a large increase in participation across cohorts, in line with the stylized facts discussed earlier.[44] For example, women born in the 1970s are 4 percentage points more likely to work or seek employment than women born in the early 1930s. Moreover, the dispersion of cohort effects for women is significantly smaller for later cohorts, underscoring the convergence of women's labor force participation across countries. However, cohort effects have plateaued recently and even edged down, especially in the United States. This finding has important implications: the historical gains in female labor force participation owing to the entry of new birth cohorts and the exit of older ones may no longer be an option for raising participation in many advanced economies without significant policy efforts.

Figure 2.17. Age and Cohort Effects of Labor Force Participation
(Percent)

Gains in female participation across cohorts have plateaued, and even edged down recently, especially in the United States. The age participation profile of women remains below that of men, significantly so for the prime-age population.



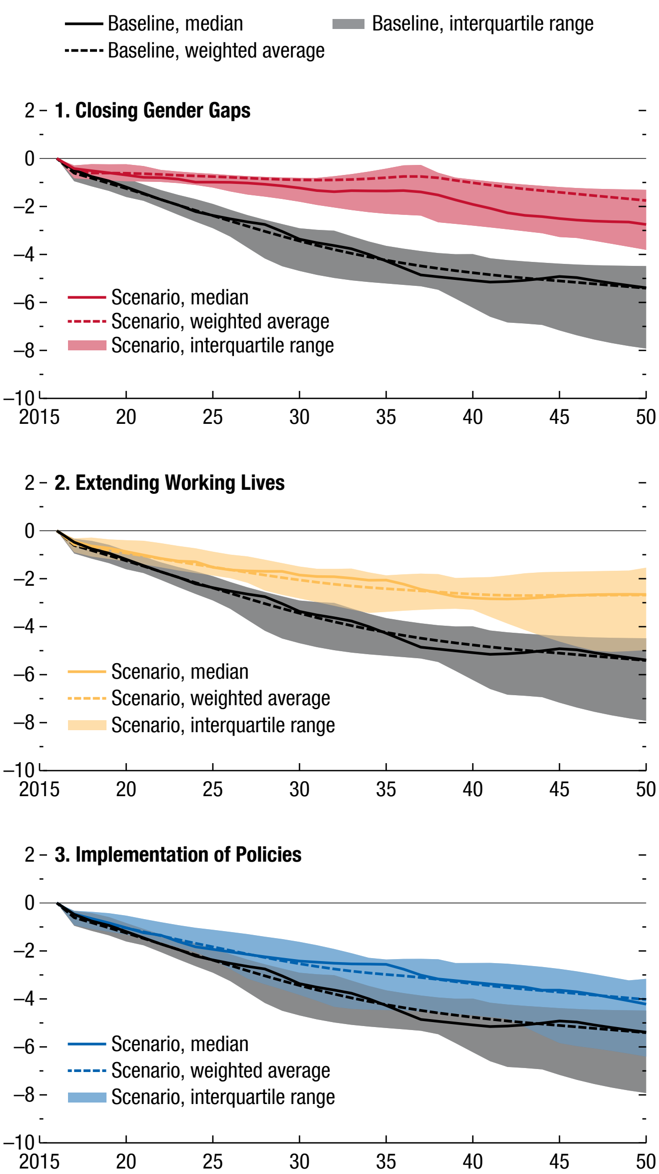
Source: IMF staff calculations.
Note: Other advanced economies comprise Australia, Canada, and Japan. Age effects describe the age-participation profile, and cohort effects describe the shifts in the age-participation profile across cohorts. See Annex 2.6 for specification details.
[1]Lines denote median, dotted lines show population-weighted average, and shaded areas show interquartile range.

of cohort effects, which requires sufficiently long data series, other determinants of labor supply, such as educational attainment and policies, are not included because of limited temporal coverage.

[44]To explain the presence of cohort effects in women's labor force participation, Fernandez (2013) proposes a theoretical model in which women learn from the participation behavior of earlier generations. Goldin (2006), on the other hand, attributes the positive cohort effects to the increase in returns to education, changes in preferences, and higher human capital accumulation.

Figure 2.18. Projected Changes in Participation Rates under Alternative Scenarios
(Percentage points)

Increasing the participation of prime-age women and older workers by implementing policies aimed at boosting incentives to participate could partially offset some of the negative effects of aging.



Source: IMF staff calculations.
Note: The "Closing Gender Gaps" scenario assumes that the participation rate of women ages 25–54 converges to the participation rate of men ages 25–54 over 20 years; the "Extending Working Lives" scenario assumes that the participation rate of the 55–59 age group converges to the participation rate of the 50–54 age group over 20 years and that the participation rate of the 60–64 age group converges to the participation rate of the 50–54 age group over 40 years; the "Implementation of Policies" scenario assumes that policies converge to the 10th or 90th percentile of the level observed among advanced economies.

Projection Scenarios

A baseline projection scenario for trend labor force participation up to 2050 is constructed by combining the estimated age-gender-group trend rates with projections of how demographic distributions will evolve based on the United Nations World Population Prospects.[45] The simulation suggests that, absent policies to boost participation, the median trend participation rate will fall by 5½ percentage points over the next 30 years (Figure 2.18). All else being constant, a decline in aggregate participation of this magnitude would translate into a 3 percentage point reduction in potential output by 2050 for the typical advanced economy.[46] The decline in participation is projected to be broad based, with rates hovering around 50 percent or lower in Belgium, France, Italy, Portugal, and Spain.

To give a sense of the scope for boosting labor supply, an illustrative simulation makes the stark assumption that prime-age women's participation rates gradually converge to those of prime-age men over the next 20 years (Figure 2.18, panel 1).[47] In this scenario, the median aggregate participation rate would decline more gradually, and by the end of the projection horizon, it would be 2½ percentage points higher than in the baseline scenario.

An alternative simulation assumes that older workers remain in the labor force longer. Specifically, the participation rate of the 55–59 age group converges to the participation rate of the 50–54 age group over the next 20 years, and the participation rate of the 60–64 age group converges to that of the 50–54 age group over the next 40 years, keeping gender gaps in participation across age groups unchanged (Figure 2.18, panel 2). Raising the participation of older workers would also

[45]It is assumed that new cohorts entering the labor force do not shift the age-participation profile and that output is equal to potential during the projection horizon.

[46]For the purpose of this exercise, the labor share of income is assumed to be 56 percent, which corresponds to the average labor share of income in 2017 for a subset of advanced economies (Australia, Canada, Germany, Italy, Japan, Spain, United States). The fall in potential output is thus obtained by multiplying the average labor share of income by the projected fall in labor force participation during 2017–50. If this were to occur at the same rate every year, it would correspond to a loss in potential output of 0.09 percentage point a year over 33 years.

[47]This scenario assumes unchanged birth rates, as higher female labor force participation need not go hand in hand with lower fertility. Sweden, for example, enjoys both one of the highest female labor force participation rates and one of the highest fertility ratios among advanced economies due to policies designed to support both objectives.

make the decline in the median trend participation rate more gradual. In 2050, the median aggregate participation rate is projected to be 2¾ percentage points higher than in the baseline scenario. Of course, sufficiently large increases in participation rates among older workers, especially among those older than 65, could entirely offset or even reverse the drag from aging.[48]

Finally, the analysis attempts to quantify the extent to which policies can offset the projected decline in aggregate participation. In an illustrative scenario, policy settings are assumed to converge gradually over the next 20 years to their "best possible" levels, defined as the 90th (or 10th) percentile of the level observed among advanced economies (Figure 2.18, panel 3). The coefficients estimated in the cross-country empirical model are used to forecast the impact of these policy changes on trend participation rates by age-gender group, which are then aggregated using projected demographic weights. This simple simulation suggests that bringing policies to what can be viewed as best practice (from the point of view of labor force participation) can offset some, but not much, of the drag from aging. Aggregate participation rates would be about 1¼ percentage points higher than in the baseline by 2050.

Conclusions and Policy Implications

The increase in longevity is one of the most remarkable successes in human history (Bloom and others 2015). Yet it could have serious macroeconomic consequences when coupled with the decline in population growth. Because older workers participate in the labor force at much lower rates, population aging raises concerns about the supply of labor in advanced economies, which has implications for potential growth and the sustainability of social insurance systems.

This chapter documents that—despite the acceleration in population aging over the past decade—many advanced economies have been able to counteract its downward pressure on labor force participation. In about half of advanced economies, the aggregate labor force participation rate increased after the global financial crisis. Yet these aggregate developments mask strikingly different shifts in the workforce attachment of men and women. In most countries, the aggregate participation rates of men have declined since the crisis, broadly in line with changes in the age structure of populations and the drag from the global financial crisis. Women's participation, however, increased in most countries, despite aging and adverse cyclical developments, underscoring the importance of policies and other factors in shaping participation rates.

Disparate developments in labor market involvement across different age groups of workers are evident over the long term. Participation of young men and women and prime-age men has been declining for the past 35 years. Participation of prime-age women has increased dramatically since the mid-1980s, and for older workers it has picked up considerably since the mid-1990s.

The chapter's analysis suggests that changes in labor market policies and institutions, together with structural changes and gains in educational attainment, account for the bulk of the increase in the labor force attachment of prime-age women and older workers in the past three decades. Conversely, technological advances, namely automation—while beneficial for the economy as a whole—have weighed on the labor supply of most groups of workers and can partially explain declining prime-age male participation. Individual-level evidence confirms the significant impact of vulnerability to routinization. Detachment from the labor force is significantly more likely among individuals whose current or past occupations are more vulnerable to automation. But encouragingly, higher spending on education and active labor market programs, and access to more diverse labor markets, tend to attenuate this negative effect.

What does this mean for labor force participation prospects in advanced economies? In the absence of policy efforts, expected demographic developments could lead to large declines in aggregate participation rates. The chapter's simulations imply that by 2050, overall participation rates could fall by 5½ percentage points in the median advanced economy.

There is, however, scope for policies to counteract the forces of aging by making sure those who are willing to work can do so. In particular, reforming the tax-benefit system, for example, by reducing the labor tax wedge, along with strengthening policies that improve the job-matching process, can encourage individuals to keep working or seek employment.

[48]Data constraints on participation by age groups of workers older than 65 prevent the simulation of alternative scenarios such as raising effective retirement ages to maintain the proportion of life spent in retirement or indexation of effective retirement ages to healthy life expectancy.

There is also strong evidence of the effectiveness of family-friendly policies that help people combine market work with the demands of parenthood—public spending on early childhood education and care, flexible work arrangements, and parental leave—in attracting women to the labor force. For older workers, reducing the incentives to retire early, by raising statutory retirement ages or making pension systems more actuarially fair, could lengthen working lives, although care should be taken that reforms do not jeopardize other goals, such as a basic social safety net for vulnerable individuals.[49]

However, the chapter's simple illustrative simulations suggest that even if countries converge to the best (observed) policy settings for encouraging labor supply, expected demographic shifts may still depress participation rates in advanced economies, taking a toll on economic activity. Unless technological progress delivers offsetting productivity gains, many countries may need to reconsider immigration policies to boost domestic labor supply, alongside policies to encourage older workers to postpone retirement. Although receiving migrants can pose challenges for host countries, the chapter's analysis suggests that net migration accounts for roughly half of the population growth in advanced economies over the past three decades—any efforts to curb international migration would thus further exacerbate demographic pressure.[50]

Finally, technological advances that transform production processes and reduce the need for labor could help alleviate the challenges to aggregate growth from aging. But policymakers should be mindful of the difficult adjustment such transformations may entail for some sectors, occupations, and geographic areas and deal with the concerns of workers displaced by technology, including through effective support for retraining, skill building, and occupational and geographic mobility. As the chapter's findings suggest, increasing investment in education and training can not only make the workforce more resilient to changing labor needs, but also encourage labor force participation. Investing more in the education of the young is also critical to prepare them for the jobs of the future.

[49]It is important to recognize that some of these policies may entail significant fiscal costs, while others may be politically challenging because of their cross-generational distributional consequences.

[50]As discussed in Chapter 4 of the October 2016 WEO, cultural and language differences, as well as concerns about displacement of native workers, can stir social tensions and provoke a political backlash against migration in host countries. The prompt integration of migrants is key to alleviate such concerns. In source countries, migration can weigh on long-term growth prospects if it is associated with brain drain, though such effects can be mitigated by remittances or diaspora networks.

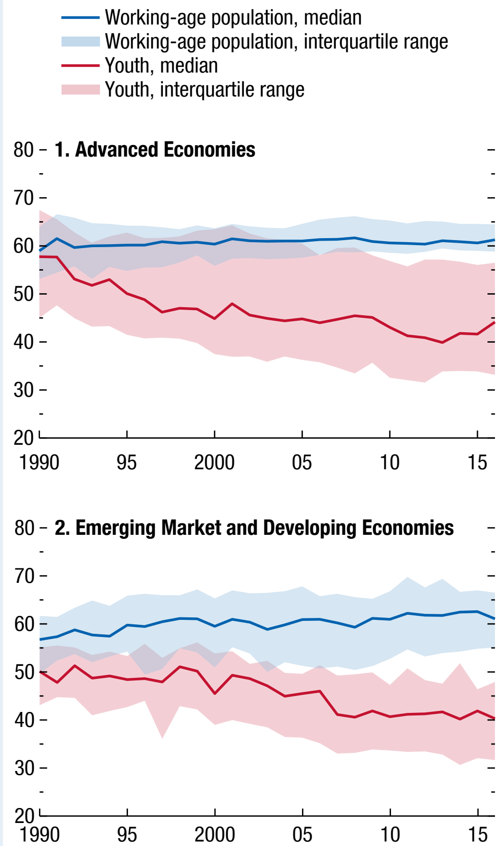
Box 2.1. Youth Labor Force Participation in Emerging Market and Developing Economies versus Advanced Economies

Median labor force participation rates for the overall working-age population in advanced and emerging market and developing economies have fluctuated around 60 percent over the past 25 years. Youth labor force participation, however, has fallen in both groups of economies (Figure 2.1.1).[1] Whether these declines are a cause for concern depends largely on whether they reflect primarily growth in school enrollment or an increasing share of idle youth. This is particularly important in emerging market and developing economies, where young people comprise about 18 percent of the population on average, about 6 percentage points higher than their share in advanced economies.[2] Motivated by these considerations, this box looks at how youth labor force participation has evolved in recent years across advanced and emerging market and developing economies.[3]

Low and declining youth labor force participation rates are a greater cause for concern in emerging market and developing economies than in advanced economies. In both cases, there has been an uptick in youth human capital investment (Figure 2.1.2). For the median advanced economy, secondary school enrollment rose more than 10 percentage points since 1990, to about 97 percent in 2010. The pickup in schooling has been even more dramatic in emerging market and developing economies—median secondary enrollment rose almost 40 percentage points, to about 70 percent. However, the lower overall schooling rate and similar youth labor force participation suggest that a larger share of emerging market and developing economy youth is neither in the labor force nor studying. There are, moreover, significant differences in enrollment rates across regions—in emerging Europe enrollment rates are nearly the same as in advanced economies, while sub-Saharan Africa, although improved, is well behind.

The gender gap in youth labor force participation is also much larger in emerging market and developing economies (Figure 2.1.3). Median youth labor force participation has trended down for both females and males in advanced economies: the initial female partic-

Figure 2.1.1. Labor Force Participation by Age Group
(Percent)



Sources: International Labour Organization; and IMF staff calculations.

The authors of this box are John Bluedorn and Davide Malacrino with research assistance from Daniela Muhaj.

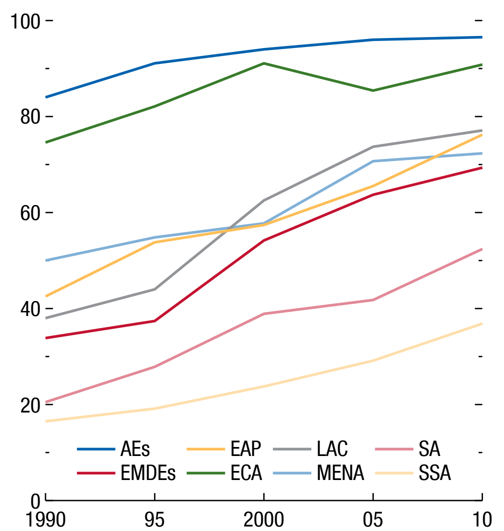
[1]Age ranges defining the youth population sometimes differ across data sets and publications. Unless indicated otherwise, the International Labour Organization definition of 15–24 years old is used. Working-age population is 15–64 years old.

[2]Country group median population shares in 2015 (United Nations, Department of Economic and Social Affairs, Population Division 2017).

[3]Ahn and others (forthcoming) investigate in greater depth the patterns and drivers of youth labor market outcomes in emerging market and developing economies, including potential policy implications.

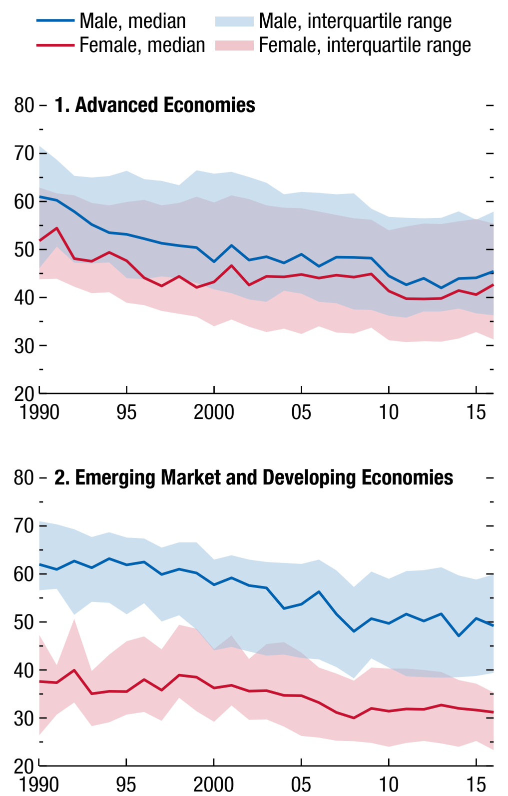
Box 2.1 *(continued)*

Figure 2.1.2. Median Secondary Enrollment by Geographic Region
(Percent)



Sources: Lee and Lee, Long-Run Education Dataset (2016); and IMF staff calculations.
Note: Adjusted gross enrollment ratios are shown. AEs = advanced economies; EAP = East Asia and Pacific; ECA = Europe and central Asia; EMDEs = emerging market and developing economies; LAC = Latin America and Caribbean; MENA = Middle East and North Africa; SA = south Asia; SSA = sub-Saharan Africa.

Figure 2.1.3. Youth Labor Force Participation by Gender
(Percent)



Sources: International Labour Organization; and IMF staff calculations.

ipation gap of about 10 percentage points has shrunk to just a couple of percentage points in recent years. By contrast, the gender gap remains very large in emerging market and developing economies, at about 20 percentage points.

Individual-level census data allow for deeper investigation into the dynamics of the youth gender gap across countries. From these data, for each country and year, the predicted probability of participating in the labor market can be calculated for each young woman, given her observable characteristics.[4] The counterfactual likelihood can also be calculated for each young woman: the predicted probability of labor force participation if she were male, holding all other observable characteristics constant. The average difference between these two quantities at the individual level yields an alternative measure of the gender gap

[4]More specifically, the analysis estimates multinomial logit probability models by country-year, gender, and age group (young and not young) for individual labor market outcomes (that is, in school, unemployed, employed, out of the labor force, or unoccupied) conditional on individual-level observable characteristics (such as marital status, parent or not, educational attainment, and others). The models are then used to calculate predicted probabilities at the individual level, which can be aggregated up to get a sense of the average behavior.

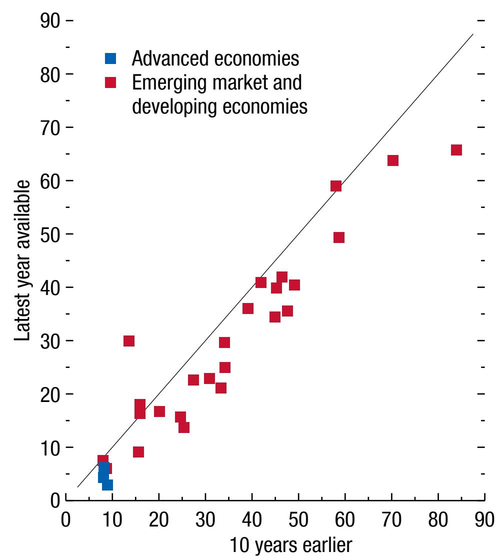
Box 2.1 *(continued)*

in labor force participation facing young women in that country and year, with the advantage that it takes account of the effects of non-gender-related individual characteristics.

There is a wide range of youth gender gaps across countries, from about 5 percentage points to almost 70 percentage points in the latest year for which data are available (Figure 2.1.4).[5] That said, there has been a broad-based improvement—most points lie below the 45-degree line, indicating that the gender gap has shrunk. While this decline is encouraging, there is still a long way to go to fully close the gender gap in youth labor force participation. As discussed in Elborgh-Woytek and others (2013), Gonzales and others (2015a), and Ahn and others (forthcoming), potential policy responses include a mix of labor market, social policy, and other reforms.

[5]See Minnesota Population Center (2017). IPUMS International underlying data set sources: Argentina (National Institute of Statistics and Censuses), Austria (National Bureau of Statistics), Bangladesh (Bureau of Statistics), Bolivia (National Institute of Statistics), Botswana (Central Statistics Office), Brazil (Institute of Geography and Statistics), Cambodia (National Institute of Statistics), Colombia (National Administrative Department of Statistics), Costa Rica (National Institute of Statistics and Censuses), Dominican Republic (National Statistics Office), Ecuador (National Institute of Statistics and Censuses), El Salvador (General Directorate of Statistics and Censuses), France (National Institute of Statistics and Economic Studies), Ghana (Ghana Statistical Services), India (Ministry of Statistics and Programme Implementation), Indonesia (Statistics Indonesia), Iran (Statistical Center), Kyrgyz Republic (National Statistical Committee), Malaysia (Department of Statistics), Mexico (National Institute of Statistics, Geography, and Informatics), Nicaragua (National Institute of Statistics and Censuses), Panama (Census and Statistics Directorate), Peru (National Institute of Statistics and Informatics), Portugal (National Institute of Statistics), Romania (National Institute of Statistics), South Africa (Statistics South Africa), Tanzania (National Bureau of Statistics), Trinidad and Tobago (Central Statistical Office), United States (Bureau of the Census), Uruguay (National Institute of Statistics), Venezuela (National Institute of Statistics), Zambia (Central Statistical Office).

Figure 2.1.4. Implied 10-Year Improvement in Country Gender Gaps for Youth
(Percentage points)



Sources: Integrated Public Use Microdata Series International; and IMF staff calculations.
Note: A country's gender gap is defined as the average across the individual-level difference between a young woman's predicted probability of labor force participation given her observables and her predicted probability given the same observables if she were male (a counterfactual). See text footnote 4 for a brief description of the underlying probability models. Each country shown has at least two years of census data, but the time difference varies between 5 and 20 years. For comparability across countries, the latest data are taken as given and the change in gender gap is normalized to back out the implied gender gap 10 years earlier for each country. Youth are defined as 15–29 years old.

Box 2.2. Permanently Displaced? Labor Force Participation in US States and Metropolitan Areas

The decline in US labor force participation over the past two decades has been widely documented and, as highlighted in this chapter, deviates from the evolution of participation in many advanced European economies.

Many hypotheses have been put forth for this puzzling decline (alongside the effects of aging). These include cyclical effects and the severity of the Great Recession, structurally lower labor demand brought on by the forces of trade and technology (especially for those with low skills), and lower labor supply (because of incarceration, disability, and pain) as well as waning cohort effects for women's participation and the role of policy.[1]

This box examines regional differences in labor force participation in the United States to shed light on the factors that may underpin participation declines. It documents a broad-based decline in participation, especially in rural areas. Moreover, it finds that lower participation in metropolitan areas is strongly associated with exposure to routinization and offshoring. This supports hypotheses about the role of deteriorating job opportunities for some workers as a result of technology and globalization in their increasing detachment from the workforce (in line with the findings of Acemoglu and Autor 2011, Council of Economic Advisers 2016, and Krause and Sawhill 2017).

Broad-Based Decline across States

The decline in participation rates is very broad based across US states (Figure 2.2.1, panel 1). Between 2000 and 2016, participation declined in almost all states,[2] but declines were most pronounced in the Southeast[3] and parts of the Midwest and West.[4] The decline was much smaller in the Mid-Atlantic[5] and New England.[6]

These declines stand in marked contrast to pre-2000 developments, when participation increased almost across the board by an average of more than 5 percentage points between 1976 and 2000 (Figure 2.2.1, panels 2 and 3).

The authors of this box are Benjamin Hilgenstock and Zsóka Kóczán.

[1]See, for example, Aaronson and others (2006); Fallick and Pingle (2007); Blau and Kahn (2013); Council of Economic Advisers (2014, 2016); Balakrishnan and others (2015); Case and Deaton (2017); Krause and Sawhill (2017); and Krueger (2017). See Abraham and Kearney (2018) for a recent review.

[2]The District of Columbia is treated as a state for the purpose of this box.

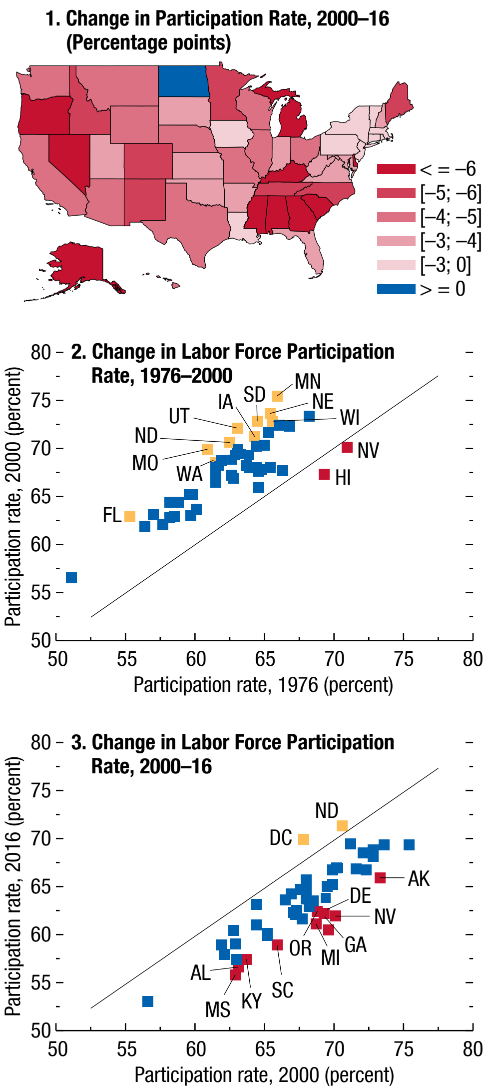
[3]Alabama, Georgia, Kentucky, Mississippi, South Carolina.

[4]Alaska, Michigan, Nevada, Oregon.

[5]Maryland, New Jersey, Pennsylvania.

[6]Connecticut, Massachusetts.

Figure 2.2.1. Labor Force Participation and Change in Labor Force Participation by State



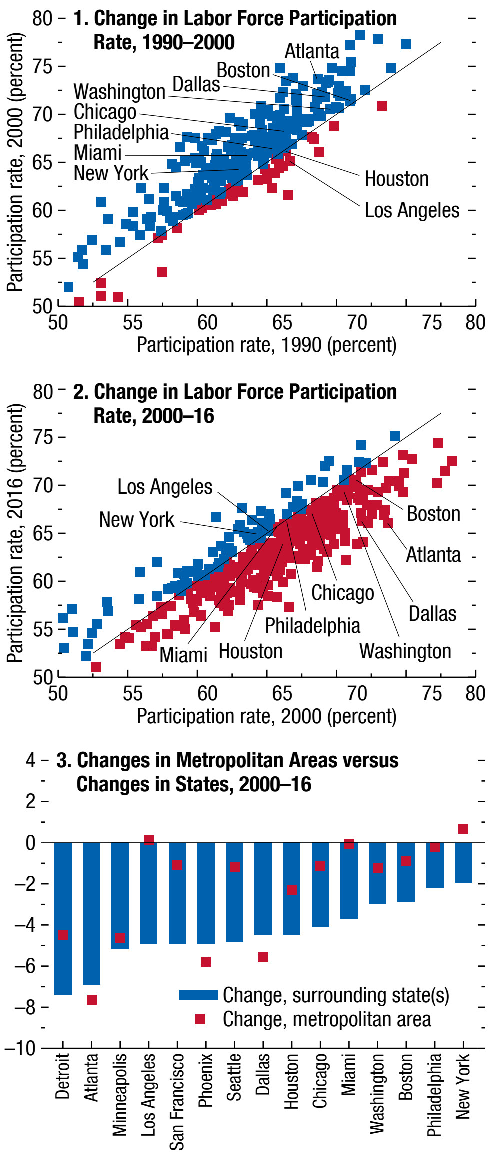
Sources: US Bureau of Labor Statistics; US Census Bureau; and IMF staff calculations.
Note: Red markers denote states with decreases (panel 2) or particularly pronounced decreases (panel 3). Gold markers denote states with increases (panel 3) or particularly pronounced increases (panel 2). Labels in the figure use International Organization for Standardization (ISO) state codes.

More Pronounced outside Metropolitan Areas

Similar patterns can be observed at the metropolitan area level (Figure 2.2.2). Labor force participation rates declined between 2000 and 2016 in three-quarters of metropolitan areas; among the 50 most populated areas,

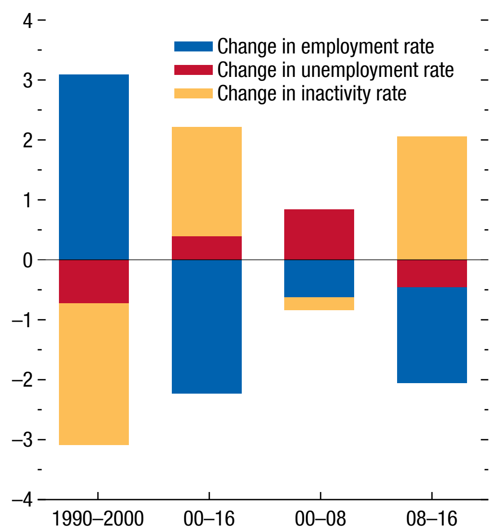
Box 2.2 *(continued)*

Figure 2.2.2. Change in Labor Force Participation Rate by Metropolitan Area



Sources: US Bureau of Labor Statistics; US Census Bureau; and IMF staff calculations.
Note: In panels 1 and 2, red markers display metropolitan areas with decreases in labor force participation rates. The 10 largest areas by 2016 population are labeled. In panel 3, if metropolitan areas are assigned to multiple states, blue bars show population-weighted averages of surrounding states.

Figure 2.2.3. Decomposition of Labor Market Changes in Metropolitan Areas
(Percentage points)



Sources: US Bureau of Labor Statistics; US Census Bureau; and IMF staff calculations.
Note: Employment rate, unemployment rate, and inactivity rate are defined, respectively, as total employment, total unemployment, and total inactive population as a percentage of total population. Numbers represent simple averages across metropolitan areas.

only 16 (typically with already high participation) displayed increases, of which most were comparably small.[7]

However, declines were typically larger in a state as a whole than in its metropolitan areas, exacerbating urban-rural differences (Figure 2.2.2, panel 3; in line with the findings of Weingarden 2017).

The Role of the Crisis and Changing Margins of Adjustment

The decline in participation became more widespread after the global financial crisis, when lower employment increasingly translated into lower participation (Figure 2.2.3). Before 2000, employment increased, on average, and was matched by declines in unemployment and increases in participation. After 2000, employment declined, matched by increasing unemployment and falling participation. Although most of the decline in employment translated into rising unemployment before the crisis, after the crisis participation fell sharply.

Drivers of Labor Force Participation

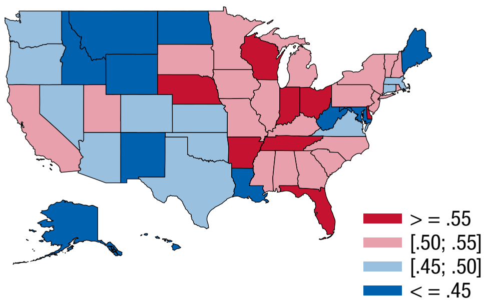
Cross-sectional regressions at the metropolitan area level examine the association between 2000–16 changes in labor force participation rates and cyclical conditions, aging, and education, as well as the impact of

[7]Because several metropolitan areas cross state lines, Figure 2.2.2, panel 3, assigns metropolitan areas to states based on the definition of the US Office of Management and Budget.

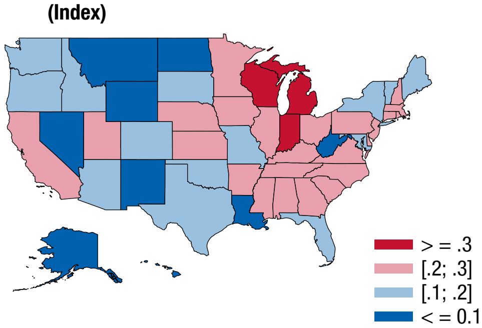
Box 2.2 *(continued)*

Figure 2.2.4. Routine and Offshoring Exposure by State

1. Routine Exposure by State, 2000
(Index)



2. Offshoring Exposure by State, 2000
(Index)



Sources: US Bureau of Labor Statistics; US Census Bureau; and IMF staff calculations.

technology and trade, captured by the initial exposures to routinization and offshoring.[8] These results confirm the significant effects of cyclical conditions, aging, and education highlighted in the chapter (Table 2.2.1).[9]

Furthermore, metropolitan areas with higher initial exposures to automation and offshoring due to their occupational employment compositions saw larger subsequent declines in participation rates.[10] This suggests that automation and offshoring may have permanently displaced some workers, even if their effects on the economy as a whole were beneficial through the creation of job opportunities in other sectors or productivity gains.

In the short and medium term, support should thus be provided to workers displaced as a result of automation and globalization to dampen the negative effects of labor market shocks that may be highly concentrated in some sectors, occupations, or geographic areas.

[8]Exposures to routinization and offshoring act as proxies for the share of jobs at risk of being automated or offshored (see Chapter 3 of the April 2017 WEO; and Das and Hilgenstock, forthcoming). Regressions include state fixed effects.

[9]State-level cyclical effects are also documented by Erceg and Levin (2014), Council of Economic Advisers (2014), and Balakrishnan and others (2015). Dao, Furceri, and Loungani (2014) highlight the increasing role of participation as an absorber of state-level labor demand shocks. Sanchez, Shen, and Peng (2004) look at the impact of mobility on employment outcomes at the metropolitan area level.

[10]Figures 2.2.4 and 2.2.1, panel 1, suggest that this link holds at the state level as well: exposure to routinization and offshoring was especially high in the Southeast and Midwest, which also exhibited the largest declines in participation.

Table 2.2.1. Drivers of Labor Force Participation Rates in US Metropolitan Areas

	(1)	(2)	(3)	(4)	(5)
Average Real GDP Growth			0.442***	0.444***	0.368***
			(0.145)	(0.144)	(0.140)
Change in Old-Age-Dependency Ratio			–0.144***	–0.130***	–0.152***
			(0.040)	(0.041)	(0.038)
Change in Postsecondary Share			0.037	0.040*	0.053**
			(0.023)	(0.023)	(0.022)
Initial Exposure to Routinization	–2.811**			–2.492**	
	(1.153)			(1.222)	
Initial Exposure to Offshoring		–4.212***			–4.929***
		(0.935)			(0.962)
Observations	370	370	335	335	335
R^2	0.289	0.319	0.360	0.369	0.414

Source: IMF staff calculations.
Note: Standard errors are in parentheses. The dependent variable is change in labor force participation rate.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

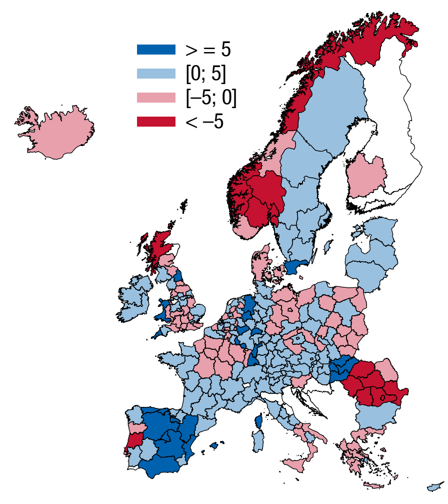
Box 2.3. Still Attached? Labor Force Participation Trends in European Regions

In addition to the significant cross-country variation in Europe documented in this chapter, there are also large within-country differences in labor force participation.[1] As in the United States (Box 2.2), rural areas saw larger drops or smaller increases in labor force participation rates than urban areas, though declines typically started later and were less broad based than in the United States. However, European regions more exposed to routinization and offshoring through their initial occupation mix did not experience larger declines in participation over a longer horizon, once labor markets had time to adjust.[2]

Heterogeneity across Regions

Labor force participation declined in about one-third of European regions between 2000 and 2016. Although some countries exhibit similar patterns across regions (for instance, participation declined in all regions in Norway and Romania and increased in all regions in Spain and Sweden), others (such as France, Germany, Portugal, and the United Kingdom) show significant within-country differences (Figure 2.3.1).[3] This contrasts with broad-based declines observed across US states and metropolitan areas (Box 2.2). Participation declined in only about 27 percent of European regions between 2000 and 2008 and in about 45 percent of regions between 2008 and 2016.[4,5]

Figure 2.3.1. Change in Labor Force Participation by Region, 2000–16
(Percentage points)



Sources: Eurostat; and IMF staff calculations.

However, as in the United States, there is a divide between urban and rural regions, with the latter showing larger decreases or smaller increases in participation rates (Figure 2.3.2, panel 3).

The Role of the Crisis and Changing Margins of Adjustment

Margins of adjustment changed in Europe too, though later than in the United States (Figure 2.3.3). While in the United States employment started to decline around 2000, employment increased, on average, in European regions until the crisis, matched by falling unemployment and rising participation. As employment started to decline after the crisis, this translated into rising unemployment, with, on average, still small increases in participation.

Drivers of Labor Force Participation

As in Box 2.2, cross-sectional regressions (here at the level of European regions) examine the link between 2000–16 changes in labor force participation and cycli-

The authors of this box are Benjamin Hilgenstock and Zsóka Kóczán.

[1]A great deal of literature analyzes the drivers of (especially women's) participation in Europe at the country level, focusing predominantly on the role of policy (such as incentives for part-time work and family-friendly measures—see, for example, Genre, Gómez-Salvador, and Lamo 2010; Cipollone, Patacchini, and Vallanti 2013; Thévenon 2013; and Miani and Hoorens 2014), and cohort effects (see, for example, Balleer, Gómez-Salvador, and Turunen 2014 for a cross-country study and Euwals, Knoef, and van Vuuren 2011 for the Netherlands). Dauth, Findeisen, and Suedekum (2014) look at the impact of trade on German labor markets. The key contribution of this box is its focus on variation at the regional level, in particular the impact of technology.

[2]In the following the term "regions" refers to Eurostat's Nomenclature of Territorial Units for Statistics (NUTS) 2 level regions wherever data are available. When these data are not available, NUTS 1 and NUTS 0 regions are used instead. Most of the box includes regions in advanced Europe as well as in emerging Europe; for consistency with the chapter, the regression analysis focuses on advanced Europe only. Simple averages are used throughout.

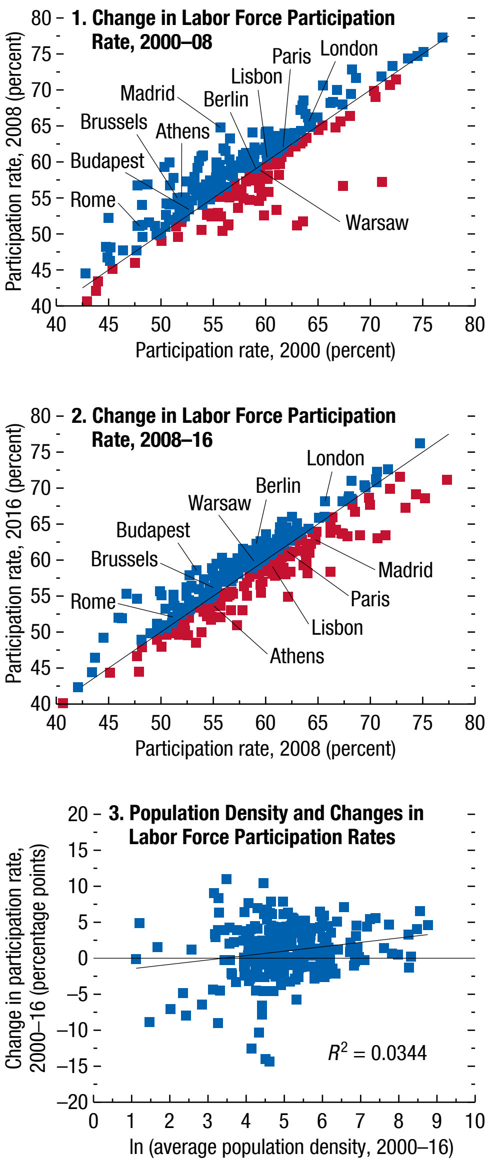
[3]See also Centre for Cities (2018) on the economic divide in the United Kingdom.

[4]Regional participation rates are not available before 2000.

[5]Furthermore, this hides a great deal of underlying disparity: participation continued to increase after as well as before the crisis in 38 percent of regions (for example, Austria, Germany, and Switzerland); continued to fall in 10 percent (for example, Romania and the United Kingdom); started to decline in 35 percent (for example, Belgium, Denmark, the Netherlands, and Portugal); but started to increase in 18 percent (for example, the Czech Republic, Poland, and the Slovak Republic).

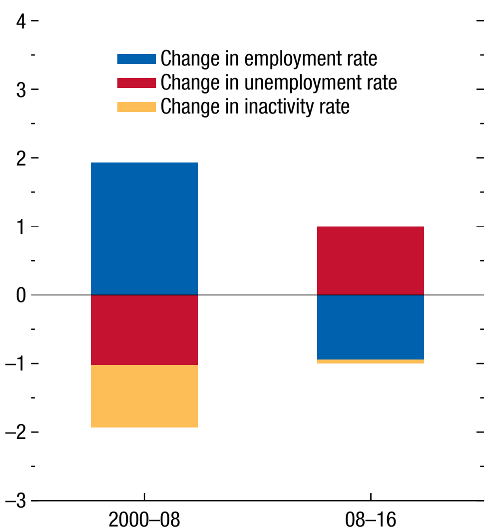
Box 2.3 *(continued)*

Figure 2.3.2. Change in Labor Force Participation Rate by Region



Sources: Eurostat; and IMF staff calculations.
Note: In panels 1 and 2, red markers display regions with decreases in labor force participation rates. The 10 largest regions by 2016 population are labeled.

Figure 2.3.3. Decomposition of Labor Market Changes
(Percentage points)



Sources: Eurostat; and IMF staff calculations.
Note: Employment rate, unemployment rate, and inactivity rate are defined, respectively, as total employment, total unemployment, and total inactive population as a percentage of total population. Numbers represent simple averages across regions.

cal conditions, aging, and education.[6] Subnational evidence confirms the significant effects of aging, cyclical conditions, and education highlighted in this chapter (Table 2.3.1). However, unlike in the United States (Box 2.2), European regions more exposed to routinization and offshoring as a result of their 2000 occupational mix experienced, if anything, larger participation gains during 2000–16 (Figures 2.3.4 and 2.3.5).[7]

There are several possible explanations for this finding, which seems contrary to the patterns observed in the chapter and across US metropolitan areas. First, unlike the analysis in the main text, which examines the participation consequences of annual variation in the relative price of investment as a proxy for firms' incentives to automate routine tasks, this specification focuses on changes in participation over a longer time horizon, allowing labor markets to adjust to demand shocks. The positive correlation across European regions could thus be picking up an added-worker effect. Secondary earners may enter the labor market as a result of lower household income. This would be

[6]Regressions control for country fixed effects.

[7]Dauth, Findeisen, and Suedekum (2014) find that the rise of China and eastern Europe in the world economy caused substantial job losses in German regions specializing in import-competing industries, but caused employment gains in export-oriented industries, with an overall positive effect of trade integration on employment.

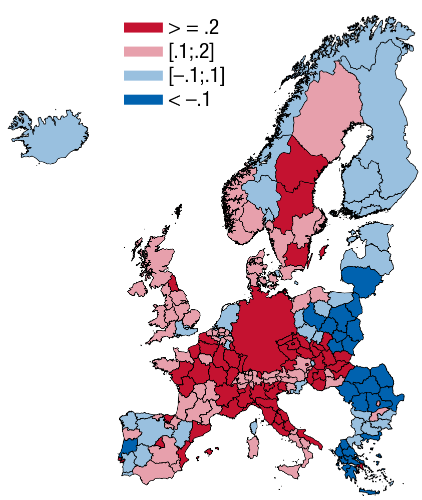
Box 2.3 *(continued)*

Table 2.3.1. Drivers of Labor Force Participation Rates in European Regions

	(1)	(2)	(3)	(4)	(5)
Average Real GDP Growth			0.457	1.061***	1.176***
			(0.325)	(0.383)	(0.387)
Change in Old-Age-Dependency Ratio			–0.282***	–0.211***	–0.218***
			(0.056)	(0.072)	(0.072)
Change in Postsecondary Share			0.187***	0.145**	0.117*
			(0.053)	(0.069)	(0.070)
Initial Exposure to Routinization	4.258**			5.435***	
	(1.995)			(1.815)	
Initial Exposure to Offshoring		4.157**			5.518***
		(1.968)			(1.846)
Observations	148	148	223	140	139
R^2	0.645	0.644	0.646	0.730	0.729

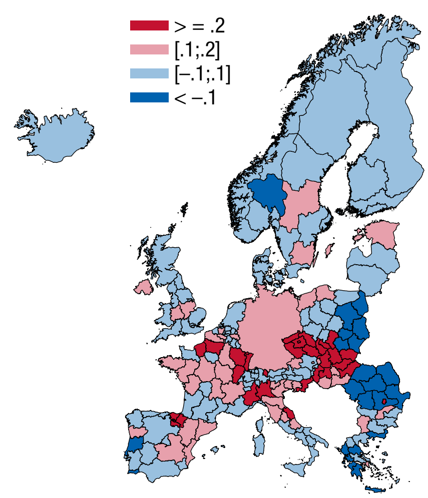
Source: IMF staff calculations.
Note: Standard errors are in parentheses. The dependent variable is change in labor force participation rate.
$^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

Figure 2.3.4. Initial Routine Exposure by Region, 2000
(Index)



Sources: Eurostat, European Union Labour Force Survey; and IMF staff calculations.

Figure 2.3.5. Initial Offshoring Exposure by Region, 2000
(Index)



Sources: Eurostat, European Union Labour Force Survey; and IMF staff calculations.

consistent with the sharp rise in female participation observed in most European regions and the rise in two-earner households documented in the chapter. Second, institutional frameworks and policies in Europe may have allowed those potentially affected by routinization and offshoring to remain attached to the workforce and/or encouraged new entrants to the labor market. The former is consistent with the smaller changes in the occupational mix in European countries over this time period, which suggests that fewer jobs were automated or offshored than in the United States. The latter is consistent with the significantly larger contribution of policy to labor force participation in Europe relative to the United States, which is documented in this chapter.

Striking within-country differences in the evolution of labor force participation have important implications for policy—they call for more explicit recognition of the spatial dimension of economic vulnerability given that short- and medium-term costs not only are concentrated in particular sectors and occupations but also affect different places in different ways.

Box 2.4. Storm Clouds Ahead? Migration and Labor Force Participation Rates

As discussed in the chapter, slowing population growth and rising life expectancy will put significant downward pressure on labor supply. Even sizable gains in labor market participation of those more marginally attached to the labor force, such as women and older workers, could be ultimately outweighed by the pressure of aging. In this context, many argue that international migration could bring significant benefits, by boosting labor supply in recipient economies while leveraging the demographic dividend in other parts of world. Net migration has accounted for about half of the population growth in advanced economies since the mid-1980s, while natural population growth (measured as the difference between fertility and mortality) has been falling (Figure 2.4.1).

This box examines the effects of migration on future labor force participation in (receiving) advanced economies, as well as the drivers of migrants' decision to participate.

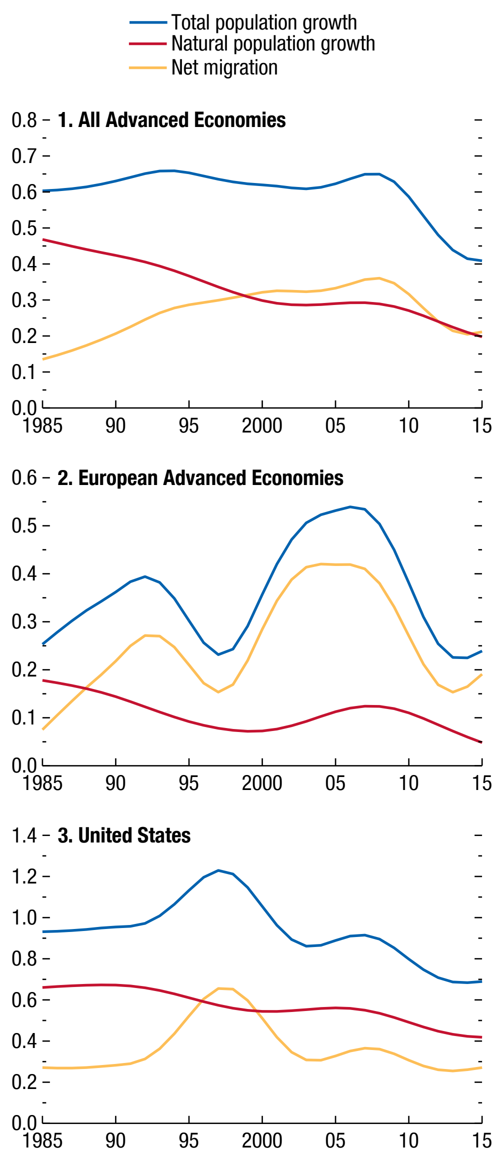
It documents that migration assumptions, already embedded in population projections for advanced economies, play a very significant role in alleviating aging pressures. In the absence of migration, the decline in participation would be significantly deeper. Support for migrants' rapid labor market integration will yield significant further gains.

Migration: The Role of Age Composition Effects

One way migrants affect the labor supply in recipient economies is through age composition. Migrants are more likely to be of prime working age than natives because they typically arrive after they have completed their education and often leave when they retire (Figure 2.4.2, panel 1). Because participation is highest among those of prime working age, age composition has significant implications for overall labor force participation.

Figure 2.4.2, panel 2, illustrates the expected evolution of aggregate labor force participation in advanced European economies under Eurostat's alternative migration scenarios; differences stem solely from changes in the age composition of the countries' populations as a result of net migration.[1] Under the

Figure 2.4.1. Contributions of Natural Population Growth and Net Migration to Total Population Growth
(Percent)



Sources: United Nations; and IMF staff calculations.
Note: Panel 1 is based on a balanced sample of 34 advanced economies. Natural population growth refers to the difference between fertility and mortality.

The authors of this box are Benjamin Hilgenstock and Zsóka Kóczán.

[1]The Eurostat baseline scenario is broadly based on trend extrapolation until 2050 (EC 2017). It would imply, for instance, an increase in Germany's migrant stock from the current 14 percent to 29 percent. The high (low) migration

Box 2.4 *(continued)*

baseline scenario, the average aggregate participation rate would decline by 7.4 percentage points by 2050. Allowing for an increase in net migration could offset some of this decline: the drop would be 0.8 percentage point less under the assumption of high migration (it would be 0.8 percentage point more under low migration). More restrictive immigration policies would significantly exacerbate the negative effect of population aging on participation. Strikingly, if no new migration is allowed, the decline in participation would be 2.7 percentage points larger. These effects would be especially large in high-migration countries (Figure 2.4.2, panel 3).

Participation Effects of Migration

While migration can boost aggregate participation rates through compositional shifts, it is important to recognize that participation rates differ significantly between migrants and natives, and these differences vary by gender and age.

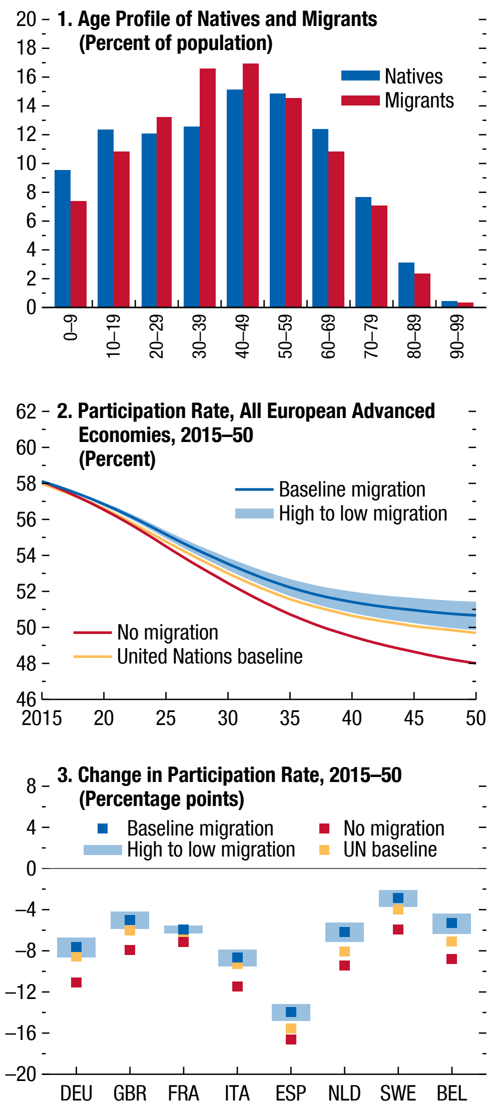
Disaggregated data from 24 advanced European economies suggest that young migrants are more likely to be in the labor force than young natives (42 percent versus 36 percent; young natives are, on average, more likely to be in education), but participation among migrants 55 and older is slightly lower than for natives in the same age group (5 percent versus 6 percent).[2] A close look at prime-age workers shows that participation of prime-age men is very similar for natives and migrants. The most significant difference relates to the participation of prime-age women, with significantly lower participation among migrant women (75 percent versus 81 percent; Figure 2.4.3, panel 1).

However, migrant participation rates converge toward those of natives over time: participation increases with years in the host country, especially for prime-age women (Figure 2.4.3, panel 2). This

scenarios refer to a one-third increase (decrease) in net migration relative to the baseline (so, for Germany, would result in migrant stocks of 25 and 33 percent, respectively, by 2050). The United Nations baseline scenario assumes a continuation of recent migration trends for nonrefugee flows until 2050, but also considers the country's migration policy stance (see UN 2017 for details). While, on average, this produces estimates broadly consistent with the European Union's low-migration scenario, this is not necessarily the case for individual countries. Figure 2.4.2, panel 2, shows population-weighted averages across countries.

[2]Disaggregated data are from Eurostat's European Labour Force Survey. The statistics described above are from a random sample of 10,000 respondents per country per year.

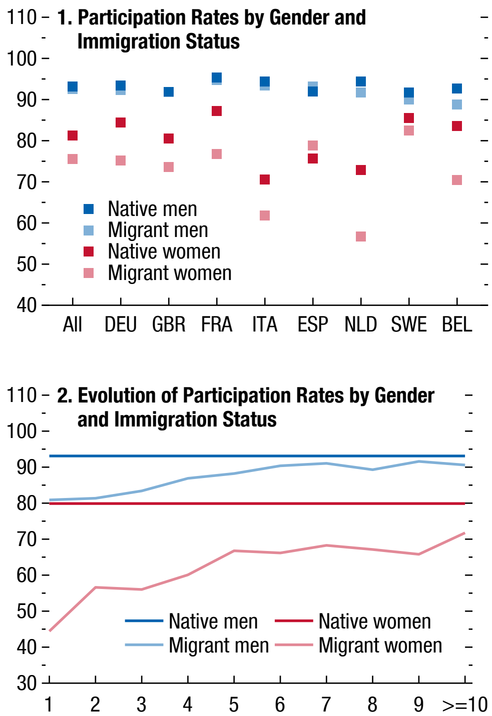
Figure 2.4.2. Projected Evolution of Labor Force Participation Rates



Sources: Eurostat; United Nations; and IMF staff calculations.
Note: In panels 1 and 2, countries included are AUT, BEL, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, IRL, ITA, LTU, LUX, LVA, MLT, NLD, NOR, PRT, SVK, SVN, and SWE. Labels in the figure and note use International Organization for Standardization (ISO) country codes. Detailed migration scenarios are based on Eurostat data and are compared to the United Nations baseline scenario.

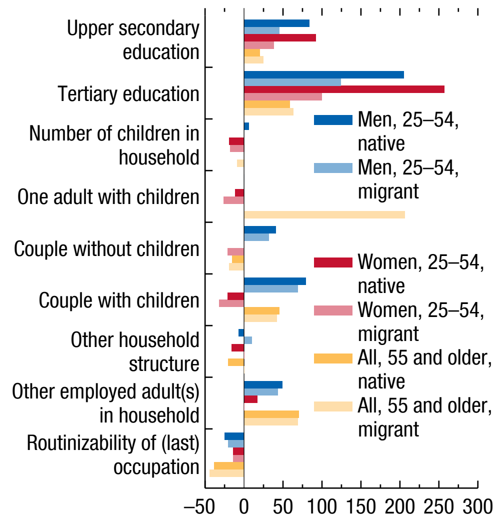
Box 2.4 *(continued)*

Figure 2.4.3. Labor Force Participation Rates of Prime-Age Natives and Migrants, 2000–16
(Percent)



Sources: Eurostat, European Union Labour Force Survey; and IMF staff calculations.
Note: In panel 1, "All" refers to European advanced economies as listed in the note to Figure 2.4.2. Panel 2 is based on the eight countries listed in panel 1. *x*-axis in panel 2 denotes years since migration.

Figure 2.4.4. Change in the Odds of Being Active
(Percent)



Sources: Eurostat, European Union Labour Force Survey; and IMF staff calculations.
Note: Logit regressions are based on a 10,000 respondents per country per year random sample of 18 countries. Only effects significant at the 10 percent level are shown. The base category for education is "up to lower secondary education." For family composition the base category is "one adult without children." The routine exposure coefficient is scaled by the difference between the 25th and 75th percentiles. Regressions also control for age, gender, urban/rural location, year, country and region fixed effects, and the output gap. Standard errors are clustered at the country-year level.

effect holds up even when controlling for individual and household characteristics: an additional year in the host country is estimated to increase the odds of participation by 5–6 percent.

Abstracting from the age composition effect discussed earlier, allowing migrants' participation rates to increase to natives' participation rates would result in an additional 1.4 percentage point increase in overall participation (relative to a no convergence scenario), even holding the relative shares of the age groups in the population constant.[3]

Migrants' Participation Decisions

What is holding back migrants' involvement in the labor market? Figure 2.4.4 builds on the logit specification estimated in the chapter—looking at the effects of individual and household characteristics on individual participation decisions—but here it is examined separately for migrants and natives.

In many ways, migrants' participation decisions are shaped by the same factors that shape those of natives. Those who are more educated participate more, house-

[3]This example keeps population shares of the eight groups (young, prime-age men, prime-age women, and people 55 and over for natives and migrants separately) constant at their 2000–16 average shares and examines what the overall rate would be if migrants' participation equaled that of natives. Given that young migrants' participation exceeds young natives' this is assumed to stay constant; prime-age and 55-plus migrants' participation are assumed to increase to natives' levels.

Box 2.4 *(continued)*

hold composition matters, and the threat of automation is linked to a lower likelihood of being active.

However, the results also point to significant differences relative to natives. Although higher education increases the odds of being active for both migrants and natives, the effects are significantly smaller for migrants, likely pointing to difficulties in the recognition of foreign qualifications or language barriers to labor market integration.

The effects of household composition are much larger for migrants: being married and having children has larger negative effects on the participation of migrant women than on that of native women. Local labor market effects are also weaker for migrant women.

Policies for Migrant Integration

These results suggest that policies that support migrant integration, such as recognition of educational qualifications or language training, could increase the positive effect of migration on participation in (receiving) advanced economies, beyond its effects on age composition (see also Chapter 4 of the October 2016 *World Economic Outlook* [WEO]). This could help mitigate some of the future negative effects of aging and help make social safety nets more sustainable in these economies.

Higher migration flows could contribute to labor supply and the host economy more broadly as well—increasing output per capita by boosting demand and investment, contributing to technological progress, and increasing labor productivity, including through skill complementarity.[4]

[4]See Chapter 4 of the October 2016 WEO for a summary; see also Peri and Sparber (2009); Hunt and Gauthier-Loiselle (2010); Farré, González, and Ortega (2011); D'Amuri and Peri (2014); Ortega and Peri (2014); Alesina, Harnoss, and Rapoport (2015); Cattaneo, Fiorio, and Peri (2015); Peri, Shih, and Sparber (2015); Aiyar and others (2016); and Jaumotte, Koloskova, and Saxena (2016). At the same time, the impact of migration on average wages or employment of native workers is found to be limited (see Card 1990; Peri 2014; IMF 2015; and Aiyar and others 2016).

Annex 2.1. Data Sources and Country Coverage

The primary data sources for this chapter are the Organisation for Economic Co-operation and Development, IMF World Economic Outlook (WEO) database, and United Nations World Population Prospects. The micro-level analysis is based on data from the 2000–16 European Union Labour Force Surveys by the European Commission, which are available from Eurostat. All data sources used in the main analysis (excluding boxes) are listed in Annex Table 2.1.1.

The sample consists of the 39 economies classified as advanced economies in Table B of the April 2018 WEO, excluding the smallest economies (that is, Hong Kong Special Administrative Region, Macao Special Administrative Region, Malta, Puerto Rico, San Marino, and Taiwan Province of China). However, due to data limitations, the included economies vary across the analyses, as indicated in Annex Table 2.1.2. The shift-share analysis relies on a sample of 32 advanced economies during 1980–2016 for which detailed data on labor force participation by age group and gender are available. The cross-country analysis on the role of policies and other factors is based on annual data for 23 advanced economies during 1980–2011, which were classified as advanced economies for the entire sample period and for which data on policy variables

Annex Table 2.1.1. Data Sources

Indicator	Source
Labor Force Participation	OECD, Employment database
Labor Force Participation by Education	Eurostat; National authorities
Employment Rate	OECD, Employment database
Unemployment Rate	IMF, WEO database
Output Gap	IMF, WEO database
Crisis Indicator	Gourinchas and Obstfeld (2012)
Relative Price of Investment	IMF, WEO database
Routine Exposure	Das and Hilgenstock (forthcoming) based on Autor and Dorn (2013), Eurostat, and population censuses
Trade Openness	IMF, WEO database
Sectoral Employment of Industry and Services	World Bank, World Development Indicators database; European Union, Level Analysis of Capital, Labour, Energy, Materials, and Service inputs (EU KLEMS)
Urban Population	World Bank, World Development Indicators database
Population by Education (primary, secondary, tertiary)	Barro-Lee Educational Attainment data set
Labor Tax Wedge	OECD, Tax database; Bassanini and Duval (2006); Chapter 3 of the April 2016 WEO
Unemployment Benefits	OECD, Benefits and Wages: Statistics
Public Spending on ALMP	OECD, Social Expenditure database
Migration Policies	International Migration Institute, DEMIG POLICY database
Union Density	OECD, Employment database
Coordination of Wage Setting	Amsterdam Institute for Advanced Labour Studies, Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention, and Social Pacts
Public Spending on Early Childhood Education and Care	OECD, Social Expenditure database
Part-Time Employment	OECD, Employment database
Job-Protected Maternity Leave	OECD, Family database
Statutory Retirement Age	International Social Security Association, Social Security Programs throughout the World
Old-Age-Pension Spending	OECD, Social Expenditure database
Incapacity Spending	OECD, Social Expenditure database
Implicit Tax on Continued Work	Duval (2004); Chapter 3 of the April 2016 WEO
Pension Replacement Ratio	Luxembourg Income Study database
Population Projections	United Nations World Population Prospects, 2017 revision
School Enrollment	OECD, Education database
Returns to Education	Luxembourg Income Study database
Education Spending	Eurostat
Employment Protection	OECD, Employment database

Source: IMF staff compilation.
Note: ALMP = active labor market programs; OECD = Organisation for Economic Co-operation and Development; WEO = *World Economic Outlook*.

Annex Table 2.1.2. Country Coverage

Exercise	Countries
Shift-Share Analysis	Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States
Aggregate Analysis	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States
Micro-Level Analysis	Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom
Cohort-Based Analysis	Australia, Belgium, Canada, Denmark, France, Germany, Greece, Israel, Italy, Japan, Luxembourg, Norway, Portugal, Spain, Sweden, United Kingdom, United States

Source: IMF staff compilation.

are available. Micro-level analysis is based on annual data for 24 advanced European economies during 2000–16. Information on family composition is not available for Denmark, Finland, Iceland, Norway, Sweden, or Switzerland, so regressions including these variables are estimated on a subset of 18 economies. The cohort-based analysis relies on annual data for 17 advanced economies from 1985 to 2016 for which gender-specific labor force participation rate data are available for quinquennial age groups starting at age 15 and up to 64 and covering ages 65 to 99.

Annex 2.2. Additional Stylized Facts

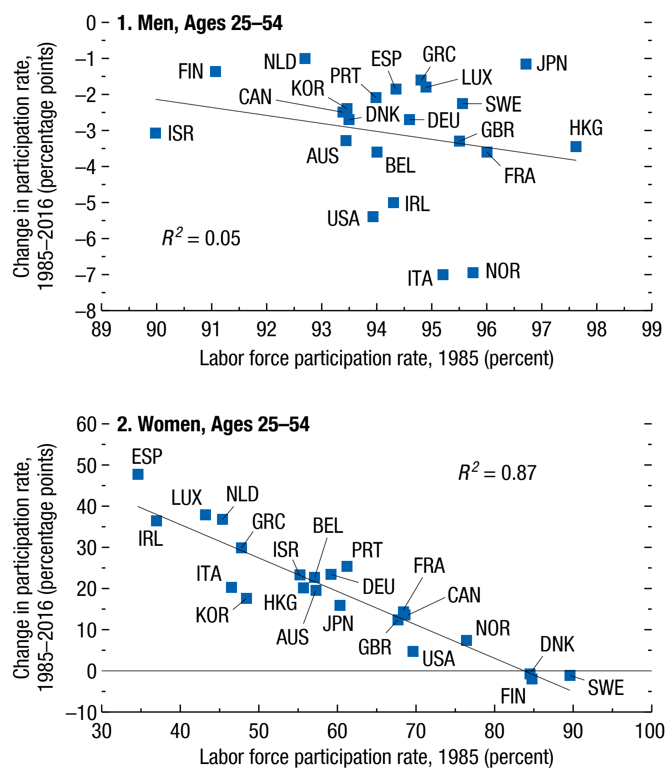
This section provides further stylized facts on convergence across economies in participation rates, the link between the participation of men and women, and the effects of the global financial crisis.

Annex Figure 2.2.1 examines whether there is evidence for convergence across economies in participation rates. While this seems to be limited for men, gains in female participation were indeed substantially larger in economies where women were historically less likely to be part of the workforce. As a result, as documented in the chapter, the dispersion in women's participation across advanced economies has narrowed since 1985.

The rise in women's labor force participation is also consistent with the rising share of two-earner households. Based on micro data from the European Union Labour Force Survey, Annex Figure 2.2.2 shows that the share of households with one adult working and one adult not working has fallen since 2000, while the share of households with both adults working has increased.

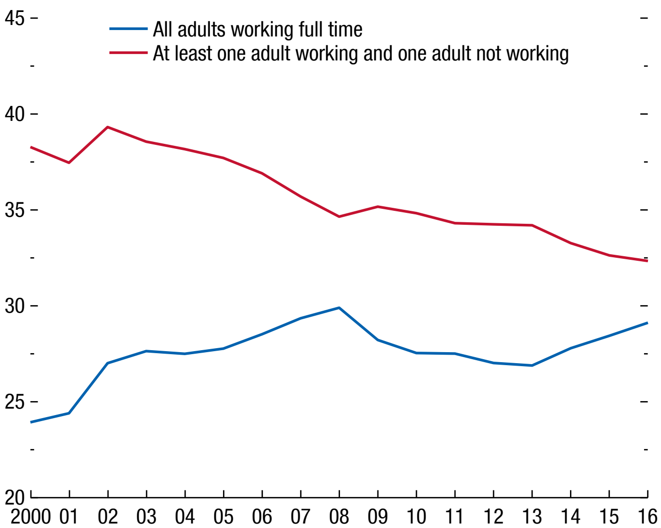
Annex Figure 2.2.3 examines the hypothesis that women's increasing participation may have allowed some men to drop out of the labor force and finds no evidence for this at the country level. Correlations between changes in prime-age female and male participation rates are, if anything, positive, though relatively weak.

Annex Figure 2.2.1. Changes in Labor Force Participation Rates, 1985–2016



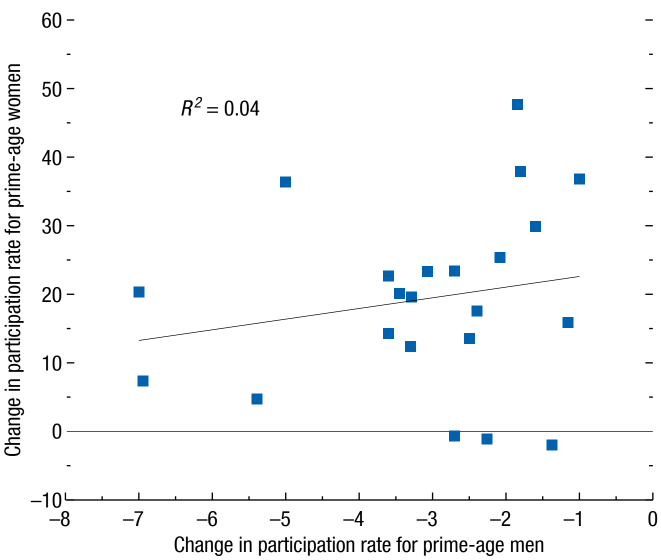
Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Labels in the figure use International Organization for Standardization (ISO) country codes.

Annex Figure 2.2.2. Share of Households by Employment Composition, 2000–16
(Percent)



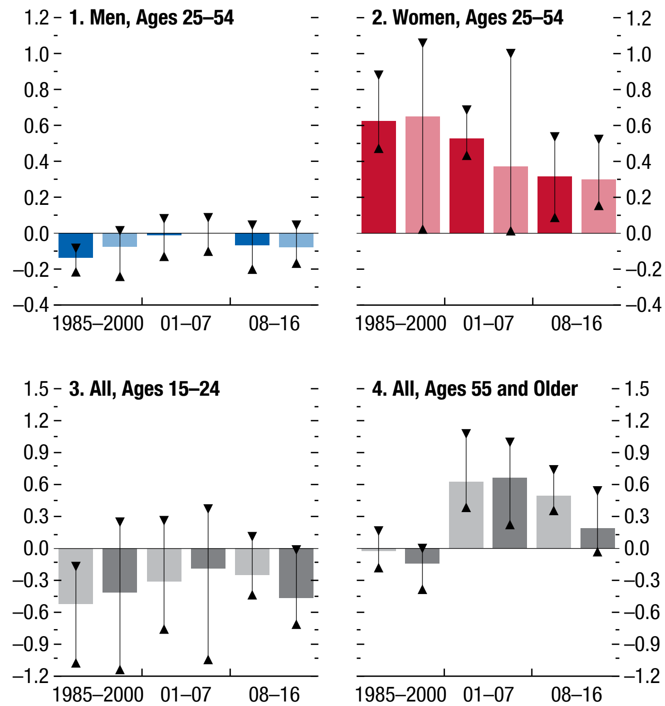
Sources: Eurostat, European Union Labour Force Survey; and IMF staff calculations.
Note: Reported statistics are estimated from a random sample of 10,000 respondents per country per year from the European Union Labour Force Survey over the period 2000–16.

Annex Figure 2.2.3. Changes in Labor Force Participation Rates of Prime-Age Men and Women, 1985–2016
(Percentage points)



Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Prime age is defined as between 25 and 54.

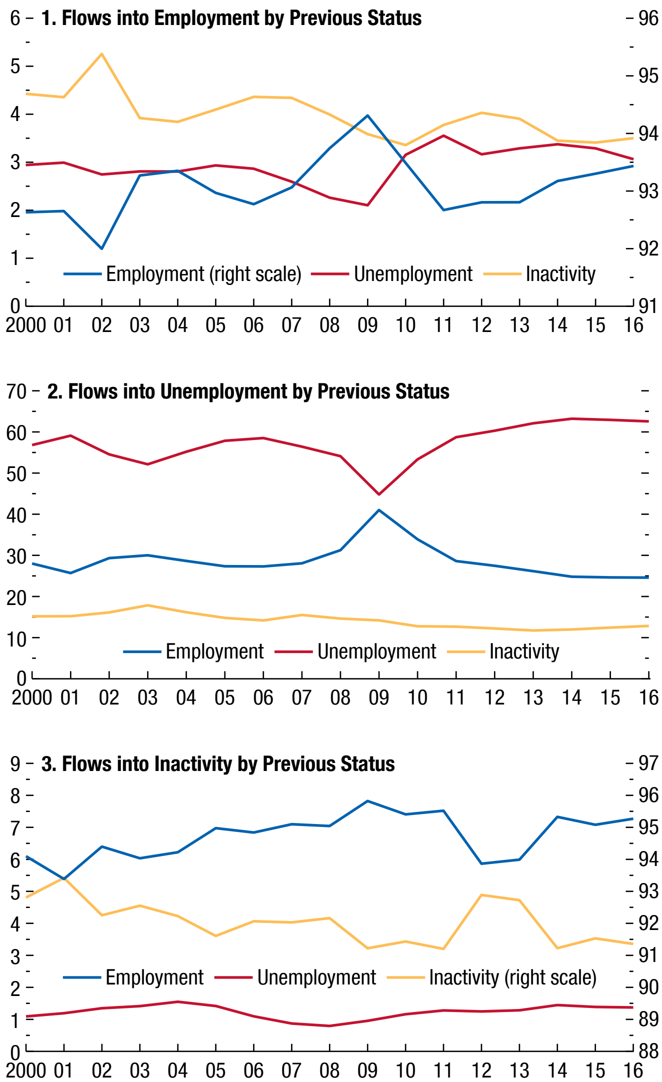
Annex Figure 2.2.4. Average Annual Changes in Labor Force Participation Rates
(Percentage points)



Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Bars denote median; and vertical lines denote interquartile range. In all panels, left bars for each time period show countries above the median in terms of real GDP loss during 2008–12 and right bars show countries below the median.

Annex Figures 2.2.4 and 2.2.5 analyze the effects of the global financial crisis and European debt crises further. Annex Figure 2.2.4 compares economies with above- and below-median GDP losses during the crisis and finds that the dynamics of their labor force participation rates were broadly similar. Annex Figure 2.2.5 in turn examines the evolution of transition probabilities—flows from employment, unemployment, and inactivity into employment, unemployment, and inactivity—over time. This suggests that the share of discouraged workers (those who are inactive but were unemployed the previous year) has been increasing since the crisis and is approaching the precrisis peak. This figure also illustrates the spike in flows from employment into unemployment during the global financial crisis, as well as flows from unemployment back into employment after the crisis.

Annex Figure 2.2.5. Flows into Employment, Unemployment, and Inactivity
(Percent)



Sources: Eurostat, European Union Labour Force Survey; and IMF staff calculations.
Note: Previous status refers to labor force status in the previous year. Reported statistics are estimated from a random sample of 10,000 respondents per country per year from the European Union Labor Force Survey over the period 2000–16.

Annex 2.3. The Role of Aging and Cyclical Factors

Shift-Share Analysis

A standard shift-share analysis is performed to establish how demographic changes in advanced economies have contributed to the trends in participation rates since 2008. The gender-specific aggregate labor force participation rate, LFP^a, can be rewritten as the participation rates of workers of gender a in age group g, weighted by their share in the male or female population, respectively:

$$LFP^a_{i,t} = \sum_{g=1}^{n} LFP^{a,g}_{i,t} \frac{pop^{a,g}_{i,t}}{pop_{i,t}}, \tag{2.1}$$

in which i denotes the country, t is the time index, a is the gender, g is the age group (15–24, 25–54, 55–64, 65 and over), and pop is the population. The aging effect is obtained as the difference between the actual participation rate and the one obtained by holding constant the gender- and group-specific participation rates at their 2008 level, $LFP^{a,g}_{i,2008}$, but allowing the population shares, $\frac{pop^{a,g}_{i,t}}{pop_{i,t}}$, to vary as observed in the data.

Estimating the Role of Cyclical Conditions

Economic contractions generally result in greater unemployment and lower labor force participation as some workers get discouraged and permanently separate from the workforce, and others choose to delay entry. To capture the effect of the cycle on labor force participation, the chapter estimates the following regression:

$$\begin{aligned} LFP^{*}_{i,t} = {} & \sum_{k=0}^{1} \beta^k UG_{i,t-k} + \sum_{k=0}^{1} \delta^k Crisis_{i,t-k} \\ & + \sum_{k=0}^{1} \gamma^k UG_{i,t-k} Crisis_{i,t-k} + \pi_i \\ & + \tau_t + \varepsilon_{it}, \end{aligned} \tag{2.2}$$

in which LFP^* is the detrended aggregate labor force participation rate, obtained by applying the Hodrick-Prescott (HP) filter to the labor force participation rate; UG is the unemployment gap, defined as the gap between current unemployment and the nonaccelerating inflation rate of unemployment (NAIRU);[51] *Crisis* is a dummy variable that takes a value of 1 when there is either a currency crisis, a sudden stop, a debt crisis, or a banking crisis, based on the Gourinchas-Obstfeld database; and π_i and τ_t are country and time fixed effects.

The regression is estimated using annual data during 1980–2016, and the cyclical effect at time t is obtained as the predicted value of the regression. The difference in the predicted cyclical component relative to its 2008 value captures the role of the cycle in the change in

[51]The NAIRU is constructed as in Chapter 3 of the April 2013 *World Economic Outlook*.

aggregate participation since then. While the findings rely on a specification with a single lag ($k = 1$) estimated in a panel setting, the results are qualitatively similar if a richer lag structure is used instead, or if the sensitivity of labor force participation to the cycle is allowed to vary across economies. Results are also robust to employing the Corbae-Ouliaris (CO) filter instead of the HP filter to obtain the detrended aggregate labor force participation rate in equation (2.2), as well as to calculating it as deviations from a three-year moving average, limiting the distortions generated by the endpoint problem of the HP filter.

Annex 2.4. The Role of Policies and Other Factors: Aggregate Cross-Country Analysis

This analysis estimates a reduced-form specification of labor force participation that relates the participation rate of specific groups of workers to factors that may affect the decision to supply labor. It controls for all differences across economies that are constant over time and shocks that affect all economies. While the potential set of drivers is large, the analysis, guided by the conceptual framework described in the main text, focuses on factors that can be measured relatively consistently across economies and over time and that are most commonly discussed in policy debates.[52] More specifically, the aggregate analysis is based on the estimation of the equation

$$LFP^g_{i,t} = \beta^{X,g} X^g_{i,t} + \beta^{D,g} D_{i,t} + \beta^{GAP,g} GAP_{i,t-1} + \beta^{Z,g} Z_{i,t} + \pi^g_i + \tau^g_t + \varepsilon^g_{i,t}, \quad (2.3)$$

in which LFP denotes the participation rate of worker group g in country i in year t, GAP is the cyclical position of the economy, X represents the set of policies and institutions (some of which are specific to group g), D denotes a set of factors that may shift the demand for worker group g, Z includes other determinants of labor supply (education), and π_i and τ_t are country and time fixed effects.[53] Some of the evidently endogenous variables are included in the specification with a one-year lag. The groups comprise young workers (15–24), prime-age men (25–54), prime-age women (25–54), and older workers (55 and over); an additional equation is estimated for a group encompassing all workers 15 and older.

Given the complex correlation structure of the error term with dependence across economies, autocorrelation due to the slow-moving nature of the dependent variable, and heteroscedasticity, the Driscoll and Kraay (1998) correction to the standard errors is used to make statistical inferences. The findings are robust to various alternative corrections of standard errors as discussed later.

The analysis then decomposes the contributions from each regressor to changes in participation of group g between years t and t' as

$$C^{S,g}_{i,t,t'} = \widehat{\beta^{S,g}}\left(S^g_{i,t'} - S^g_{i,t}\right), \quad (2.4)$$

in which $S = \{X, D, GAP, Z\}$ and $C^{S,g}_{i,t,t'}$ is the contribution of variable S.

The key variables included in the analysis are the following:

- The cyclical position is captured using the output gap. The results are not sensitive to using alternative measures, such as the unemployment rate.
- Exposure to technological progress is measured following Chapter 3 of the April 2017 *World Economic Outlook* (WEO) and Das and Hilgenstock (forthcoming). The relevant variable is the interaction between the relative price of investment and the country's exposure to routinization through its initial occupational mix. The latter consists of scores that rely on occupation-level measures by Autor and Dorn (2013), which order occupations by their share of routine tasks, and then use the employment shares of these occupations to construct country-level measures of routinizability. The average relative price of investment across all advanced economies is used to minimize endogeneity concerns and capture changes that are due to global technological progress (rather than, for example, country-specific capital taxation policies).

[52]The vast theoretical literature on labor supply offers a large number of models with different assumptions, including about (1) the ability of consumers to transfer capital across periods and to consider more generally a life-cycle framework; (2) the extent to which labor supply decisions are made by the household rather than the individual worker; (3) the role of uncertainty about future income, household composition, and health status; and (4) how government programs affect the incentives to work (see Blundell and Macurdy 1999 for a review). Developing a macroeconomic theory of labor supply encompassing all these features for different groups of workers is beyond the scope of this chapter.

[53]Results from panel unit root tests suggest that the time series of labor force participation rates for different age groups are trend stationary. Because of limited data availability for some of the explanatory variables, using a dynamic specification in the presence of country fixed effects would return biased estimates (Nickell 1981).

- Potential shifts in the demand for different types of labor due to structural transformation are measured as the ratio of employment in the service sector relative to employment in the industrial sector and the share of urban population.
- Educational attainment is from the Barro-Lee database (Lee and Lee 2016) and is measured as the share of the population within a specific age-gender group with the highest level of education reported as primary, secondary, or tertiary.
- The labor tax wedge is defined as the ratio between the average tax paid by a single-earner family (one parent at 100 percent of average earnings with two children) and the corresponding total labor cost for the employer. The labor tax wedge is available from the Organisation for Economic Co-operation and Development (OECD) for 2000–16 and is extended back to 1979 using Bassanini and Duval (2006) and Chapter 3 of the April 2016 WEO. The latter series is available only in odd years; the value of the labor tax wedge in even years is obtained by linear interpolation.
- The generosity of the unemployment benefits system is measured as the gross replacement rate, which is equal to the gross unemployment benefit levels as a percentage of previous gross earnings and is published by the OECD. The OECD summary measure with the best coverage is the average of the gross unemployment benefit replacement rates for two earnings levels, three family situations, and three durations of unemployment. Such measures are available in odd years and are interpolated for even years. The reported values are for the average worker from 2001 to 2011 and the average production worker from 1981 to 2005. The two series are spliced.
- Public expenditure on active labor market programs, published by the OECD, is calculated as active labor market program spending per unemployed person in percent of GDP per capita, following Gal and Theising (2015).
- Restrictiveness of migration policy is obtained from the DEMIG POLICY database compiled by the International Migration Institute, which codes all changes to the existing legal framework relevant for migration (see also de Haas, Natter, and Vezzoli 2014). The chapter focuses on major changes in policies guiding the postentry rights or other aspects of migrants' integration. These changes are cumulated starting in 1980 to construct an index for each country, with a higher value denoting more restrictive policies.
- Union density is measured as net union membership as a proportion of wage earners in employment. The variable is published by the OECD.
- Coordination of wage setting is an index of the centralization of bargaining, published by the Amsterdam Institute for Advanced Labour Studies Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts. The index runs from 1 to 5 with values defined as (1) fragmented wage bargaining, confined largely to individual firms or plants; (2) mixed industry and firm-level bargaining, weak government coordination through minimum wage setting or wage indexation; (3) negotiation guidelines based on centralized bargaining; (4) wage norms based on centralized bargaining by peak association with or without government involvement; and (5) maximum or minimum wage rates/increases based on centralized bargaining.
- Policies that help reconcile work inside and outside the household are proxied by public spending on early childhood education and care as a percent of GDP; the proportion of employees with a part-time contract to total employees; and job-protected maternity leave, defined as the total number of weeks of job-protected maternity, parental, and extended leave available to mothers, regardless of income support. These variables are published by the OECD.
- Retirement incentives are proxied by the statutory retirement age and by the generosity of pension plans. A database of statutory retirement ages is compiled from various publications of *Social Security Programs throughout the World*. Several alternatives are used to capture the generosity of pension plans. The measure with the best country and time coverage is old-age and incapacity spending as a percent of GDP from the OECD. This measure is first purged of fluctuations resulting from cyclical and demographic factors (namely, share of the population in different age groups and health status, proxied by life expectancy) that may mechanically generate a negative correlation with the labor force attachment of older workers. As a robustness check, the analysis considers the (conceptually more appropriate but less widely available) implicit tax on continued work, calculated as the change in the present value of the stream of future pension payments

net of contributions to the system from working five more years for typical workers at different ages (see Duval 2004 and Chapter 3 of the April 2016 WEO). An alternative measure also considered is the aggregate replacement ratio, calculated as the ratio of the mean disposable income of people ages 65–74 to the mean disposable income of those ages 50–59, from the Luxembourg Income Study Database. This variable can be computed for selected years based on the availability of household survey data and is interpolated for the missing years.

Annex Tables 2.4.1–2.4.5 present the key results from the cross-country panel regressions, along with numerous robustness checks. Annex Table 2.4.1 contains the estimated coefficients for the regression on the young, Annex Table 2.4.2 on the prime-age male workers, Annex Table 2.4.3 on the prime-age female workers, Annex Table 2.4.4 on older workers, and Annex Table 2.4.5 on the aggregate participation rate. Each table shows the results from the baseline specification discussed in the main text (Table 2.1, column 1) and establishes its robustness to alternative measures, specification, error structure, and the like.

- *Logistic transformation*: Given that participation rates are bounded by 0 and 100 by construction, the analysis is repeated using the logistic transformation of the dependent variable in column (2).
- Alternative corrections to standard errors are as follows:
  - *Cross-equation correlation:* There may be correlation across the error terms of the estimations for different worker groups. Estimating a system including one equation for each group in a seemingly unrelated regression framework returns similar results in column (3).
  - *Cross-sectional dependence:* Tests by Pesaran (2004) and Frees (1995) reject the null hypothesis of cross-sectional independence, but the results of the test by Friedman (1937) suggest that cross-sectional dependence is not present. The results are generally robust to alternative corrections of the standard errors. In particular, the conclusions are broadly unchanged when employing the Beck and Katz (1995) estimator in column (4), correcting the standard errors only for heteroscedasticity and autocorrelation in column (5) and adopting the Newey-West correction for the standard errors in column (6).
- *Cyclical effects:* Possible distortions arising from inability to control for cyclical effects are controlled for by estimating the equation on five-year averages, which could also rule out the possibility that the results depend on some undetected local unit root. The dependent variables in the regressions are trend stationary, which excludes the possibility of undetected cointegrating relationships with the explanatory variables. While some of the explanatory variables are locally nonstationary, most of these are shares bounded between 0 and 100. The results based on five-year averages presented in column (7) are broadly comparable to those of the baseline estimates.
- *Global financial crisis:* The significance and the magnitude of the coefficients are not affected by dropping 2008 and 2009 from the sample, as shown in column (8).
- *Other advanced economies:* Broadening the sample to economies that were classified as advanced in the WEO database after 2006 does not generally alter the results, as can be seen in column (9).
- *Alternative measures of the output gap:* In column (10), the analysis replaces the output gap with the unemployment rate. This specification returns qualitatively comparable results. However, in this case, older workers' participation rates turn out to be sensitive to the cyclical conditions of the economy.
- *Sample selection:* The analysis rules out the possibility that single economies drive the results by estimating the same specification dropping one economy at a time. The estimates display remarkable stability, as is shown in column (11). This exercise also allays concerns that the findings on the role of certain variables may be an artifact of measurement errors in the series of some economies.

Annex Table 2.4.1. Drivers of Youth (Ages 15–24) Labor Force Participation Rates: Robustness

	(1) Baseline	(2) Logistic Transformation	(3) SUR	(4) Beck and Katz	(5) HAC Standard Errors	(6) Newey-West Standard Errors	(7) Five-Year Averages	(8) Excluding GFC	(9) Including All AEs	(10) Replacing Output Gap with Unemployment Rate	(11) Dropping One Country at a Time
Lag of Output Gap	0.360***	0.015***	0.219***	0.226***	0.360***	0.360***	0.473**	0.366***	0.286***	–0.519***	0.354
	(0.112)	(0.005)	(0.073)	(0.063)	(0.080)	(0.103)	(0.183)	(0.121)	(0.100)	(0.100)	(0.292; 0.393)
Routinization x Relative Price	0.303	0.012	0.313	–0.143	0.303	0.303	0.358	0.358	0.295	0.404	0.297
of Investment	(0.299)	(0.012)	(0.280)	(0.377)	(0.262)	(0.344)	(0.299)	(0.313)	(0.291)	(0.293)	(0.184; 0.489)
Lag of Trade Openness	0.059***	0.003***	0.045***	0.020	0.059***	0.059***	0.059*	0.053**	0.043*	0.021	0.057
	(0.022)	(0.001)	(0.016)	(0.019)	(0.018)	(0.019)	(0.026)	(0.024)	(0.022)	(0.028)	(0.045; 0.071)
Relative Service Employment	–0.002	–0.000	–0.026***	–0.020**	–0.002	–0.002	–0.004	–0.004	0.002	0.004	–0.001
	(0.010)	(0.000)	(0.008)	(0.009)	(0.009)	(0.011)	(0.012)	(0.009)	(0.009)	(0.009)	(–0.01; 0.001)
Lag of Urbanization	0.668***	0.030***	–0.089	0.575***	0.668***	0.668***	0.560***	0.700***	0.685***	0.715***	0.669
	(0.142)	(0.006)	(0.098)	(0.135)	(0.085)	(0.159)	(0.139)	(0.170)	(0.139)	(0.175)	(0.626; 0.702)
Education (percent secondary)	–0.050	–0.002	0.007	–0.042	–0.050*	–0.050	–0.049	–0.062	–0.050	–0.050	–0.049
	(0.042)	(0.002)	(0.022)	(0.032)	(0.026)	(0.036)	(0.060)	(0.049)	(0.042)	(0.049)	(–0.076; –0.031)
Education (percent tertiary)	–0.275***	–0.012***	–0.105***	–0.227***	–0.275***	–0.275***	–0.253*	–0.290***	–0.286***	–0.294***	–0.273
	(0.057)	(0.002)	(0.038)	(0.047)	(0.042)	(0.054)	(0.105)	(0.064)	(0.048)	(0.062)	(–0.303; –0.247)
Tax Wedge	–0.103	–0.005*	–0.021	–0.029	–0.103**	–0.103*	–0.086	–0.082	–0.094	0.057	–0.104
	(0.064)	(0.003)	(0.046)	(0.050)	(0.048)	(0.058)	(0.060)	(0.064)	(0.059)	(0.074)	(–0.127; –0.058)
Unemployment Replacement	–0.002	–0.000	0.111***	0.009	–0.002	–0.002	–0.001	0.016	–0.009	0.007	0.003
Ratio	(0.068)	(0.003)	(0.035)	(0.044)	(0.039)	(0.059)	(0.140)	(0.070)	(0.065)	(0.066)	(–0.036; 0.034)
Public Spending on ALMP	0.041***	0.002**	–0.004	0.031	0.041***	0.041**	0.023	0.048***	0.045***	0.030*	0.041
	(0.014)	(0.001)	(0.013)	(0.023)	(0.014)	(0.019)	(0.033)	(0.014)	(0.014)	(0.017)	(0.036; 0.048)
Restrictiveness of Migrant	0.491***	0.021***	0.421***	0.277**	0.491***	0.491***	0.521***	0.492***	0.464***	0.421***	0.487
Integration Policies	(0.098)	(0.004)	(0.079)	(0.108)	(0.090)	(0.146)	(0.091)	(0.109)	(0.094)	(0.114)	(0.414; 0.539)
Union Density	–0.009	–0.000	–0.065	–0.116**	–0.009	–0.009	–0.021	–0.020	–0.001	0.011	–0.01
	(0.068)	(0.003)	(0.046)	(0.057)	(0.046)	(0.066)	(0.091)	(0.069)	(0.061)	(0.065)	(–0.026; 0.016)
Coordination of Wage Setting	1.104***	0.045***	0.942***	0.081	1.104***	1.104***	1.848***	1.117***	1.088***	0.694**	1.105
	(0.245)	(0.010)	(0.241)	(0.180)	(0.251)	(0.329)	(0.451)	(0.252)	(0.233)	(0.284)	(0.852; 1.255)
Number of Observations	571	571	489	571	571	571	132	525	593	525	
Countries	23	23	23	23	23	23	23	23	25	23	
R^2	0.515	0.521		0.922	0.515	0.515	0.573	0.529	0.517	0.540	

Source: IMF staff calculations.
Note: The table presents results from estimation equation (2.3) with the participation rate of youth (ages 15–24) as the dependent variable on a sample of 23 advanced economies (AEs) during 1980–2011 using annual data. See Annex 2.4 for the construction of the explanatory variables and Annex Table 2.1.2 for the countries in the sample. All specifications include country and year fixed effects. Column (1) reports the baseline estimation results; column (2) reports the results after applying the logistic transformation to the dependent variable; column (3) reports the estimates from a seemingly unrelated regressions (SUR) estimation of a four-equation system (one for each group of workers); column (4) shows the results using the Beck and Katz (1995) estimator; column (5) reports the estimates with heteroscedasticity and autocorrelation consistent (HAC) standard errors, without the correction for cross-sectional dependence; column (6) shows the results with the Newey-West correction for the standard errors; column (7) shows the results based on a sample of five-year averages; column (8) reports the results dropping global financial crisis (GFC) years 2008 and 2009 from the sample; column (9) reports the coefficients when Czech Republic and Slovak Republic, which recently joined AEs, are added to the sample; column (10) shows the results when the lag of the output gap is replaced with the lag of the unemployment rate; and column (11) reports the median coefficient from a distribution of estimates obtained by dropping one country at a time from the sample. Driscoll-Kraay standard errors are reported in parentheses in columns (1), (2), (7)–(10); bootstrapped standard errors are reported in parentheses in column (3); HAC standard errors assuming a panel-dependent correlation structure are reported in column (4). Column (11) reports the 10th and 90th percentile of the estimated coefficients in parentheses. ALMP = active labor market programs.
$*p < .10$; $**p < .05$; $***p < .01$.

Annex Table 2.4.2. Drivers of Prime-Age Male (Ages 25–54) Labor Force Participation Rates: Robustness

	(1) Baseline	(2) Logistic Transformation	(3) SUR	(4) Beck and Katz	(5) HAC Standard Errors	(6) Newey-West Standard Errors	(7) Five-Year Averages	(8) Excluding GFC	(9) Including All AEs	(10) Replacing Output Gap with Unemployment Rate	(11) Dropping One Country at a Time
Lag of Output Gap	0.072***	0.012***	0.058***	0.020	0.072***	0.072***	0.117**	0.070***	0.062***	–0.002	0.07
	(0.020)	(0.003)	(0.017)	(0.016)	(0.018)	(0.022)	(0.037)	(0.022)	(0.019)	(0.029)	(0.06; 0.081)
Routinization × Relative Price of Investment	0.302***	0.070***	0.204***	0.217***	0.302***	0.302***	0.266***	0.303***	0.284***	0.315***	0.302
	(0.048)	(0.011)	(0.067)	(0.057)	(0.057)	(0.074)	(0.072)	(0.048)	(0.037)	(0.049)	(0.285; 0.33)
Lag of Trade Openness	–0.005	–0.001	–0.012***	–0.015***	–0.005	–0.005	–0.003	–0.007	–0.005	–0.010	–0.005
	(0.005)	(0.001)	(0.004)	(0.005)	(0.004)	(0.005)	(0.009)	(0.006)	(0.004)	(0.006)	(–0.006; –0.003)
Relative Service Employment	–0.002	–0.000	–0.000	–0.000	–0.002	–0.002	0.001	–0.002	–0.003	–0.002	–0.002
	(0.002)	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(–0.003; –0.001)
Lag of Urbanization	0.101***	0.015***	0.006	0.105***	0.101***	0.101***	0.072**	0.105***	0.104***	0.110***	0.101
	(0.019)	(0.004)	(0.023)	(0.027)	(0.019)	(0.020)	(0.023)	(0.023)	(0.020)	(0.026)	(0.091; 0.114)
Education (percent secondary)	0.019***	0.003**	0.037***	0.022***	0.019**	0.019**	0.015**	0.022***	0.018**	0.023***	0.019
	(0.007)	(0.001)	(0.008)	(0.009)	(0.008)	(0.009)	(0.005)	(0.007)	(0.007)	(0.008)	(0.016; 0.026)
Education (percent tertiary)	0.019	0.001	0.023**	0.030*	0.019*	0.019	0.017	0.027	0.018	0.029	0.018
	(0.015)	(0.002)	(0.010)	(0.016)	(0.010)	(0.012)	(0.019)	(0.019)	(0.014)	(0.018)	(0.012; 0.027)
Tax Wedge	–0.002	–0.003	–0.009	0.005	–0.002	–0.002	–0.002	–0.001	0.004	0.002	–0.002
	(0.015)	(0.002)	(0.010)	(0.011)	(0.010)	(0.010)	(0.027)	(0.016)	(0.014)	(0.017)	(–0.007; 0.001)
Unemployment Replacement Ratio	–0.041***	–0.007***	–0.037***	–0.024**	–0.041***	–0.041***	–0.031***	–0.041***	–0.039***	–0.044***	–0.04
	(0.007)	(0.001)	(0.008)	(0.010)	(0.008)	(0.011)	(0.008)	(0.008)	(0.008)	(0.008)	(–0.045; –0.034)
Public Spending on ALMP	0.005	0.001	–0.000	0.005	0.005	0.005	0.005	0.007	0.006	0.010*	0.005
	(0.005)	(0.001)	(0.003)	(0.005)	(0.003)	(0.005)	(0.009)	(0.005)	(0.005)	(0.005)	(0.004; 0.006)
Restrictiveness of Migrant Integration Policies	–0.047**	–0.007**	–0.052***	–0.019	–0.047**	–0.047**	–0.092**	–0.053**	–0.048**	–0.056**	–0.046
	(0.020)	(0.003)	(0.019)	(0.024)	(0.020)	(0.023)	(0.025)	(0.020)	(0.021)	(0.022)	(–0.062; –0.034)
Union Density	–0.001	0.002	–0.016	–0.023*	–0.001	–0.001	–0.011	0.000	–0.004	–0.000	–0.001
	(0.011)	(0.002)	(0.011)	(0.012)	(0.010)	(0.013)	(0.019)	(0.011)	(0.011)	(0.013)	(–0.01; 0.007)
Coordination of Wage Setting	0.131**	0.018*	0.074	0.073*	0.131**	0.131*	0.302**	0.134*	0.139**	0.131	0.131
	(0.063)	(0.010)	(0.057)	(0.040)	(0.055)	(0.069)	(0.090)	(0.068)	(0.062)	(0.080)	(0.117; 0.15)
Number of Observations	571	571	489	571	571	571	132	525	593	525	
Countries	23	23	23	23	23	23	23	23	25	23	
R^2	0.606	0.622		0.997	0.606	0.606	0.695	0.622	0.600	0.611	

Source: IMF staff calculations.

Notes: The table presents results from estimation equation (2.3) with the participation rate of prime-age men (ages 25–54) as the dependent variable on a sample of 23 advanced economies (AEs) during 1980–2011 using annual data. See Annex 2.4 for the construction of the explanatory variables and Annex Table 2.1.2 for the countries in the sample. All specifications include country and year fixed effects. Column (1) reports the baseline estimation results; column (2) reports the results after applying the logistic transformation to the dependent variable; column (3) reports the estimates from a seemingly unrelated regressions (SUR) estimation of a four-equation system (one for each group of workers); column (4) shows the results using the Beck and Katz (1995) estimator; column (5) reports the estimates with heteroscedasticity and autocorrelation consistent (HAC) standard errors, without the correction for cross-sectional dependence; column (6) shows the results with the Newey-West correction for the standard errors; column (7) shows the results based on a sample of five-year averages; column (8) reports the results dropping global financial crisis (GFC) years 2008 and 2009 from the sample; column (9) reports the coefficients when Czech Republic and Slovak Republic, which recently joined AEs, are added to the sample; column (10) shows the results when the lag of the output gap is replaced with the lag of the unemployment rate; and column (11) reports the median coefficient from a distribution of estimates obtained by dropping one country at a time from the sample. Driscoll-Kraay standard errors are reported in parentheses in columns (1), (2), (7)–(10); bootstrapped standard errors are reported in parentheses in column (3); HAC standard errors assuming a panel-dependent correlation structure are reported in column (4); HAC standard errors are reported in parentheses in column (5); and Newey-West corrected standard errors are reported in column (6). Column (11) reports the 10th and 90th percentile of the estimated coefficients in parentheses. ALMP = active labor market programs.

$^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

Annex Table 2.4.3. Drivers of Prime-Age Female (Ages 25–54) Labor Force Participation Rates: Robustness

	(1) Baseline	(2) Logistic Transformation	(3) SUR	(4) Beck and Katz	(5) HAC Standard Errors	(6) Newey-West Standard Errors	(7) Five-Year Averages	(8) Excluding GFC	(9) Including All AEs	(10) Replacing Output Gap with Unemployment Rate	(11) Dropping One Country at a Time
Lag of Output Gap	0.170*	0.008*	0.180***	0.114**	0.170***	0.170*	0.114	0.201*	0.119	–0.407**	0.167
	(0.092)	(0.004)	(0.052)	(0.050)	(0.056)	(0.095)	(0.223)	(0.098)	(0.072)	(0.151)	(0.139; 0.188)
Routinization × Relative Price	1.793***	0.072***	1.866***	1.245***	1.793***	1.793***	1.565***	1.720***	1.578***	1.692***	1.781
of Investment	(0.206)	(0.008)	(0.206)	(0.192)	(0.222)	(0.326)	(0.229)	(0.204)	(0.205)	(0.237)	(1.672; 1.914)
Lag of Trade Openness	0.010	0.000	0.016	0.009	0.010	0.010	0.013	0.022	–0.003	0.014	0.009
	(0.014)	(0.001)	(0.012)	(0.013)	(0.013)	(0.016)	(0.022)	(0.020)	(0.011)	(0.018)	(0.002; 0.02)
Relative Service Employment	0.015***	0.000*	0.015***	0.010*	0.015**	0.015**	0.017**	0.016***	0.020***	0.016***	0.015
	(0.005)	(0.000)	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)	(0.005)	(0.005)	(0.005)	(0.01; 0.019)
Lag of Urbanization	0.355***	0.021***	0.373***	0.313***	0.355***	0.355***	0.343***	0.372***	0.398***	0.341***	0.35
	(0.071)	(0.004)	(0.068)	(0.061)	(0.073)	(0.075)	(0.048)	(0.079)	(0.078)	(0.077)	(0.299; 0.393)
Education (percent secondary)	0.211***	0.010***	0.203***	0.247***	0.211***	0.211***	0.187***	0.215***	0.195***	0.221***	0.209
	(0.017)	(0.001)	(0.023)	(0.030)	(0.025)	(0.031)	(0.016)	(0.020)	(0.018)	(0.022)	(0.19; 0.236)
Education (percent tertiary)	0.332***	0.016***	0.268***	0.360***	0.332***	0.332***	0.249***	0.332***	0.319***	0.360***	0.333
	(0.030)	(0.001)	(0.038)	(0.048)	(0.042)	(0.053)	(0.049)	(0.035)	(0.031)	(0.042)	(0.285; 0.374)
Tax Wedge	–0.129***	–0.002	–0.134***	–0.095***	–0.129***	–0.129***	–0.141	–0.125***	–0.104***	–0.115***	–0.13
	(0.029)	(0.001)	(0.032)	(0.026)	(0.035)	(0.041)	(0.071)	(0.028)	(0.029)	(0.027)	(–0.158; –0.104)
Unemployment Replacement	–0.035	–0.003	–0.036	–0.028	–0.035	–0.035	0.044	–0.040	–0.030	–0.048	–0.034
Ratio	(0.033)	(0.002)	(0.025)	(0.021)	(0.026)	(0.033)	(0.095)	(0.035)	(0.033)	(0.034)	(–0.047; –0.025)
Public Spending on ALMP	0.039***	0.002***	0.040***	0.038***	0.039***	0.039***	0.022	0.038***	0.046***	0.042***	0.039
	(0.006)	(0.000)	(0.009)	(0.008)	(0.010)	(0.013)	(0.016)	(0.007)	(0.007)	(0.008)	(0.031; 0.042)
Restrictiveness of Migrant	–0.462***	–0.019***	–0.464***	–0.330***	–0.462***	–0.462***	–0.449***	–0.470***	–0.436***	–0.496***	–0.463
Integration Policies	(0.049)	(0.002)	(0.056)	(0.063)	(0.060)	(0.082)	(0.083)	(0.052)	(0.047)	(0.057)	(–0.491; –0.418)
Union Density	0.153***	0.004**	0.165***	0.084**	0.153***	0.153***	0.050	0.127**	0.156***	0.116**	0.151
	(0.044)	(0.002)	(0.033)	(0.041)	(0.036)	(0.047)	(0.094)	(0.046)	(0.042)	(0.046)	(0.114; 0.173)
Coordination of Wage Setting	0.701***	0.026**	0.675***	0.190	0.701***	0.701***	1.658**	0.640**	0.687***	0.603**	0.707
	(0.219)	(0.010)	(0.164)	(0.126)	(0.177)	(0.235)	(0.444)	(0.259)	(0.219)	(0.247)	(0.64; 0.771)
Public Spending on Early	3.708***	0.250***	3.423***	2.151***	3.708***	3.708***	5.855**	3.628***	3.670***	3.709***	3.699
Childhood Education and Care	(1.210)	(0.071)	(0.622)	(0.799)	(0.683)	(0.951)	(2.146)	(1.295)	(1.177)	(1.276)	(3.122; 4.285)
Share of Part-Time	0.946***	0.045***	0.932***	0.735***	0.946***	0.946***	0.982***	0.943***	1.021***	0.889***	0.956
Employment	(0.118)	(0.006)	(0.066)	(0.064)	(0.073)	(0.098)	(0.168)	(0.126)	(0.109)	(0.104)	(0.868; 0.994)
Job-Protected Maternity	0.025***	0.001***	0.026***	0.013	0.025***	0.025***	0.087***	0.024***	0.020***	0.025***	0.024
Leave	(0.006)	(0.000)	(0.007)	(0.009)	(0.008)	(0.009)	(0.011)	(0.006)	(0.007)	(0.006)	(0.021; 0.028)
Number of Observations	489	489	489	489	489	489	117	443	511	443	
Countries	23	23	23	23	23	23	23	23	25	23	
R^2	0.887	0.870		0.971	0.887	0.887	0.891	0.881	0.879	0.879	

Source: IMF staff calculations.

Note: The table presents results from estimation equation (2.3) with the participation rate of prime-age women (ages 25–54) as the dependent variable on a sample of 23 advanced economies (AEs) during 1980–2011 using annual data. See Annex 2.4 for the construction of the explanatory variables and Annex Table 2.1.2 for the countries in the sample. All specifications include country and year fixed effects. Column (1) reports the baseline estimation results; column (2) reports the results after applying the logistic transformation to the dependent variable; column (3) reports the estimates from a seemingly unrelated regressions (SUR) estimation of a four-equation system (one for each group of workers); column (4) shows the results using the Beck and Katz (1995) estimator; column (5) reports the estimates with heteroscedasticity and autocorrelation consistent (HAC) standard errors, without the correction for cross-sectional dependence; column (6) shows the results with the Newey-West correction for the standard errors; column (7) shows the results based on a sample of five-year averages; column (8) reports the results dropping global financial crisis (GFC) years 2008 and 2009 from the sample; column (9) reports the coefficients when Czech Republic and Slovak Republic, which recently joined AEs, are added to the sample; column (10) shows the results when the lag of the output gap is replaced with the lag of the unemployment rate; and column (11) reports the median coefficient from a distribution of estimates obtained by dropping one country at a time from the sample. Driscoll-Kraay standard errors are reported in parentheses in columns (1), (2), (7)–(10); bootstrapped standard errors are reported in parentheses in column (3); HAC standard errors assuming a panel-dependent correlation structure are reported in column (4); HAC standard errors are reported in parentheses in column (5); and Newey-West corrected standard errors are reported in column (6). Column (11) reports the 10th and 90th percentile of the estimated coefficients in parentheses. ALMP = active labor market programs.

* $p < .10$; ** $p < .05$; *** $p < .01$.

Annex Table 2.4.4. Drivers of Older Workers' (Ages 55 and over) Labor Force Participation Rates: Robustness

	(1) Baseline	(2) Logistic Transformation	(3) SUR	(4) Beck and Katz	(5) HAC Standard Errors	(6) Newey-West Standard Errors	(7) Five-Year Averages	(8) Excluding GFC	(9) Including All AEs	(10) Replacing Output Gap with Unemployment Rate	(11) Dropping One Country at a Time
Lag of Output Gap	–0.006	–0.000	0.009	0.025	–0.006	–0.006	0.178	0.003	0.000	–0.268***	–0.008
	(0.068)	(0.003)	(0.056)	(0.037)	(0.055)	(0.083)	(0.131)	(0.078)	(0.065)	(0.079)	(–0.045; 0.014)
Routinization × Relative Price	0.505*	0.009	1.038***	0.198	0.505***	0.505	0.473	0.468	0.742***	0.472	0.503
of Investment	(0.288)	(0.015)	(0.222)	(0.229)	(0.184)	(0.372)	(0.298)	(0.292)	(0.241)	(0.289)	(0.219; 0.593)
Lag of Trade Openness	–0.059***	–0.002***	–0.066***	–0.012	–0.059***	–0.059***	–0.051***	–0.063***	–0.045***	–0.063***	–0.06
	(0.009)	(0.000)	(0.013)	(0.008)	(0.013)	(0.014)	(0.013)	(0.015)	(0.012)	(0.013)	(–0.07; –0.044)
Relative Service Employment	0.009	0.001***	0.007	0.002	0.009	0.009	0.007	0.008	0.005	0.008	0.01
	(0.006)	(0.000)	(0.006)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.004; 0.014)
Lag of Urbanization	0.194	0.014**	–0.056	0.118	0.194***	0.194*	0.138	0.225*	0.189*	0.223*	0.194
	(0.115)	(0.007)	(0.084)	(0.092)	(0.064)	(0.114)	(0.172)	(0.127)	(0.111)	(0.126)	(0.095; 0.245)
Education (percent secondary)	0.038*	0.001	0.019	–0.016	0.038*	0.038	0.004	0.037*	0.053**	0.037*	0.036
	(0.021)	(0.001)	(0.021)	(0.021)	(0.020)	(0.027)	(0.043)	(0.022)	(0.020)	(0.022)	(0.016; 0.059)
Education (percent tertiary)	0.389***	0.018***	0.321***	0.260***	0.389***	0.389***	0.296**	0.384***	0.397***	0.386***	0.387
	(0.050)	(0.002)	(0.059)	(0.057)	(0.058)	(0.093)	(0.085)	(0.053)	(0.046)	(0.056)	(0.3; 0.44)
Tax Wedge	–0.263***	–0.012***	–0.185***	–0.062**	–0.263***	–0.263***	–0.332***	–0.255***	–0.245***	–0.255***	–0.268
	(0.037)	(0.002)	(0.035)	(0.029)	(0.032)	(0.049)	(0.070)	(0.039)	(0.040)	(0.040)	(–0.288; –0.208)
Unemployment Replacement	–0.081	–0.006**	–0.036	–0.039	–0.081***	–0.081*	–0.073	–0.051	–0.079	–0.051	–0.08
Ratio	(0.050)	(0.002)	(0.029)	(0.024)	(0.029)	(0.043)	(0.052)	(0.049)	(0.052)	(0.047)	(–0.088; –0.042)
Public Spending on ALMP	–0.025**	–0.001	–0.024**	–0.003	–0.025**	–0.025**	–0.039**	–0.026**	–0.027***	–0.027***	–0.025
	(0.009)	(0.001)	(0.010)	(0.008)	(0.010)	(0.012)	(0.012)	(0.010)	(0.010)	(0.009)	(–0.029; –0.018)
Restrictiveness of Migrant	0.056	0.001	0.131*	0.066	0.056	0.056	0.126	0.063	0.108	0.063	0.055
Integration Policies	(0.088)	(0.005)	(0.068)	(0.058)	(0.069)	(0.092)	(0.132)	(0.087)	(0.092)	(0.084)	(–0.024; 0.11)
Union Density	–0.115***	–0.006***	–0.126***	–0.118***	–0.115***	–0.115***	–0.077	–0.127***	–0.125***	–0.125***	–0.114
	(0.032)	(0.002)	(0.036)	(0.031)	(0.032)	(0.038)	(0.052)	(0.038)	(0.026)	(0.036)	(–0.146; –0.096)
Coordination of Wage Setting	0.040	0.010	–0.016	0.102	0.040	0.040	0.803*	0.109	0.106	0.088	0.029
	(0.222)	(0.011)	(0.185)	(0.078)	(0.173)	(0.214)	(0.363)	(0.239)	(0.231)	(0.246)	(–0.066; 0.111)
Statutory Retirement Age	0.661***	0.035***	0.677***	0.495**	0.661***	0.661**	0.505	0.591***	0.943***	0.594***	0.658
	(0.174)	(0.010)	(0.196)	(0.209)	(0.204)	(0.321)	(0.308)	(0.178)	(0.204)	(0.179)	(0.456; 0.815)
Public Spending on Old-Age	–0.750***	–0.038***	–0.597***	–0.306**	–0.750***	–0.750***	–0.873***	–0.826***	–0.596***	–0.840***	–0.749
Pension	(0.154)	(0.009)	(0.196)	(0.126)	(0.176)	(0.255)	(0.095)	(0.152)	(0.161)	(0.179)	(–0.839; –0.566)
Public Spending on Incapacity	-0.421	–0.025	–0.689**	–0.008	–0.421	–0.421	–0.659	–0.208	–0.320	–0.203	–0.426
	(0.562)	(0.031)	(0.348)	(0.300)	(0.295)	(0.404)	(0.831)	(0.586)	(0.570)	(0.584)	(–0.634; –0.163)
Number of Observations	568	568	489	568	568	568	132	522	589	522	
Countries	23	23	23	23	23	23	23	23	25	23	
R^2	0.686	0.681		0.925	0.686	0.686	0.737	0.665	0.690	0.666	

Source: IMF staff calculations.

Note: The table presents results from estimation equation (2.3) with the participation rate of older workers (ages 55 and older) as the dependent variable on a sample of 23 advanced economies (AEs) during 1980–2011 using annual data. See Annex 2.4 for the construction of the explanatory variables and Annex Table 2.1.2 for the countries in the sample. All specifications include country and year fixed effects. Column (1) reports the baseline estimation results; column (2) reports the results after applying the logistic transformation to the dependent variable; column (3) reports the estimates from a seemingly unrelated regressions (SUR) estimation of a four-equation system (one for each group of workers); column (4) shows the results using the Beck and Katz (1995) estimator; column (5) reports the estimates with heteroscedasticity and autocorrelation consistent (HAC) standard errors, without the correction for cross-sectional dependence; column (6) shows the results with the Newey-West correction for the standard errors; column (7) shows the results based on a sample of five-year averages; column (8) reports the results dropping global financial crisis (GFC) years 2008 and 2009 from the sample; column (9) reports the coefficients when Czech Republic and Slovak Republic, which recently joined AEs, are added to the sample; column (10) shows the results when the lag of the output gap is replaced with the lag of the unemployment rate; and column (11) reports the median coefficient from a distribution of estimates obtained by dropping one country at a time from the sample. Driscoll-Kraay standard errors are reported in parentheses in columns (1), (2), (7)–(10); bootstrapped standard errors are reported in parentheses in column (3); HAC standard errors assuming a panel-dependent correlation structure are reported in column (4); HAC standard errors are reported in parentheses in column (5); and Newey-West corrected standard errors are reported in column (6). Column (11) reports the 10th and 90th percentile of the estimated coefficients in parentheses. ALMP = active labor market programs.

* p < .10; ** p < .05; *** p < .01.

Annex Table 2.4.5. Drivers of Aggregate Labor Force Participation Rates: Robustness

	(1) Baseline	(2) Logistic Transformation	(3) Beck and Katz	(4) HAC Standard Errors	(5) Newey- West Standard Errors	(6) Five-year Averages	(7) Excluding GFC	(8) Including All AEs	(9) Replacing Output Gap with Unemployment rate	(10) Dropping One Country at a Time
Lag of Output Gap	0.183***	0.008***	0.090***	0.183***	0.183***	0.250**	0.193***	0.136***	–0.364***	0.182
	(0.044)	(0.002)	(0.025)	(0.036)	(0.042)	(0.096)	(0.045)	(0.039)	(0.037)	(0.143; 0.2)
Routinization x Relative Price	0.536***	0.022***	0.272**	0.536***	0.536***	0.552*	0.506***	0.653***	0.548***	0.533
of Investment	(0.175)	(0.007)	(0.120)	(0.118)	(0.138)	(0.247)	(0.167)	(0.156)	(0.153)	(0.459; 0.61)
Lag of Trade Openness	0.012*	0.000	0.003	0.012	0.012	0.016	0.020**	0.003	0.004	0.013
	(0.007)	(0.000)	(0.007)	(0.009)	(0.010)	(0.011)	(0.008)	(0.007)	(0.007)	(0.003; 0.016)
Relative Service Employment	0.010**	0.000**	0.002	0.010***	0.010**	0.016***	0.010**	0.013***	0.016***	0.011
	(0.004)	(0.000)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006; 0.012)
Lag of Urbanization	0.249***	0.011***	0.208***	0.249***	0.249***	0.240***	0.260***	0.257***	0.268***	0.25
	(0.047)	(0.002)	(0.042)	(0.039)	(0.071)	(0.047)	(0.056)	(0.045)	(0.063)	(0.202; 0.294)
Education (percent secondary)	0.063***	0.003***	0.018	0.063***	0.063***	0.058**	0.061***	0.062***	0.066***	0.064
	(0.017)	(0.001)	(0.014)	(0.015)	(0.017)	(0.017)	(0.019)	(0.016)	(0.017)	(0.047; 0.074)
Education (percent tertiary)	0.135***	0.006***	0.108***	0.135***	0.135***	0.121**	0.115***	0.136***	0.060**	0.134
	(0.031)	(0.001)	(0.027)	(0.032)	(0.035)	(0.034)	(0.029)	(0.031)	(0.026)	(0.119; 0.158)
Tax Wedge	–0.240***	–0.010***	–0.073***	–0.240***	–0.240***	–0.275***	–0.223***	–0.226***	–0.125***	–0.242
	(0.026)	(0.001)	(0.020)	(0.021)	(0.027)	(0.029)	(0.024)	(0.025)	(0.030)	(–0.253; –0.216)
Unemployment Replacement	–0.078***	–0.003***	–0.032**	–0.078***	–0.078***	–0.083*	–0.068**	–0.076***	–0.069***	–0.076
Ratio	(0.025)	(0.001)	(0.013)	(0.017)	(0.028)	(0.041)	(0.025)	(0.024)	(0.023)	(–0.085; –0.067)
Public Spending on ALMP	0.031***	0.001***	0.017***	0.031***	0.031***	0.034**	0.030***	0.033***	0.015*	0.031
	(0.007)	(0.000)	(0.006)	(0.006)	(0.009)	(0.013)	(0.007)	(0.007)	(0.008)	(0.024; 0.034)
Restrictiveness of Migrant	–0.207***	–0.008***	–0.084**	–0.207***	–0.207***	–0.245***	–0.191***	–0.198***	–0.230***	–0.211
Integration Policies	(0.049)	(0.002)	(0.038)	(0.040)	(0.070)	(0.055)	(0.054)	(0.047)	(0.052)	(–0.255; –0.184)
Union Density	–0.015	–0.001	–0.064***	–0.015	–0.015	0.021	–0.030	–0.007	–0.004	–0.016
	(0.025)	(0.001)	(0.018)	(0.021)	(0.031)	(0.024)	(0.025)	(0.023)	(0.022)	(–0.033; –0.001)
Coordination of Wage Setting	0.256**	0.011**	0.020	0.256**	0.256*	0.289	0.274**	0.238*	–0.027	0.26
	(0.120)	(0.005)	(0.065)	(0.112)	(0.148)	(0.302)	(0.108)	(0.121)	(0.115)	(0.203; 0.312)
Number of Observations	570	570	570	570	570	132	524	592	524	
Countries	23	23	23	23	23	23	23	25	23	
R^2	0.578	0.569	0.983	0.578	0.578	0.596	0.560	0.567	0.602	

Source: IMF staff calculations.
Note: The table presents results from estimation equation (2.3) with the participation rate of all workers (ages 15 and older) as the dependent variable on a sample of 23 advanced economies (AEs) during 1980–2011 using annual data. See Annex 2.4 for the construction of the explanatory variables and Annex Table 2.1.2 for the countries in the sample. All specifications include country and year fixed effects. Column (1) reports the baseline estimation results; column (2) reports the results after applying the logistic transformation to the dependent variable; column (3) shows the results using the Beck and Katz (1995) estimator; column (4) reports the estimates with heteroscedasticity and autocorrelation consistent (HAC) standard errors, without the correction for cross-sectional dependence; column (5) shows the results with the Newey-West correction for the standard errors; column (6) shows the results based on a sample of five-year averages; column (7) reports the results dropping global financial crisis (GFC) years 2008 and 2009 from the sample; column (8) reports the coefficients when Czech Republic and Slovak Republic, which recently joined AEs, are added to the sample; column (9) shows the results when the lag of the output gap is replaced with the lag of the unemployment rate; and column (10) reports the median coefficient from a distribution of estimates obtained by dropping one country at a time from the sample. Driscoll-Kraay standard errors are reported in parentheses in columns (1), (2), (6)–(9); HAC standard errors assuming a panel-dependent correlation structure are reported in column (3); HAC standard errors are reported in parentheses in column (4); and Newey-West corrected standard errors are reported in column (5). Column (10) reports the 10th and 90th percentile of the estimated coefficients in parentheses. ALMP = active labor market programs.
$^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

Annex 2.5. The Role of Individual and Household Characteristics: Micro-Level Analysis

The micro-level analysis relies on the European Union Labour Force Survey for 24 advanced economies during 2000–16. It estimates logit models on a random sample of 10,000 people per country per year. The dependent variable is a dummy variable indicating whether someone is in or out of the labor force.[54]

Explanatory variables include age; gender (for the 55 and older group); and whether the person was born in the country or abroad, whether the person lives in an urban or rural area, and the person's highest level of education completed (lower secondary, upper secondary, or tertiary). The regressions also control for measures of family composition: the number of children; other employed adults in the household; and whether the individual lives in a household of a single adult without children (the baseline category), a single adult with children, or a couple with or without children. Finally, regressions control for the routinization score of an individual's current occupation (if currently employed) or last occupation (if currently unemployed or inactive). Country, region, and year fixed effects are included. Results are robust if interacted country-year fixed effects are included instead. Standard errors are clustered at the country-year level.

The baseline specification does not control for income due to data limitations (Annex Table 2.5.1, columns 1–3). However, results are broadly robust to controlling for the income decile of employed individuals and the predicted income decile (based on age, gender, education, location, immigration status, and sector and occupation of last employment) for unemployed or inactive people (for whom income information is not available). Once a (predicted) income decile is included, the effect on women's participation of being part of a couple and having children turns positive, the effect of other employed adults in the household turns negative, and income itself has a negative effect (Annex Table 2.5.1, columns 4–6). This suggests that individuals in upper deciles may be able to afford to drop out of the labor force. The results on vulnerability to routinization and education are very similar to those in the baseline.

[54]Main labor force status is coded as *employed* (if a person has a job or profession, including unpaid work for a family business, apprenticeship, or paid traineeship), *unemployed*, or *out of the labor force* (including people who are students, retired, permanently disabled, in compulsory military service, fulfilling domestic tasks, and otherwise inactive). This coding is assigned based on respondents' answers about their activity during the reference week.

Annex 2.6. Prospects for Labor Force Participation: Cohort-Based Analysis

The cohort-based analysis relies on Organisation for Economic Co-operation and Development data on participation rates for a balanced sample of 17 advanced economies during 1985–2016. It estimates a system of 11 seemingly unrelated regressions (one for each age group) for each country, and separately for men and women, of the following form:

$$LFP_t^{a,g} = \alpha^{a,g} + \frac{1}{n_g}\sum_{t-g}^{T} \beta^{a,g} C_{t-g}^{a} + \lambda^{a,g} X_t + \varepsilon_t^{a,g}, \quad (2.5)$$

in which $\alpha^{a,g}$ is a gender- and age-specific constant; C_{t-g}^{a} is a set of birth cohort- and gender-specific dummy variables, which take the value 1 if the birth cohort $t - g$ appears in the age group g in year t; $\beta^{a,g}$ is a gender- and birth-year-specific fixed effect (that is, the cohort effect), which is divided by the number of birth cohorts in the age group n_g; X_t is the output gap; and $\lambda^{a,g}$ is a coefficient on the output gap that varies by gender and age group.[55] Within each gender group and country, the coefficient for each birth cohort $\beta^{a,g}$ is constrained to be the same across equations. In addition, each birth cohort appears in at least two equations, which implies that the sample covers cohorts born between 1925 and 1994.

A series of tests ensures that the results are broadly robust to the application of a logistic transformation to the dependent variable, replacing the output gap with the unemployment rate, and dropping more birth cohorts at the end of the sample.

Age-group-specific trend labor force participation rates are obtained as the predicted values of the cohort-based model estimates, assuming a zero output gap. The aggregate trend labor force participation rate is calculated as the three-year moving average of the age group's specific trend labor force participation rates multiplied by its population share.

Projected scenarios for trend labor force participation rely on the United Nations World Population Prospects data, under the assumptions of medium fertility and migration flows and policies based on historical trends. Projections assume no effects from new cohorts entering the labor force. Three illustrative scenarios are built on the following assumptions. The first assumes that for people of prime age (25–54), women's participation rates gradually

[55]For example, in 1985, the birth cohort dummy variable for those born between 1970 and 1974 takes the value 1 for the equation of the 15–19 age group.

Annex Table 2.5.1. Determinants of Being in the Labor Force

	(1) Men, Ages 25–54	(2) Women, Ages 25–54	(3) All, Ages 55+	(4) Men, Ages 25–54	(5) Women, Ages 25–54	(6) All, Ages 55+
Age	1.158***	1.320***	1.396***	1.261***	1.347***	1.356***
	(0.011)	(0.014)	(0.113)	(0.018)	(0.021)	(0.151)
Age Squared	0.998***	0.997***	0.998***	0.997***	0.997***	0.998***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Male			1.196***			1.539***
			(0.031)			(0.046)
Upper Secondary Education	1.719***	1.709***	1.209***	1.737***	1.855***	1.102**
	(0.032)	(0.033)	(0.036)	(0.056)	(0.060)	(0.046)
Tertiary Education	2.759***	2.961***	1.594***	2.217***	2.763***	1.240***
	(0.082)	(0.077)	(0.059)	(0.097)	(0.115)	(0.063)
Born in Country	1.489***	1.333***	1.091**	1.761***	1.520***	1.167**
	(0.035)	(0.024)	(0.046)	(0.051)	(0.050)	(0.075)
Urban	1.008	1.024*	1.019	0.896***	0.864***	0.866***
	(0.019)	(0.013)	(0.027)	(0.027)	(0.022)	(0.037)
Number of Children in Household	1.049***	0.816***	0.960*	1.094***	0.869***	1.039
	(0.009)	(0.007)	(0.020)	(0.012)	(0.012)	(0.035)
One Adult with Children	1.042	0.846***	1.785***	1.045	0.846***	1.217
	(0.059)	(0.026)	(0.394)	(0.087)	(0.039)	(0.330)
Couple without Children	1.356***	0.906***	0.842***	1.757***	1.741***	1.161***
	(0.035)	(0.034)	(0.025)	(0.083)	(0.128)	(0.051)
Couple with Children	1.726***	0.757***	1.446***	2.141***	1.248***	2.429***
	(0.052)	(0.028)	(0.128)	(0.114)	(0.088)	(0.350)
Other Household Structure	0.937**	0.868***	0.812***	1.212***	1.334***	1.726***
	(0.027)	(0.030)	(0.038)	(0.063)	(0.092)	(0.138)
Other Employed Adult(s) in Household	1.497***	1.152***	1.703***	0.992	0.601***	0.636***
	(0.035)	(0.038)	(0.091)	(0.043)	(0.046)	(0.079)
Routinization Score of Occupation	0.825***	0.900***	0.716***	0.467***	0.490***	0.488***
	(0.011)	(0.010)	(0.013)	(0.012)	(0.012)	(0.016)
Lagged Output Gap	1.037***	1.023***	1.031***	1.042***	1.030***	1.037***
	(0.006)	(0.004)	(0.007)	(0.008)	(0.008)	(0.012)
Predicted Income Decile[1]				0.952***	0.950***	0.952***
				(0.001)	(0.001)	(0.002)
Number of Observations	491,820	474,240	86,441	474,434	443,687	63,982

Source: IMF staff calculations.
Note: Logit regressions are based on a random sample of 10,000 respondents per country per year of 19 countries, exponentiated coefficients. All specifications include country, region, and year fixed effects. The base category for education is "up to lower secondary education." For family composition the base category is "one adult without children." Standard errors clustered at the country-year level.
* $p < .10$; ** $p < .05$; *** $p < .01$.
[1]Predicted income decile uses the actual income decile for those currently employed and predicts the income decile for those currently unemployed/inactive using age, gender, education, migration status, location, sector, and occupation; and country, region, and year fixed effects.

converge to those of men over the next 20 years. The second scenario assumes that the participation rate of those ages 55–59 converges to the rate of the 50–54 age group over the next 20 years and that the rate for the 60–64 age group becomes the same as for the 50–54 age group over the next 40 years. The third scenario assumes that policies converge to the best possible levels, defined as the 90th (or 10th) percentile of the level observed among advanced economies, over the next 20 years. The impact is then simulated using the coefficients estimated in the cross-country empirical model.

References

Aaronson, Stephanie, Tomaz Cajner, Bruce Fallick, Felix Galbis-Reig, Christopher Smith, and William Wascher. 2014. "Labor Force Participation: Recent Developments and Future Prospects." *Brookings Papers on Economic Activity* 45 (2): 197–275.

Aaronson, Stephanie, Bruce Fallick, Andrew Figure, Jonathan Pingle, and William Wascher. 2006. "The Recent Decline in the Labor Force Participation Rate and Its Implications for Potential Labor Supply." *Brookings Papers on Economic Activity* 37 (1): 69–154.

Abraham, Katharine, and Melissa Kearney. 2018. "Explaining the Decline in the US Employment-to-Population Ratio:

A Review of the Evidence." NBER Working Paper 24333, National Bureau of Economic Research, Cambridge, MA.

Acemoglu, Daron, and David Autor. 2011. "Skills, Tasks and Technologies: Implications for Employment and Earnings." In *Handbook of Labor Economics,* edited by Orley Ashenfelter and David Card. 4: 1043–171. Amsterdam: Elsevier.

Acemoglu, Daron, and Pascual Restrepo. 2017. "Robots and Jobs: Evidence from US Labor Markets." NBER Working Paper 23285, National Bureau of Economic Research, Cambridge, MA.

Aguiar, Mark, Mark Bils, Kerwin Kofi Charles, and Erik Hurst. 2017. "Leisure Luxuries and the Labor Supply of Young Men." NBER Working Paper 23552, National Bureau of Economic Research, Cambridge, MA.

Ahn, Jaebin, Zidong An, John Bluedorn, Gabriele Ciminelli, Zsóka Kóczán, Davide Malacrino, Daniela Muhaj, and Patricia Neidlinger. Forthcoming. "Youth Labor Markets in Emerging Market and Developing Economies: Drivers and Policies." IMF Staff Discussion Note, International Monetary Fund, Washington, DC.

Aiyar, Shekhar, Bergljot Barkbu, Nicoletta Batini, Helge Berger, Enrica Detragiache, Allan Dizioli, Christian Ebeke, Huidan Lin, Linda Kaltani, Sebastian Sosa, Antonio Spilimbergo, and Petia Topalova. 2016. "The Refugee Surge in Europe: Economic Challenges." IMF Staff Discussion Note 16/02, International Monetary Fund, Washington, DC.

Alesina, Alberto, Johann Harnoss, and Hillel Rapoport. 2015. "Birthplace Diversity and Economic Prosperity." NBER Working Paper 18699, National Bureau of Economic Research, Cambridge, MA.

Arulampalam, Wiji, Alison Booth, and Mark Taylor. 2000. "Unemployment Persistence." *Oxford Economic Papers* 52 (1): 24–50.

Arulampalam, Wiji, Paul Gregg, and Mary Gregory. 2001. "Unemployment Scarring." *The Economic Journal* 111 (475): 577–84.

Autor, David, and David Dorn. 2013. "The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market." *American Economic Review* 103 (5): 1553–97.

Autor, David, David Dorn, and Gordon Hanson. 2016. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." *American Economic Review* 103 (6): 2121–68.

Balakrishnan, Ravi, Mai Dao, Juan Solé, and Jeremy Zook. 2015. "Recent US Labor Force Dynamics: Reversible or Not?" IMF Working Paper 15/76, International Monetary Fund, Washington, DC.

Balleer, Almut, Ramon Gómez-Salvador, and Jarkko Turunen. 2014. "Labor Force Participation across Europe: A Cohort-Based Analysis." *Empirical Economics* 46: 1385–415.

Banerji, Angana, Huidan Lin, and Sergejs Saksonovs. 2015. "Youth Unemployment in Advanced Europe: Okun's Law and Beyond." IMF Working Paper 15/5, International Monetary Fund, Washington, DC.

Baron-Cohen, Simon, Rebecca Knickmeyer, and Matthew Belmonte. 2005. "Sex Differences in the Brain: Implications for Explaining Autism." *Science* 310 (4): 819–23.

Bassanini, Andrea, and Romain Duval. 2006. "Employment Patterns in OECD Countries: Reassessing the Role of Policies and Institutions." OECD Economic Department Working Paper 486, Organisation for Economic Co-operation and Development, Paris.

———. 2009. "Unemployment, Institutions, and Reform Complementarities: Reassessing the Aggregate Evidence for OECD Countries." *Oxford Review of Economic Policy* 25 (1): 40–59.

Beck, Nathaniel, and Jonathan Katz. 1995. "What to Do (and Not to Do) with Time-Series Cross-Section Data." *American Political Science Review* 89 (3): 634–47.

Bertola, Giuseppe, Francine Blau, and Lawrence Kahn. 2007. "Labor Market Institutions and Demographic Employment Patterns." *Journal of Population Economics* 20 (4): 833–67.

Betcherman, Gordon. 2012. "Labor Market Institutions: A Review of the Literature." World Bank Policy Research Working Paper 6276, World Bank, Washington, DC.

Blagrave, Patrick, and Marika Santoro. 2017. "Labor Force Participation in Chile: Recent Trends, Drivers, and Prospects." IMF Working Paper 17/54, International Monetary Fund, Washington, DC.

Blanchard, Olivier, and Justin Wolfers. 2000. "The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence." *Economic Journal* 110 (462): C1–33.

Blau, David, and Ryan Goodstein. 2008. "Can Social Security Explain Trends in Labor Force Participation of Older Men in the United States?" *Journal of Human Resources* 45 (2): 328–63.

Blau, Francine, and Lawrence Kahn. 2013. "Female Labor Supply: Why Is the US Falling Behind?" *American Economic Review* 103 (3): 251–56.

Blöndal, Sveinbjörn, and Stefano Scarpetta. 1999. "The Retirement Decision in OECD Countries." OECD Economics Department Working Paper 202, Organisation for Economic Co-operation and Development, Paris.

Bloom, David, Somnath Chatterji, Paul Kowal, Peter Lloyd-Sherlock, Martin McKee, Bernd Rechel, Larry Rosenberg, and James Smith. 2015. "Macroeconomic Implications of Population Ageing and Selected Policy Responses." *The Lancet* 385: 649–57.

Blundell, Richard, Eric French, and Gemma Tetlow. 2016. "Retirement Incentives and Labor Supply." In *Handbook of the Economics of Population Aging,* edited by John Piggott and Alan Woodland. 1: 457–566. Amsterdam: Elsevier.

Blundell, Richard, and Thomas Macurdy. 1999. "Labor Supply: A Review of Alternative Approaches." In *Handbook of Labor Economics*, edited by Orley C. Ashenfelter and David Card. 3A: 1559–695. Amsterdam: Elsevier.

Börsch-Supan, Axel, and Irene Ferrari. 2017. "Old-Age Labor Force Participation in Germany: What Explains the Trend

Reversal among Older Men? And What the Steady Increase Among Women?" NBER Working Paper 24044, National Bureau of Economic Research, Cambridge, MA.

Burniaux, Jean-Marc, Romain Duval, and Florence Jaumotte. 2004. "Coping with Aging: A Dynamic Approach to Quantify the Impact of Alternative Policy Options for Future Labor Supply in OECD Countries." OECD Economics Department Working Paper 371, Organisation for Economic Co-operation and Development, Paris.

Calvo, Esteban. 2006. "Does Working Longer Make People Healthier and Happier?" Work Opportunities for Older Americans Series 2. Center for Retirement Research, Chestnut Hill, MA.

Canon, Maria, Marianna Kudlyak, and Yang Liu. 2015. "Youth Labor Force Participation Continues to Fall, but It Might Be for a Good Reason." *Regional Economist* (January).

Card, David. 1990. "The Impact of the Mariel Boatlift on the Miami Labor Market." *Industrial and Labor Relations Review* 43 (2): 245–57.

Card, David, Jochen Kluve, and Andrea Weber. 2010. "Active Labour Market Policy Evaluations: A Meta-Analysis." *Economic Journal* 120 (548): F452–F477.

Carrasco, Raquel, Juan F. Jimeno, and A. Carolina Ortega. 2008. "The Effect of Immigration on the Labor Market Performance of Native-Born Workers: Some Evidence for Spain." *Journal of Population Economics* 21 (3): 627–48.

Case, Anne, and Angus Deaton. 2017. "Mortality and Morbidity in the 21st Century." *Brookings Papers on Economic Activity* (Spring): 397–476.

Cattaneo, Cristina, Carlo V. Fiorio, and Giovanni Peri. 2015. "What Happens to the Careers of European Workers when Immigrants 'Take Their Jobs'?" *Journal of Human Resources* 50 (3): 655–93.

Centre for Cities. 2018. "Cities Outlook 2018." London.

Christiansen, Lone, Huidan Lin, Joana Pereira, Petia Topalova, and Rima Turk. 2016a. "Gender Diversity in Senior Positions and Firm Performance: Evidence from Europe." IMF Working Paper 16/50, International Monetary Fund, Washington, DC.

———. 2016b. "Individual Choice or Policies? Drivers of Female Employment in Europe." IMF Working Paper 16/49, International Monetary Fund, Washington, DC.

Cipollone, Angela, Eleonora Patacchini, and Giovanna Vallanti. 2013. "Women Labor Market Participation in Europe: Novel Evidence on Trends and Shaping Factors." IZA Discussion Paper 7710, IZA Institute of Labor Economics, Bonn, Germany.

Clements, Benedict, Kamil Dybczak, Vitor Gaspar, Sanjeev Gupta, and Mauricio Soto. 2015. "The Fiscal Consequences of Shrinking Population." IMF Staff Discussion Note 15/21, International Monetary Fund, Washington, DC.

Cohen, Sheldon. 2004. "Social Relationships and Health." *American Psychologist* 59 (8): 676–84.

Cortes, Guido Matias, Nir Jaimovich, and Henry E. Siu. 2018. "The End of Men and Rise of Women in the High-Skilled Labor Market." NBER Working Paper 24274, National Bureau of Economic Research, Cambridge, MA.

Council of Economic Advisers. 2014. "The Labor Force Participation Rate since 2007: Causes and Policy Implications." Executive Office of the President of the United States, July.

———. 2016. "The Long-Term Decline in Prime-Age Male Labor Force Participation." Executive Office of the President of the United States, June.

D'Amuri, Francesco, and Giovanni Peri. 2014. "Immigration, Jobs, and Employment Protection: Evidence from Europe before and during the Great Recession." *Journal of the European Economic Association* 12 (2): 432–64.

Dao, Mai, Mitali Das, Zsóka Kóczán, and Weicheng Lian. 2017. "Why Is Labor Receiving a Smaller Share of Global Income? Theory and Empirical Evidence." IMF Working Paper 17/169, International Monetary Fund, Washington, DC.

Dao, Mai, Davide Furceri, Jisoo Hwang, Meeyeon Kim, and Tae-Jeong Kim. 2014. "Strategies for Reforming Korea's Labor Market to Foster Growth." IMF Working Paper 14/137, International Monetary Fund, Washington, DC.

Dao, Mai, Davide Furceri, and Prakash Loungani. 2014. "Regional Labor Market Adjustments in the United States and Europe." IMF Working Paper 14/26, International Monetary Fund, Washington, DC.

Das, Mitali, and Benjamin Hilgenstock. Forthcoming. "Labor Market Consequences of Routinization in Developed and Developing Economies." IMF Working Paper, International Monetary Fund, Washington, DC.

Dauth, Wolfgang, Sebastian Findeisen, and Jens Suedekum. 2014. "The Rise of the East and the Far East: German Labor Markets and Trade Integration." *Journal of the European Economic Association* 12 (6): 1643–75.

de Haas, Hein, Katharina Natter, and Simona Vezzoli. 2014. "Compiling and Coding Migration Policies. Insights from the DEMIG POLICY Database." International Migration Institute Working Paper 87, Oxford, United Kingdom.

de Serres, Alain, Fabrice Murtin, and Christine Maisonneuve. 2012. "Policies to Facilitate the Return to Work." *Comparative Economic Studies* 54: 5–42.

Driscoll, John, and Aart Kraay. 1998. "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data." *Review of Economics and Statistics* 80 (4): 549–60.

Duval, Romain. 2004. "Retirement Behaviour in OECD Countries: Impact of Old-Age Pension Schemes and Other Social Transfer Programmes." *OECD Economic Studies* 2003 (2): 7–50.

Duval, Romain, Mehmet Eris, and Davide Furceri. 2011. "The Effects of Downturns on Labour Force Participation: Evidence and Causes." Economics Department Working Paper 875, Organisation for Economic Co-operation and Development, Paris.

Eberstadt, Nicholas. 2016. *Men without Work: America's Invisible Crisis.* West Conshohocken, PA: Templeton Press.

Elborgh-Woytek, Katrin, Monique Newiak, Kalpana Kochhar, Stefania Fabrizio, Kangni Kpodar, Philippe Wingender, Benedict Clements, and Gerd Schwartz. 2013. "Women, Work and the Economy: Macroeconomic Gains from Gender Equity." IMF Staff Discussion Note 13/10, International Monetary Fund, Washington, DC.

Eliason, Marcus, and Donald Storrie. 2009. "Does Job Loss Shorten Life?" *The Journal of Human Resources* 44 (2): 277–302.

Elsby, Michael, Bart Hobijn, and Aysegül Sahin. 2015. "On the Importance of the Participation Margin for Labor Market Fluctuations." *Journal of Monetary Policy* 72: 64–82.

Erceg, Christopher, and Andrew Levin. 2014. "Labor Force Participation and Monetary Policy in the Wake of the Great Recession." *Journal of Money, Credit and Banking* 46: 3–49.

Erikson, Erik, Joan Erikson, and Helen Kivnick. 1986. *Vital Involvement in Old Age*. New York: Norton.

European Commission (EC). 2017. "Technical Note: Summary Methodology of the 2015-based Population Projections." Annex to Eurostat Metadata. Luxembourg.

Euwals, Rob, Marike Knoef, and Daniel van Vuuren. 2011. "The Trend in Female Labour Force Participation: What Can Be Expected for the Future?" *Empirical Economics* 40: 729–53.

Fallick, Bruce, and Jonathan Pingle. 2007. "A Cohort-Based Model of Labor Force Participation." Finance and Economics Discussion Series 2007–9, Federal Reserve Board, Washington, DC.

Farré, Lidia, Libertad González, and Francesc Ortega. 2011. "Immigration, Family Responsibility and the Labor Supply of Skilled Native Women." *B.E. Journal of Economic Analysis & Policy* 11 (1): Article 34.

Feingold, Alan. 1994. "Gender Differences in Personality: A Meta-Analysis." *Psychological Bulletin* 116 (3): 429–56.

Fernandez, Raquel. 2013. "Cultural Change as Learning: The Evolution of Female Labor Force Participation over a Century." *American Economic Review* 103 (1): 472–500.

Fitzenberger, Bernd, and Gaby Wunderlich. 2004. "The Changing Life Cycle Pattern in Female Employment: A Comparison of Germany and the UK." *Scottish Journal of Political Economy* 51 (3): 302–28.

Foged, Mette, and Giovanni Peri. 2015. "Immigrants' Effect on Native Workers: New Analysis on Longitudinal Data." IZA Discussion Paper 8961, IZA Institute of Labor Economics, Bonn, Germany.

Frees, Edward. 1995. "Assessing Cross-Sectional Correlations in Panel Data." *Journal of Econometrics* 69 (2): 393–414.

Friedman, Milton. 1937. "The Use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance." *Journal of the American Statistical Association* 32 (200): 675–701.

Gal, Peter, and Adam Theising. 2015. "The Macroeconomic Impact of Policies on Labour Market Outcomes in OECD Countries: A Reassessment." OECD Economics Department Working Paper 1271, Organisation for Economic Co-operation and Development, Paris.

Galor, Oded, and David N. Weil. 1996. "The Gender Gap, Fertility, and Growth." *American Economic Review* 86 (3): 374–87.

Genda, Yuji, Ayako Kondo, and Souichi Ohta. 2010. "Long-Term Effects of a Recession at Labor Market Entry in Japan and the United States." *Journal of Human Resources* 45 (1): 157–96.

Genre, Veronique, Ramon Gómez-Salvador, and Ana Lamo. 2005. "The Determinants of Labour Force Participation in the European Union." In *Labour Supply and Incentives to Work in Europe,* edited by Ramon Gómez-Salvador, Ana Lamo, Barbara Petrongolo, Melanie Ward, and Etienne Wasmer. Cheltenham, United Kingdom, and Northampton, MA: Edward Elgar.

———. 2010. "European Women: Why Do(n't) They Work?" *Applied Economics* 42 (12): 1499–514.

Gerdtham, Ulf-G, and Magnus Johannesson. 2003. "A Note on the Effect of Unemployment on Mortality." *Journal of Health Economics* 22 (3): 505–18.

Goldin, Claudia. 2006. "The Quiet Revolution That Transformed Women's Employment, Education, and Family." *American Economic Review* 96 (2): 1–21.

Gonzales, Christian, Sonali Jain-Chandra, Kalpana Kochhar, and Monique Newiak. 2015a. "Fair Play: More Equal Laws Boost Female Labor Force Participation." IMF Staff Discussion Note 15/02, International Monetary Fund, Washington, DC.

Gonzales, Christian, Sonali Jain-Chandra, Kalpana Kochhar, Monique Newiak, and Tlek Zeinullayev. 2015b. "Catalyst for Change: Empowering Women and Tackling Income Inequality." IMF Staff Discussion Note 15/20, International Monetary Fund, Washington, DC.

Goos, Maarten, Alan Manning, and Anna Salomons. 2014. "Explaining Job Polarization: Routine-Biased Technological Change and Offshoring." *American Economic Review* 104 (8): 2509–26.

Gourinchas, Pierre-Olivier, and Maurice Obstfeld. 2012. "Stories of the Twentieth Century for the Twenty-First." *American Economic Journal: Macroeconomics* 4 (1): 226–65.

Grigoli, Francesco, Alexander Herman, Andrew Swiston, and Gabriel Di Bella. 2015. "Output Gap Uncertainty and Real-Time Monetary Policy." *Russian Journal of Economics* 1 (4): 329–58.

Grigoli, Francesco, and Adrian Robles. 2017. "Inequality Overhang." IMF Working Paper 17/76, International Monetary Fund, Washington, DC.

Gruber, Jonathan, and David Wise. 1999. *Social Security and Retirement around the World*. Chicago: University of Chicago Press.

Hall, Robert. 2015. "Quantifying the Lasting Harm to the US Economy from the Financial Crisis." In *NBER Macroeconomics Annual 2014,* edited by Jonathan Parker and Michael Woodford. 29: 71–128. Chicago: University of Chicago Press.

Heckman, James, Robert Lalonde, and Jeffrey Smith. 1999. "The Economic and Econometrics of Active Labor Market Programs." In *Handbook of Labor Economics,* edited by Orley Ashenfelter and David Card. 3: 1865–2097. Amsterdam: Elsevier.

Holzer, Harry, Paul Offner, and Elaine Sorensen. 2005. "Declining Employment among Young Black Less-Educated Men: The Role of Incarceration and Child Support." *Journal of Policy Analysis and Management* 24 (2): 329–50.

Hunt, Jennifer, and Marjolaine Gauthier-Loiselle. 2010. "How Much Does Immigration Boost Innovation?" *American Economic Journal: Macroeconomics* 2 (2): 31–56.

Hurt, Muchale, and Susann Rohwedder. 2011. "Trends in Labor Force Participation: How Much Is Due to Changes in Pensions?" *Journal of Population Ageing* 4 (1–2): 81–96.

International Monetary Fund (IMF). 2015. "International Migration: Recent Trends, Economic Impacts, and Policy Implications." Staff Background Paper for G20 Surveillance Note. Washington, DC.

IMF, World Bank, and World Trade Organization (IMF/WB/WTO). 2017. "Making Trade an Engine of Growth for All: The Case for Trade and for Policies to Facilitate Adjustment." Policy Papers for Discussion at the Meeting of G20 Sherpas, March 23–24, Frankfurt.

Janssen, Simon. 2018. "The Decentralization of Wage Bargaining and Income Losses after Worker Displacement." *Journal of the European Economic Association* 16 (1): 77–122.

Jaumotte, Florence. 2003. "Female Labour Force Participation: Past Trends and Main Determinants in OECD Countries." Economics Department Working Paper 376, Organisation for Economic Co-operation and Development, Paris.

Jaumotte, Florence, Ksenia Koloskova, and Sweta Saxena. 2016. "Impact of Migration on Income Levels in Advanced Economies." Spillover Note 8, International Monetary Fund, Washington, DC.

Kahn, Lisa. 2010. "The Long-Term Labor Market Consequences of Graduating College in a Bad Economy." *Labour Economics* 17 (2): 303–16.

Kazandjian, Romina, Lisa Kolovich, Kalpana Kochhar, and Monique Newiak. 2016. "Gender Equality and Economic Diversification." IMF Working Paper 16/140, International Monetary Fund, Washington, DC.

Knabe, Andrea, and Steffen Ratzel. 2011. "Scarring or Scaring? The Psychological Impact of Past Unemployment and Future Unemployment Risk." *Economica* 78 (310): 283–93.

Krause, Eleanor, and Isabel Sawhill. 2017. "What We Know and Don't Know about Declining Labor Force Participation: A Review." Brookings Institution, Washington, DC.

Krueger, Alan. 2017. "Where Have All the Workers Gone? An Inquiry into the Decline in the US Labor Force Participation Rate." *Brooking Papers on Economic Activity* (September).

Lee, Jong-Wha, and Hanol Lee. 2016. "Human Capital in the Long Run." *Journal of Development Economics* 122: 147–169.

Lucas, Richard, Andrew Clark, Yannis Georgellis, and Ed Diener. 2004. "Unemployment Alters the Set Point for Life Satisfaction." *Psychological Science* 15 (1): 8–13.

Miani, Celine, and Stijn Hoorens. 2014. "Parents at Work: Men and Women Participating in the Labour Force." Rand Europe, Short Statistical Report No. 2. https://www.rand.org/pubs/research_reports/RR348.html

Minnesota Population Center. 2017. Integrated Public Use Microdata Series, International: Version 6.5, various data sets. Minneapolis: University of Minnesota. http://doi.org/10.18128/D020.V6.5.

Murtin, Fabrice, Alain de Serres, and Alexander Hijzen. 2014. "Unemployment and the Coverage Extension of Collective Wage Agreements." *European Economic Review* 71: 52–66.

Ngai, L. Rachel, and Barbara Petrongolo. 2017. "Gender Gaps and the Rise of the Service Economy." *American Economic Journal: Macroeconomics* 9 (4): 1–44.

Nickell, Stephen. 1981. "Biases in Dynamic Models with Fixed Effects." *Econometrica* 49 (6): 1417–426.

Olivetti, Claudia, and Barbara Petrongolo. 2016. "The Evolution of Gender Gaps in Industrialized Countries." *Annual Review of Economics* 8: 405–34.

———. 2017. "The Economic Consequences of Family Policies: Lessons from a Century of Legislation in High-Income Countries." *Journal of Economic Perspectives* 31 (1): 205–30.

Oreopoulos, Philip, Till von Wachter, and Andrew Heisz. 2012. "The Short- and Long-Term Career Effects of Graduating in a Recession." *American Economic Journal: Applied Economics* 4 (1): 1–29.

Organisation for Economic Co-operation and Development (OECD). 2001. *Aging and Income. Financial Resources and Retirement in 9 OECD Countries*. Paris.

————. 2004 "Employment Protection Regulation and Labour Market Performance." OECD Employment Outlook 2004, Chapter 2: 61–126. Paris.

————. 2010 "Institutional and Policy Determinants of Labour Market Flows." OECD Employment Outlook 2010, Chapter 3: 167–210. Paris.

Ortega, Francesc, and Giovanni Peri. 2014. "Openness and Income: The Role of Trade and Migration." *Journal of International Economics* 92: 231–51.

Pager, Devah, Bruce Western, and Naomi Sugie. 2009. "Sequencing Disadvantage: Barriers to Employment Facing Young Black and White Men with Criminal Records." *Annals of the American Academy of Political and Social Sciences* 623 (May): 195–213.

Peri, Giovanni. 2014. "Do Immigrant Workers Depress the Wages of Native Workers?" *IZA World of Labor* 2014: 42.

Peri, Giovanni, Kevin Shih, and Chad Sparber. 2015. "STEM Workers, H-1B Visas, and Productivity in US Cities." *Journal of Labor Economics* 33 (3): S225–55.

Peri, Giovanni, and Chad Sparber. 2009. "Task Specialization, Immigration, and Wages." *American Economic Journal: Applied Economics* 1 (3): 135–69.

Pesaran, M. H. 2004. "General Diagnostic Tests for Cross Section Dependence in Panels." Cambridge Working Papers in Economics 0435, University of Cambridge.

Rendall, Michelle. 2017. "Brain versus Brawn: The Realization of Women's Comparative Advantage." IEW Working Papers 491, University of Zurich.

Sahay, Ratna, Martin Čihák, Papa N'Diaye, Adolfo Barajas, Annette Kyobe, Srobona Mitra, Yen Nian Mooi, and Seyed

Reza Yousefi. 2017. “Banking on Women Leaders: A Case for More?” IMF Working Paper 17/199, International Monetary Fund, Washington, DC.

Salomon, Joshua, Haidong Wang, Michael Freeman, Theo Vos, Abraham Flaxman, Alan Lopez, and Christopher Murray. 2012. “Healthy Life Expectancy for 187 Countries, 1990–2010: A Systematic Analysis for the Global Burden Disease Study 2010.” *The Lancet* 380: 2144–62.

Sanchez, Thomas, Qing Shen, and Zhong-Ren Peng. 2004. “Transit Mobility, Jobs Access and Low-Income Labour Participation in US Metropolitan Areas.” *Urban Studies* 41 (7): 1313–31.

Schmitt, John, and Kris Warner. 2010. “Ex-Offenders and the Labor Market.” CEPR Issue Brief, Center for Economic and Policy Research, Washington, DC.

Soskice, David. 1990. “Wage Determination: The Changing Role of Institutions in Advanced Industrialized Countries.” *Oxford Review of Economic Policy* 6 (4): 36–61.

Sullivan, Daniel, and Till von Wachter. 2009. “Job Displacement and Mortality: An Analysis Using Administrative Data.” *Quarterly Journal of Economics* 124 (3): 1265–306.

Thévenon, Olivier. 2013. “Drivers of Female Labour Force Participation in the OECD.” OECD Social, Employment and Migration Working Paper 145, Organisation for Economic Co-operation and Development, Paris.

United Nations (UN), Department of Economic and Social Affairs, Population Division. 2017. *World Population Prospects: The 2017 Revision, Methodology of the United Nations Population Estimates and Projections.* Working Paper ESA/P/WP250, New York.

Weingarden, Alison. 2017. “Labor Market Outcomes in Metropolitan and Non-Metropolitan Areas: Signs of Growing Disparities.” *FEDS Notes*, September 25, Federal Reserve Board, Washington, DC.

Winkelmann, Liliana, and Rainer Winkelmann. 1995. “Happiness and Unemployment: A Panel Data Analysis for Germany.” *Applied Economics Quarterly* 41 (4): 293–307.

CHAPTER 3

MANUFACTURING JOBS: IMPLICATIONS FOR PRODUCTIVITY AND INEQUALITY

The declining share of manufacturing jobs in overall employment has been a concern for policymakers and the broader public alike in both advanced economies and some developing economies. This concern stems from the widely held belief that manufacturing plays a unique role as a catalyst for productivity growth and income convergence and a source of well-paid jobs for less-skilled workers. Against that backdrop, this chapter aims to provide new evidence on the role of manufacturing in the dynamics of output per worker and in the level and distribution of labor earnings. The two main takeaways from the analysis are that (1) a shift in employment from manufacturing to services need not hinder economy-wide productivity growth and the prospects for developing economies to gain ground toward advanced economy income levels, and (2) while the displacement of workers from manufacturing to services in advanced economies has coincided with a rise in labor income inequality, this increase was mainly driven by larger disparities in earnings across all sectors. These findings imply that the goal of supporting equitable growth would be better served by policy efforts to raise productivity across all sectors and make the gains from higher productivity more inclusive. Facilitating the reallocation of labor to productively dynamic sectors, including by removing barriers to entry and trade in the service sector and supporting the reskilling of workers affected by structural change, is crucial to raise productivity and combat inequality.

Introduction

In many countries, manufacturing appears to have faded as a source of jobs (Figure 3.1). Its share in employment in advanced economies has been declining for nearly five decades. In developing economies, manufacturing employment has been more stable, but among more recent developers it seems to be peaking at relatively low shares of total employment and at levels of national income below those in market economies that emerged earlier.[1] The share of jobs in the service sector has risen almost everywhere, replacing jobs in either manufacturing (mostly in advanced economies) or agriculture (in developing economies; Figure 3.2). From a long-term economic perspective, the shift of capital and labor into different forms of economic activity is accepted as "structural transformation"—the natural consequence of changes in demand, technology, and tradability.

The implications of the reduced share of manufacturing in employment has been much debated, with researchers and policymakers focusing on two questions: (1) Does it hinder overall growth? (2) Does it raise inequality?

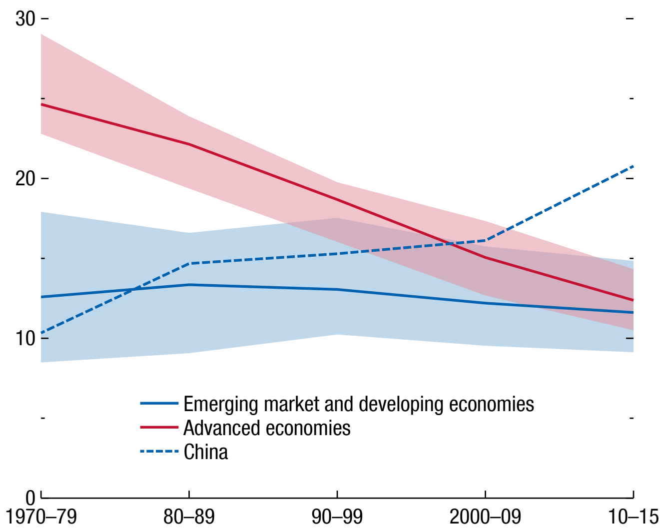
Regarding the first question, the growth of productivity and of income has historically appeared to slow once factors of production begin to shift from manufacturing to services (Baumol 1967; Imbs 2016). This phenomenon could be especially worrisome for developing economies where employment shares are shifting from agriculture to services, bypassing manufacturing, given that skipping a traditional industrialization phase could hinder their ability to narrow income gaps vis-à-vis advanced economies (Rodrik 2016). However, whether an expanding service sector necessarily weighs on economy-wide productivity growth is an open question. The service sector comprises subsectors with potentially varying productivity levels and growth rates; recent advances in technology and in the tradability of services may have accelerated the productivity gains in some of them. The impact of the shifts in employment shares on aggregate productivity would therefore depend on the exact mix of subsectors that are gaining or losing share.

The authors of this chapter are Wenjie Chen, Bertrand Gruss (lead), Nan Li, Weicheng Lian, Natalija Novta, and Yu Shi, with support from Felicia Belostecinic, Hao Jiang, Evgenia Pugacheva, and Jilun Xing and contributions from Jorge Alvarez and Ke Wang. We are grateful to Jesus Felipe for sharing his data on manufacturing employment. Joseph P. Kaboski was the external consultant. The chapter benefited from comments by Mary Hallward-Driemeier, Andrei Levchenko, and Dani Rodrik.

[1]In this chapter, emerging market and developing economies, or developing economies for short, are an augmented group consisting of all emerging market and developing economies currently classified as such by the *World Economic Outlook* (WEO) plus those that have been reclassified as advanced economies since 1996 (the latter including, for instance, Hong Kong Special Administrative Region, Israel, Korea, and Singapore). See Annex 3.1 for data sources and sample coverage.

Figure 3.1. Share of Manufacturing in Aggregate Employment
(Percent)

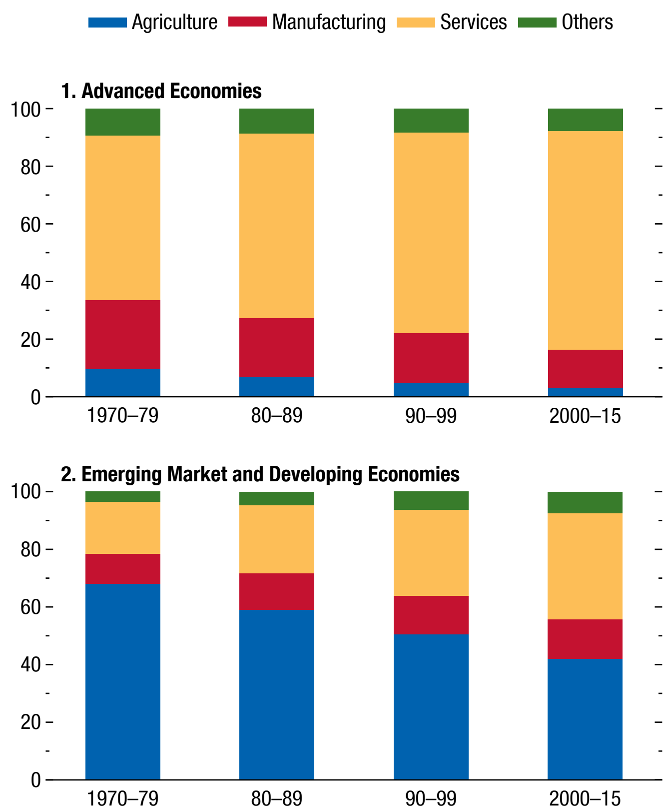
Manufacturing employment has been in relative decline for nearly five decades in advanced economies, and it seems to be peaking at low shares of total employment among more recent developers.



Source: IMF staff calculations.
Note: The solid lines and shaded areas denote the simple average and the interquartile range across economies, respectively. The sample comprises 21 advanced economies and 44 emerging market and developing economies with sectoral employment data since 1970. See Annex 3.1 for data sources and country coverage.

Figure 3.2. Sectoral Employment Shares
(Percent)

The share of service sector jobs in overall employment has risen almost everywhere, reflecting a shift away from manufacturing employment in advanced economies and mostly a shift from agriculture in developing economies.



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: The employment sectoral shares in each panel are computed as the weighted average across all economies in the group with weights given by total employment of each country. "Others" includes mining, construction, and utilities.

The second question arises because low- and middle-skilled workers have traditionally earned higher wages in manufacturing than in services (Helper, Krueger, and Wial 2012; Langdon and Lehrman 2012; Lawrence 2017); a reduced employment share for manufacturing would thus tend to worsen income inequality. Countries where inequality in labor earnings has risen since 1980 have typically experienced a decline in the share of manufacturing employment (Figure 3.3). But analysis of the mechanisms underlying that correlation has been sparse. Countries where the share of manufacturing employment has declined more may also have been more exposed to other inequality-enhancing trends (such as technological change and the automation of routine tasks), with a consequent rise in labor income inequality within all sectors. The significance of the latter explanation warrants review because it could mean that, to combat inequality, policy should focus on ensuring more inclusive gains from structural transformation rather than on supporting manufacturing employment.

Changes in the share of manufacturing jobs in employment have been accompanied by even more diverse changes in the output share of manufacturing across countries.[2] Moreover, a few developing economies have experienced sizable increases in the share of manufacturing in both employment and output since the early 1970s, most notably China. This heterogeneous picture could reflect reallocation of production across countries or country variations in the demand for manufactures, or a mix of both.

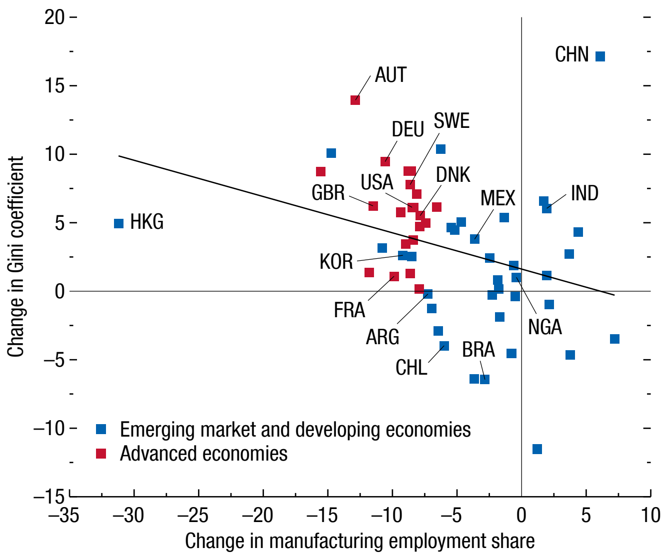
Against that backdrop, this chapter has two related goals: (1) to contribute to a better understanding of the

[2]In this chapter, output is measured in constant prices (or equivalently, as value added in real terms).

Figure 3.3. Change in Manufacturing Employment Share and Inequality, 1980–2010

(Percentage points on x-axis; points on y-axis)

Inequality in labor earnings has tended to increase more in economies that have registered a steeper decline in the share of manufacturing employment.



Sources: Standardized World Income Inequality Database (Solt 2016); and IMF staff calculations.
Note: The changes are calculated between the averages during 1980–89 and 2010–16. The Gini coefficient is based on income before taxes and transfers and ranges from 0 to 100. Data labels use International Organization for Standardization (ISO) country codes.

ongoing transformation of manufacturing activity within countries and at the global level, and (2) to examine whether manufacturing is indeed special in terms of output per worker and the level and distribution of labor earnings, so as to provide insight into how policies can help ensure strong and inclusive growth under structural transformation. In pursuit of these goals, the chapter seeks answers to the following questions:

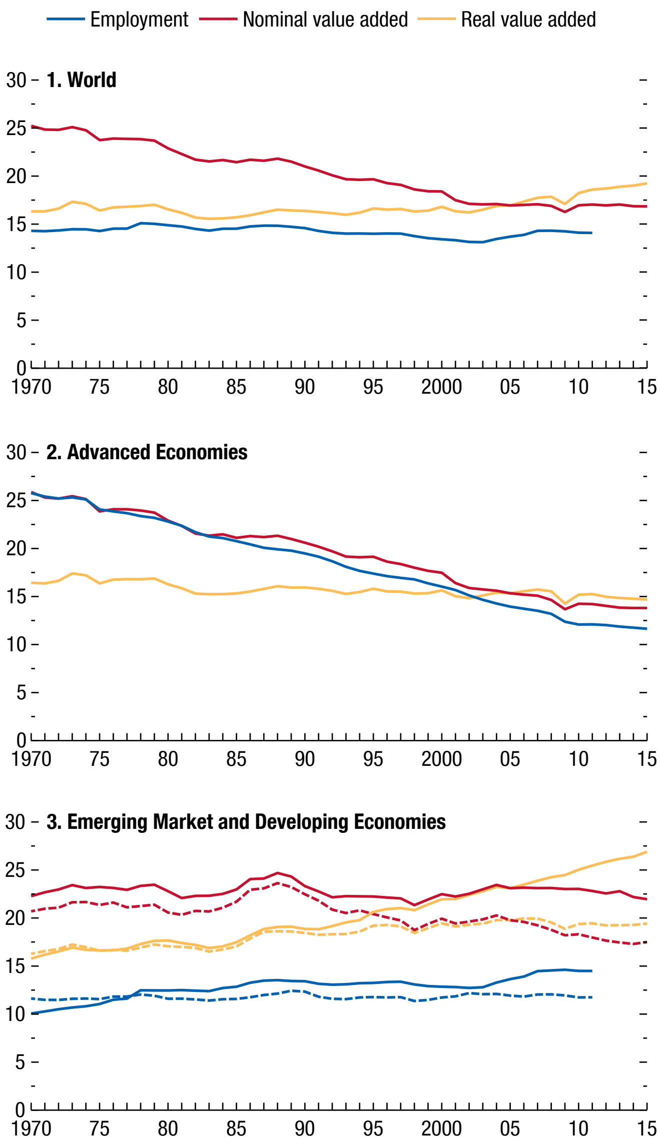
- *Trends and drivers:* How have manufacturing employment and output shares evolved within countries and at the global level since the 1970s? What were the mechanisms behind these changes? Which service subsectors have expanded during the past five decades?
- *Per capita income growth:* How diverse are trends in output per worker (the main driver of income per capita) across the various service subsectors and how do they compare with those in manufacturing? Have shifts in employment shares between sectors weighed on economy-wide labor productivity growth? Does the relative expansion of service sector employment pose a major challenge for developing economies in narrowing per capita income gaps vis-à-vis advanced economies?
- *Income inequality:* Does manufacturing uniquely offer higher incomes or a more uniform distribution of earnings across employees? How much of the increase in inequality observed in many countries over the past few decades is associated with changes in the relative size of the manufacturing sector?

The main findings of the chapter are as follows:

- The heterogenous evolution of manufacturing output and employment shares across countries reflects a mix of forces: diverse trends in domestic incomes and the associated variation in the demand for manufactures, varying productivity trends in manufacturing and other sectors, and specialization and reallocation of production based on comparative advantages, facilitated by international trade and financial integration. Even though output has outpaced employment in the manufacturing sector in most countries since the early 1970s, reflecting comparatively fast productivity growth in the sector, the same pattern has not held at the global level. The broadly parallel movement of global manufacturing output and employment shares reflects a change in the country composition of global manufacturing employment in favor of developing economies, where output per worker tends to be lower.
- The rise of services and the decline or leveling-off of manufacturing as a source of employment need not hinder economy-wide productivity growth. Some service industries have higher productivity levels and growth rates than manufacturing overall. Since the early 2000s, the rise in the service share of employment has contributed positively to economy-wide productivity growth in most developing economies. Moreover, productivity levels in services tend to converge to the global frontier (that is, to the productivity level in the most productive countries), just as in manufacturing. The rise in the employment share of those service sectors therefore can boost the growth of aggregate productivity and aid the convergence of income per worker across countries.
- While labor earnings in manufacturing are indeed somewhat higher and more uniformly distributed than in services, the main driver of the rise in labor income inequality in advanced economies since the 1980s has been an increase in inequality within all sectors.

Figure 3.4. Share of Manufacturing in Aggregate Employment and Output
(Percent)

At the global level, the share of manufacturing in employment and output (real value added) has changed little since 1970. However, that remarkable global stability masks pronounced changes in shares at the country level.



Source: IMF staff calculations.
Note: The employment (value added) manufacturing share in each panel is computed as the weighted average share across all economies in the group, with weights given by total employment (GDP in US dollars at market exchange rates) of each country. Dashed lines in panel 3 denote emerging market and developing economies excluding China.

A key question for policy is whether the service-led growth patterns observed in many developing countries since the early 2000s will continue to hold or whether they were a byproduct of a temporary boom in global demand. Higher commodity earnings and easy borrowing conditions, for instance, may have temporarily boosted the demand for nontraded services produced with less-skilled labor and facilitated the shift of labor out of agriculture—where productivity tends to be relatively low (Diao, McMillan, and Rodrik 2017). In many developing countries, less buoyant growth in domestic demand in the period ahead may restrain the expansion of nontraded services, while skill shortages may hold back the expansion of the traded, productively dynamic ones. The uncertainty surrounding future productivity trends and sizable gaps in output per worker among developing countries calls for strong policy efforts to boost productivity in all sectors and help channel labor to the most dynamic and productive activities through skill development and the removal of barriers to entry and trade in service sectors. In countries where manufacturing jobs are disappearing outright, policymakers ought to facilitate the reskilling of former manufacturing workers and reduce the costs of their reallocation, while strengthening safety nets to alleviate the adverse consequences of joblessness and job transitions for the workers and their communities.

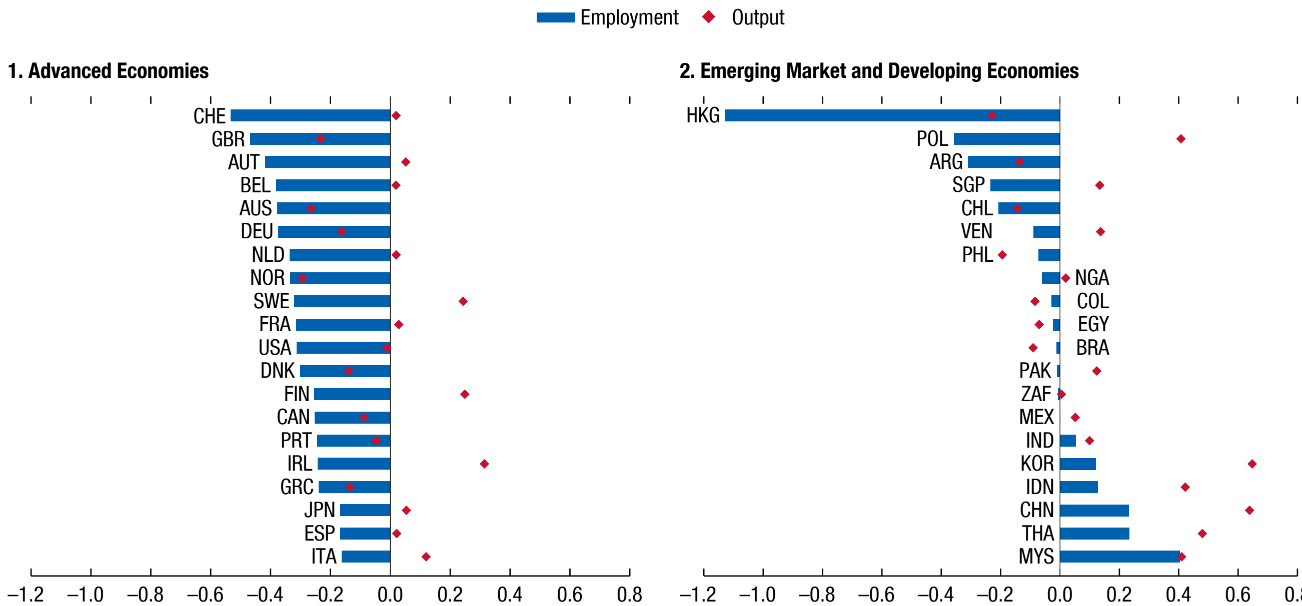
The rest of the chapter is structured as follows. The next section provides an overview of manufacturing trends at the country and global levels and discusses the mechanisms underlying changes in the relative share of manufacturing in economic activity. It also provides some statistics on the rise in service jobs. The subsequent two sections focus on the differences between manufacturing and services in terms of productivity trends and on the level and distribution of labor earnings. The concluding section discusses how policy can ensure strong and inclusive growth under ongoing structural transformation.

Structural Transformation: Key Trends and Drivers

The share of manufacturing jobs in global employment has been remarkably stable over nearly five decades (Figure 3.4, panel 1). The sector employs about the same share of the world workforce now—about one in seven workers—as it did in the 1970s. Its share in global output (value added measured at constant prices) remained broadly stable between the

Figure 3.5. Estimated Trends in Manufacturing Employment and Output Shares, 1960–2015
(Percentage points per year)

While the share of manufacturing jobs in aggregate employment has declined in all advanced economies and many developing economies since 1970, changes in the output share have been more diverse, and a few economies registered sizable increases in both their manufacturing employment and output shares.



Source: IMF staff calculations.
Note: The figure shows the average annual growth rate in manufacturing employment and real-value-added shares during 1960–2015 (depending on data availability) for the 20 largest advanced and emerging market and developing economies ranked by 2015 GDP in US dollars at market exchange rates. Data labels use International Organization for Standardization (ISO) country codes.

1970s and the early 2000s and has been on a slight upward trend ever since.[3]

The global stability of manufacturing employment and output shares masks pronounced changes at the country level (Figure 3.5). The share of manufacturing in total advanced economy output has remained unchanged since the 1970s, but with diverse (and offsetting) changes at the individual country level (Figure 3.4, panel 2; Figure 3.6, panel 3). At the same time, almost all advanced economies individually, and the advanced economy group at the aggregate, experienced steady declines in the share of manufacturing jobs in total employment over almost five decades (Figure 3.4, panel 2; Figure 3.6, panel 1), underscoring that labor productivity in manufacturing increased faster than in all the other sectors taken together.

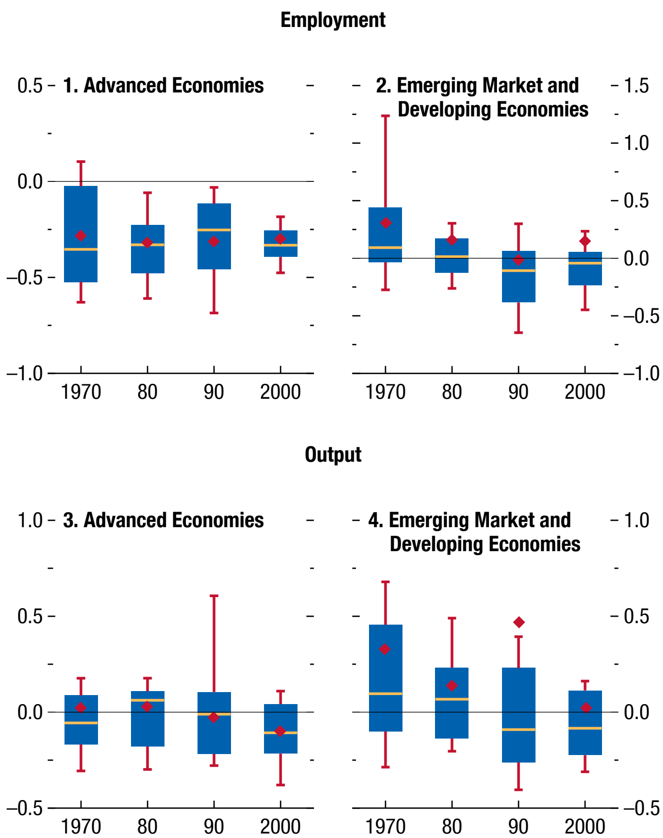
Among developing economies, the median change in manufacturing employment and output shares since 1970 has been close to zero (Figure 3.6, panels 2 and 4). If China is excluded, the group at the aggregate has seen little change in the output and employment share of manufacturing (Figure 3.4, panel 3). China, Indonesia, Korea, Malaysia, and Thailand have seen sizable gains in shares since 1970 (Figure 3.5, panel 2), although in some of these economies the manufacturing sector still employs a relatively small fraction of the workforce (for instance, in Indonesia the manufacturing employment share has remained about 13 percent since the mid-1990s; in Thailand it was below 15 percent in 2010; in China, by contrast, the share was about one-fifth in 2013).

For most developing economies, manufacturing shares peaked around the middle of the sample period: output and employment shares increased over the 1970s and 1980s in most countries but have declined in about two-thirds since the 1990s (Figure 3.6, panels 2 and 4). Very few countries have experienced rising

[3]The share of manufacturing in global output measured at current prices shows a substantial decline over the past five decades as faster productivity gains in manufacturing have lowered the prices of manufactures relative to those of other products, such as services and agricultural goods.

Figure 3.6. Cross-Country Distribution of Estimated Trends in Manufacturing Shares, 1970–2015
(Percentage points per year)

The share of manufacturing jobs in total employment has declined steadily in most advanced economies since 1970, while in half of those economies the manufacturing output share increased until the 1990s. For most developing economies, manufacturing employment and output shares peaked around the middle of the sample period.

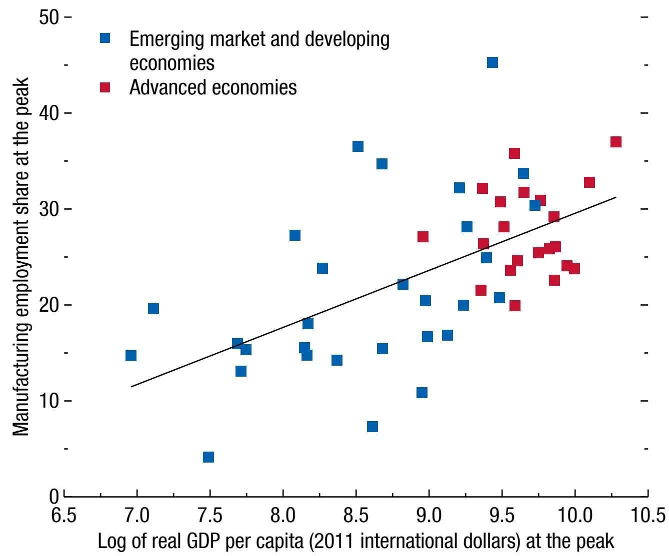


Source: IMF staff calculations.
Note: The figure shows the cross-country distribution of the average annual percent change in the employment and real-value-added manufacturing shares. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. The red diamond denotes the weighted average for the group. *X*-axis labels indicate the start of each decade. Boxes for 2000 represent data for 2000–15, whenever available.

manufacturing employment and output shares in the 2000s (for instance, Bangladesh, China, Ethiopia, and Malawi). Moreover, many of the developing economies with declining manufacturing shares never experienced strong expansion of the shares to begin with, unlike most of the economies that developed earlier. As a result, compared with those of earlier developers, the manufacturing employment shares of many developing economies have typically peaked at lower shares and income

Figure 3.7. Peak of Manufacturing Employment Share
(Percent)

Compared with economies that developed earlier, the manufacturing employment shares of many developing economies have peaked at lower levels and lower income levels.



Source: IMF staff calculations.
Note: The sample is restricted to economies that show declining manufacturing employment shares since 1990 or earlier. The *x*-axis shows the income level when manufacturing employment shares peaked.

levels (Figure 3.7).[4] Only a few developing economies in which the manufacturing sector was already relatively large by 1980—Hong Kong Special Administrative Region, Korea, Mauritius, Poland, Romania, Singapore, and Taiwan Province of China—experienced a peak in the manufacturing employment share higher than in the average advanced economy. Accordingly, the services share of employment has started to rise at a lower level of per capita income in today's developing economies than it has in today's advanced economies.

Drivers of Manufacturing Output and Employment Shares

A spectrum of explanations can help reconcile the stable manufacturing output and employment shares at the global level with diverse changes across countries. At one extreme, shifts in manufacturing output and employment shares could reflect zero-sum reallocations in supply, with manufacturing production moving from locations where production costs are higher to

[4]Dasgupta and Singh (2006) and Rodrik (2016) call this phenomenon "premature deindustrialization."

lower-cost economies (mostly developing economies) that have become increasingly integrated into the global trading system. At the other extreme, changes in output and employment shares could reflect trends in incomes and demand. Demand for manufactures increases faster than demand for food and services in the earlier stages of a country's development. In the later stages, the demand for services expands the fastest, but the decline in the relative price of manufactures could dampen the relative shift away from their consumption as income grows. Under a demand-based explanation, the global share of manufacturing output would initially be stable or even increase (as has been the case since 2000) as global incomes converge, with fast-growing developing economies consuming relatively more manufactured goods while the slower-growing advanced economies consume less. The global share of manufacturing output would be expected to decline in the long term as all economies increasingly need more services.

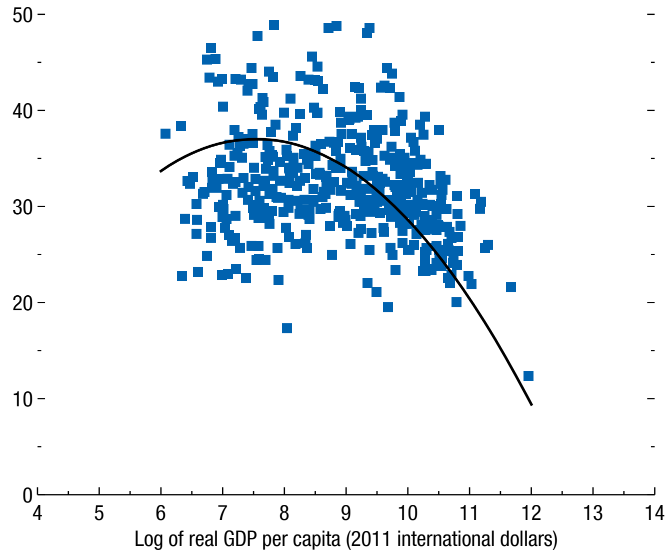
In reality, the explanation for a stable global picture amid country variations is probably somewhere between these two interpretations. The global performance likely reflects both some reallocation of manufacturing production toward countries with lower production costs and country variations in the demand for manufacturing.

Each of the potential drivers of changes in manufacturing output and employment shares—variations in demand for manufactures as incomes rise and their relative price falls, and cross-border integration—has been studied widely in the literature. Studies dating back to the 19th century (Engel 1895) as well as recent work (Kongsamut, Rebelo, and Xie 2001; Buera and Kaboski 2009, 2012; Herrendorf, Rogerson, and Valentinyi 2013; Boppart 2014) emphasize changing consumption patterns as real income per capita grows. The final consumption share of manufactured goods exhibits a hump-shaped relationship to real income per capita (Figure 3.8). As individuals' real income rises from low levels, the share they spend on food declines (Engel's law), and the share they spend on manufactured products rises. As incomes grow further, however, the proportion spent on services rises at the expense of manufactures.

A second factor is linked to the faster rise in productive efficiency in manufacturing than in other sectors (Kuznets 1966; Baumol 1967; Ngai and Pissarides 2007), which has lowered the amount of labor needed to produce a given amount of manufacturing output and has made manufactures more affordable. Faster efficiency gains in production imply that a given increase in output requires smaller increases in labor and other inputs over time; a relatively faster rise of output per worker in manufacturing has thus come with slower employment growth in manufacturing than in other sectors. The faster rise of productivity has also led unit production costs in the manufacturing sector to fall more rapidly than in other sectors, lowering the relative price of manufactures in the vast majority of countries over the past five decades (Figure 3.9). The greater affordability of manufactured goods has tempered the decline in the relative demand for manufactures driven by higher incomes and shifts in preferences, but not to an extent that prevented the productivity-driven decline in the share of manufacturing in employment (Figure 3.10).[5]

Figure 3.8. Share of Manufacturing in Final Consumption versus Income per Capita, 1980–2011
(Percent)

As real incomes rise from low levels, the share of manufactured goods in consumption increases. As incomes rise further, however, the proportion spent on services grows at the expense of manufactures.

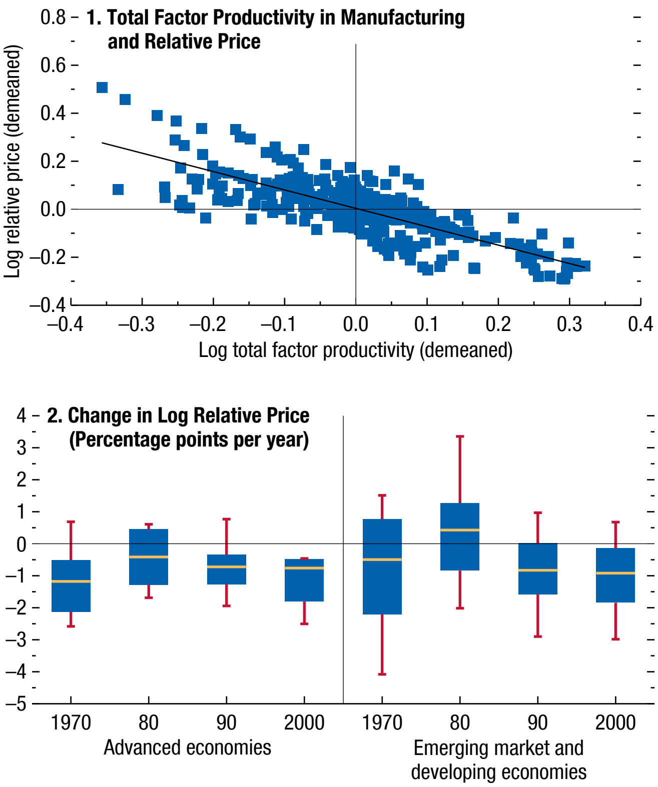


Sources: World Bank International Comparison Program (ICP) database; and IMF staff calculations.
Note: The black line shows the estimated relationship between the share of manufacturing in final consumption and income per capita based on a quadratic estimation using country fixed effects. Final consumption expenditure shares are based on ICP data (1980, 1985, 1996, 2005, and 2011 vintages) and include consumption by households and the government. Countries with a population less than 1 million in 2014 are excluded.

[5]The decline in the relative price of manufactures affects consumer behavior in two ways. First, it raises disposable incomes, allowing consumers to spend more on both goods and services (an income effect). Second, consumers may spend relatively more on the

Figure 3.9. Relative Price of Manufacturing, 1970–2015

The relative price of manufactures declined in most economies over the past five decades, reflecting faster productivity gains in manufacturing than in other sectors.

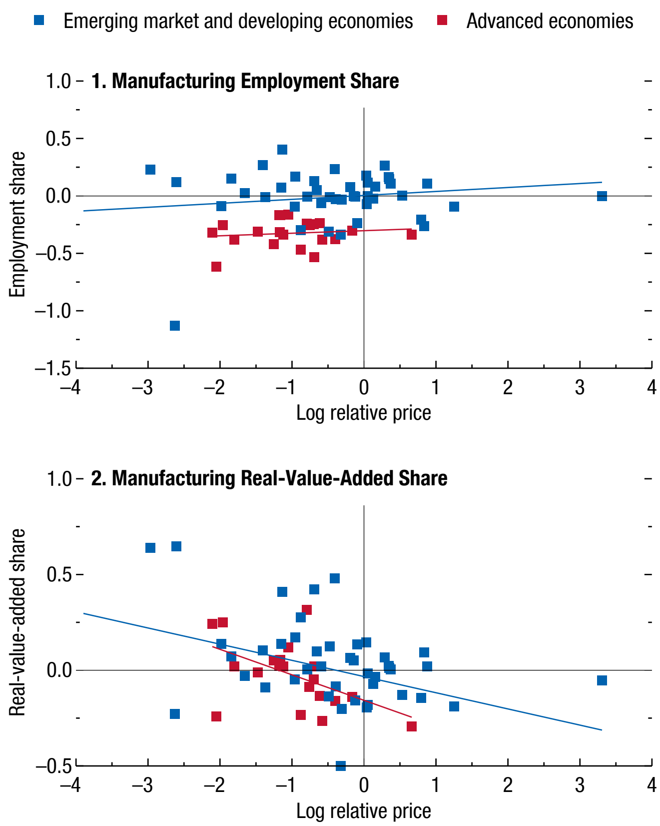


Sources: Groningen Growth and Development Centre database; United Nations database; World KLEMS database; and IMF staff calculations.
Note: Panel 1 shows the logarithm of the relative price of manufacturing value added (relative to that of the aggregate economy) in each country and year against the logarithm of the total factor productivity in manufacturing. Both variables are expressed as deviations from the country average across the sample period. Panel 2 shows the cross-country distribution of the average annual change in the logarithm of the relative price of manufacturing. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. *X*-axis labels indicate the start of each decade. Boxes for 2000 represent data for 2000–15, whenever available.

Figure 3.10. Estimated Change in Manufacturing Shares and Relative Prices, 1960–2015

(Percentage points per year)

The decline in the relative price of manufactures boosted the relative demand for goods, but not to an extent that would prevent the shift of labor from manufacturing to services.



Sources: Groningen Growth and Development Centre database; United Nations database; and IMF staff calculations.
Note: The relative price denotes the price of manufacturing value added relative to that of the whole economy.

A third factor—trade and financial integration—can give rise to new influences on manufacturing shares. International trade allows the sectoral composition of domestic demand to differ from that of domestic supply as goods and some services can be traded across borders (Matsuyama 2009; Uy, Yi, and Zhang 2013; Swiecki 2017; Wood 2017). Declining trade costs affect the patterns of specialization across countries, increasing the share of manufacturing in output and employment in countries that have comparative advantage in that sector and lowering them in countries that do not.[6] Increased access to foreign finance that lowers

now-more-affordable manufactured goods (a substitution effect). However, the second channel is not strong: consumers do not substitute services with manufactured goods to a great extent when the latter get cheaper (Buera and Kaboski 2009; Herrendorf, Rogerson, and Valentinyi 2013; Lawrence 2017).

[6]Trade also allows specialization within manufacturing: the manufacture of products requiring primarily low-skilled labor would shift to countries with an abundance of such workers, while the production of other types of manufacturing would shift to countries with an abundance of highly skilled workers and lower user costs of capital. The share of manufacturing in output may remain unchanged in both groups, while the manufacturing share of employment would rise where low-skilled labor was most abundant and decline elsewhere.

the cost of capital can accentuate the specialization patterns in capital-scarce economies, especially where financial frictions and credit rationing are more prevalent. The reallocation of manufacturing to countries with comparative advantage also lowers the relative price of manufactures globally, raising the demand for manufactures.

Trade and financial integration also speed up the adoption of technological advancements and their diffusion across borders (Chapter 4). Faster diffusion of innovations allows countries to converge to the productivity frontier more quickly and shortens the period in which an increasing share of labor needs to be employed in the manufacturing sector (the so-called industrialization phase of development).[7] Faster diffusion also raises global competition among producers and puts downward pressure on manufacturing prices everywhere, which also tends to raise the final demand for manufactures.[8]

Global sectoral expenditure and production data can give a sense of the extent of production reallocation over the past two decades. Figure 3.11 compares the change in spending on manufactures with changes in the domestic gross output of manufactures.[9] Developing economies' shares in both global gross output and final expenditures of manufactures rose between 1995 and 2011, while those of advanced economies fell (Figure 3.11, panel 1). But the changes in gross output shares have not matched the changes in expenditure shares one-for-one. In advanced economies, gross output shares have declined more than spending shares (by about 5 percent of global spending on manufactures) as production has shifted to developing economies. In developing economies, the increase in manufacturing gross output has exceeded the rise in final expenditures on manufactures.

The difference between changes in manufacturing gross output and expenditure shares (that is, the extent of reallocation) in the 1995–2011 period has been large for some countries (Figure 3.11, panels 2 and 3).[10] Among large advanced economies, gross output declined more than final spending in France (by 4 percent of GDP), the United States (3 percent), and Japan (1.5 percent). The difference between the change in gross output and final spending is also negative in several developing economies in the sample, including India, Mexico, Russia, and Turkey. In contrast, in China, Germany, Ireland, and Korea, the rise in the manufacturing output share is larger than the rise in the expenditure share. The difference in the case of China (about 10 percent of GDP) stands out, as it represents about 2½ percent of global spending on manufactures. Not all of the reallocations of gross output have been met by equal shifts in domestic manufacturing value added, however. Some of the reallocation has fallen on the service-value-added component of manufacturing output as well (Box 3.1).

The broadly parallel movements of global manufacturing output and employment shares might seem puzzling given the relatively fast pace of productivity growth in the sector, which would be expected to drive a growing wedge between the global output and employment shares of manufacturing over time (as has happened in virtually all advanced economies and most developing economies). The explanation is a gradual shift in the composition of global manufacturing employment toward developing economies, where productivity tends to be lower but the demand for manufactures higher and the unit production costs lower.[11]

The bilateral relationships between manufacturing output and employment shares and their possible drivers are helpful in gaining a sense of the mechanisms underlying structural transformation. However, empirically estimating the relative importance of each of these

[7]Huneeus and Rogerson (2016) argue that productivity growth in manufacturing (relative to other sectors) may be faster for current developing economies than for earlier developers due to catch-up effects, helping to explain why manufacturing employment shares are peaking at lower levels in developing economies.

[8]Rodrik (2016) argues that developing economies "imported" deindustrialization as they opened to trade (including those that may not have experienced much technological progress), by becoming exposed to the downward pressure on the relative price of manufactures originating from productivity gains in advanced economies.

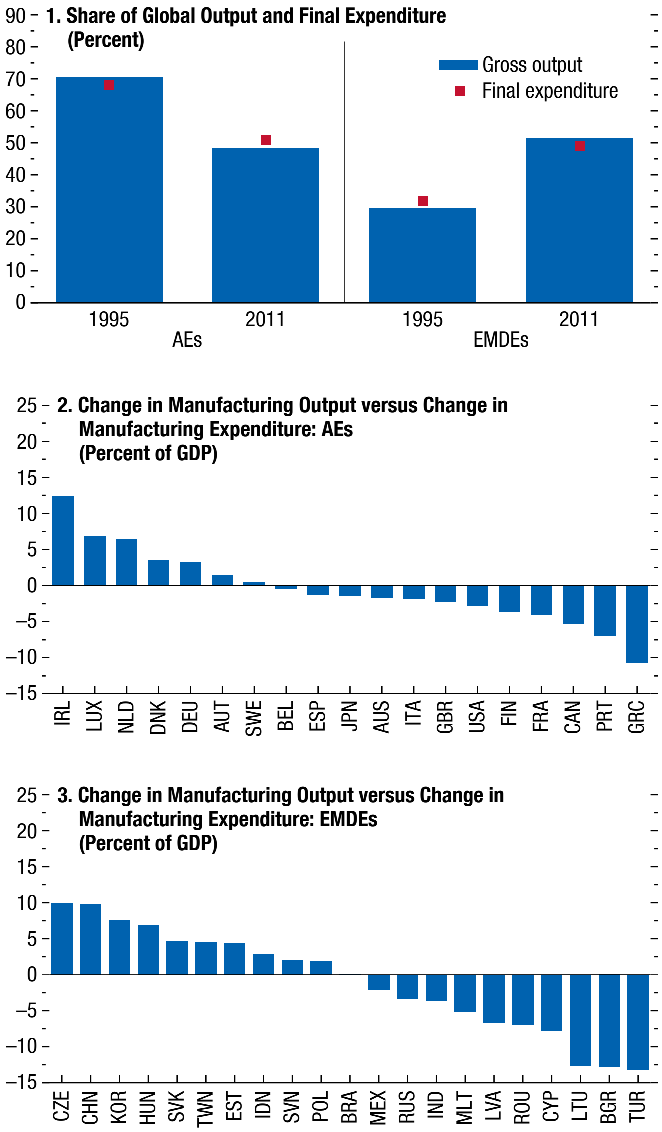
[9]A finished manufactured product embeds value added by both the domestic and foreign manufacturing and nonmanufacturing sectors. A vehicle purchased by a consumer, for instance, embeds domestically and foreign-produced manufactured parts as well as domestically and foreign-produced engineering and marketing services. The domestic gross output of the manufacturing sector is the sum of all the domestically produced content of its final output. Spending on manufactures in a given country equals the sum of the gross output of the domestic manufacturing sector, net imports of finished manufactured goods, and net imports of intermediate inputs by the manufacturing sector. Gross output and spending data used for this exercise are from the World Input-Output Database, which covers 1995–2011. See Annex 3.2 for details.

[10]The difference between changes in manufacturing gross output and spending on manufactured goods over time for individual countries can reflect a faster expansion of spending and not necessarily a decline in gross manufacturing output.

[11]Felipe and Mehta (2016) also document the impact of changes in the country composition of manufacturing activity on the shares of manufacturing in output and employment at the global level.

Figure 3.11. Manufacturing Gross Output and Final Expenditure on Manufacturing Goods, 1995–2011

Developing economies exhibited a larger expansion in the share of global gross manufacturing output than in the share of global spending on manufactures, which suggests some production reallocation toward those economies as a group. But there is considerable variation across economies.



Sources: World Input-Output Database; and IMF staff calculations.
Note: Panel 1 shows the share of each group of economies in global manufacturing gross output (bars) and in global final expenditure on manufactures (squares). Panels 2 and 3 show the difference between the change in domestic gross manufacturing output and in final expenditure on manufactures between 1995 and 2011, expressed as a share of average GDP during the period. Domestic gross manufacturing output includes value added from all domestic sectors embedded in manufacturing production (foreign value added is excluded). See Annex 3.2 for details. Data labels use International Organization for Standardization (ISO) country codes. AEs = advanced economies; EMDEs = emerging market and developing economies.

mechanisms for a broad set of countries is very challenging. The complexity of the underlying mechanisms aside, only the ex post outcomes of the causal drivers—production costs and relative prices, trade intensity, and income levels—are observed, not the exogenous forces driving structural change. The recent literature has therefore largely sought to explain structural transformation patterns using global general equilibrium models, typically focusing on one mechanism at a time.[12]

The Rise of Services

A striking feature of structural transformation is the expansion of the service sector. The share of services in global employment has increased by about 16 percentage points since the 1970s. While the increase in the share of service jobs in overall employment is largely the flip side of declining manufacturing employment in advanced economies (Figure 3.2, panel 1), in developing economies it mostly reflects a shift of labor from agriculture (Figure 3.2, panel 2).

Employment in nonmarket services (government, education, health) expanded rapidly in the group of advanced economies, contributing about one-third of the overall expansion in service employment since 1970 (Figure 3.12).[13] Within market services—which contributed the remaining two-thirds of the expansion in the share of services—financial intermediation, real estate, and business activity services were the subsectors with the fastest growth. In developing economies, employment in market services contributed the lion's share of the overall increase in services employment, with particularly large expansions in wholesale and retail trade, and hotels and restaurants.

Manufacturing output increasingly embeds inputs from services—the so-called servicification of manufacturing (National Board of Trade of Sweden 2010; Baldwin 2016; Hallward-Driemeier and Nayyar 2017). Using recently available data on global input-output

[12]Herrendorf, Rogerson, and Valentinyi (2014) survey recent contributions to the literature on structural transformation.

[13]The classification of service industries into market and nonmarket services follows the guidelines of the System of National Accounts. Market services consists of wholesale and retail trade and repair of goods; hotels and accommodation; transport, storage, and communications; financial intermediation; real estate, renting, and business activities; other community and personal activities; and activities of private households. Nonmarket services consist of government (public administration, defense, and social security); education; and health. See Annex 3.1 for a list of sectors, individual industries, and abbreviations.

linkages, analysis in Box 3.1 documents that the share of service inputs in manufacturing production has risen in most countries over the past two decades. However, the share of manufactures in final expenditure has been declining in most countries, and service inputs into manufactures still account for a small fraction of overall value added in the service sector, so the servicification of manufacturing has not contributed meaningfully to the increased share of services in overall output over the past two decades.

The changing service content of manufacturing output poses challenges to the measurement of structural change. Available statistics measure only imperfectly changes in the weight of different tasks and activities in the economy. The increasing fragmentation of manufacturing production implies that some activities formerly carried out within manufacturing firms (such as marketing, legal services, logistics) are unbundled and outsourced. The reclassification of these activities as services in official statistics could overstate the extent of structural transformation.[14] At the same time, firms in the manufacturing sector are increasingly producing and selling auxiliary services that are bundled with finished goods; including such service activities in manufacturing production may understate the true extent of structural transformation.[15] Available data do not permit reliable quantification of the relative magnitude of these two opposing effects, and partial evidence from existing studies suggests that their net effect on measures of sectoral employment and output shares is ambiguous.

Growth and Development beyond Manufacturing

Manufacturing has historically been considered more technologically progressive than the service sector, so the reallocation of production from the former to the latter has generally raised concern regarding the growth of aggregate productivity—the most important determinant of a country's standard of living (Baumol 1967; Kaldor 1967).[16] The countries that achieved

[14]Berlingieri (2014); and Bernard, Smeets, and Warzynski (2017).

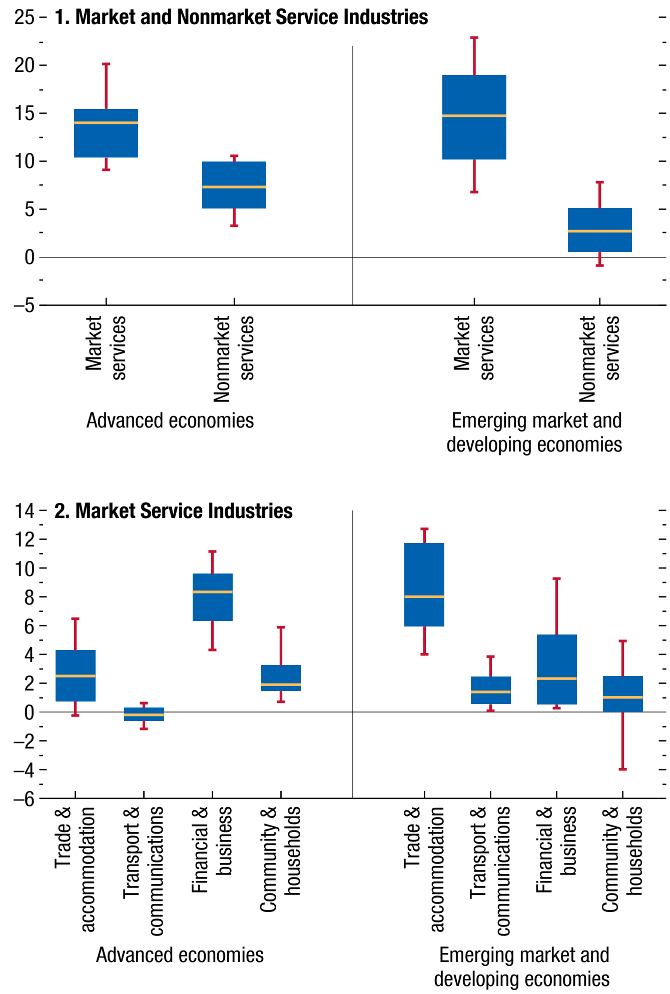
[15]Pilat and Wölfl (2005); National Board of Trade of Sweden (2010); and Crozet and Milet (2017).

[16]Many of the key attributes of the manufacturing sector—relatively high levels of innovation, foreign direct investment (facilitating technological diffusion), economies of scale, high degrees of tradability, and strong interlinkages with other sectors—have traditionally been considered critical to long-term growth and development. Hallward-Driemeier and Nayyar (2017) note that these characteristics vary considerably across manufacturing subsectors and over time.

Figure 3.12. Change in Services Employment Share, 1970–2015

(Cumulative change, percentage points)

Market services account for about two-thirds of the overall expansion in service employment since 1970 in advanced economies, and more than 80 percent in developing economies.



Source: IMF staff calculations.
Note: The figure shows the cross-country distribution of the cumulative change in the employment share of individual service industries between the average in the 1970s and the average during 2000–15. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. Nonmarket services consists of government, education, and health. All other service industries are market services. See Annex 3.1 for a list of sectors, individual industries, and abbreviations.

substantial income convergence toward more developed economies since the 1960s typically experienced strong increases in manufacturing employment and exports (Jones and Olken 2005; Johnson, Ostry, and Subramanian 2007). The observation that the industrialization phase among developing economies is not as vigorous as it was in countries that developed earlier has thus led some to doubt their ability to narrow income gaps with advanced economies. Rodrik (2013, 2016) provides compelling evidence in favor of these concerns, documenting that labor productivity in manufacturing in a sample of 130 economies has tended to converge to the frontier, regardless of policies, institutions, and other country characteristics (unconditional convergence), whereas labor productivity for the overall economy (and hence the nonmanufacturing sector) has not.[17] This unique attribute implies a pivotal role for manufacturing in the development process; a stagnant manufacturing sector could present a daunting obstacle for developing economies in catching up with advanced economy per capita income levels. Consistent with this observation, McMillan and Rodrik (2011) document that structural transformation between 1990 and 2005 tended to be growth-reducing in developing countries that did not experience increases in the share of manufacturing employment.

Nonmanufacturing activities form a very diverse group, however.[18] Productivity dynamics vary substantially within services, and shifts of employment shares within the nonmanufacturing sector have been sizable, especially in developing economies (where activity has shifted from agriculture to services). These observations highlight the value of assessing the productivity effects of structural transformation using data at a more disaggregated sectoral level than for manufacturing and the rest of the economy. If productivity converges toward the international frontier for some types of services, and employment shares shift toward these subsectors, then structural transformation that bypasses manufacturing need not hinder economy-wide productivity growth.

In seeking to shed light on whether nonmanufacturing sectors can increasingly drive growth and help narrow income gaps across countries, the analysis follows McMillan and Rodrik (2011) and Rodrik (2013) and focuses on the growth of labor productivity as a normative benchmark. Labor productivity is defined as output at constant prices divided by the number of workers in the economy or a given sector. When cross-country comparisons of sectoral productivity levels are involved, output is expressed in international dollars using sector-specific purchasing power parity (PPP), which helps ensure that the comparisons are not affected by price differences across countries. The analysis also provides some evidence of differences in total factor productivity (TFP) growth rates by disaggregated sector, with TFP defined as the output for a given combination of labor and capital inputs, a measure of overall efficiency gains that (unlike labor productivity) does not vary with the amount of capital per worker but is available for a relatively limited set of countries.[19]

As a final word of caution regarding this analysis, productivity data by disaggregated sector are available only for a subset of the Rodrik (2013) database. Wherever possible, the analysis uses a variety of data sets to ascertain robustness. At the same time, the data sets used in the chapter include sector-specific PPPs that facilitate the comparison of sectoral productivity across countries, which was not possible in the Rodrik (2013) study.

The road map for the rest of the subsection is as follows. The discussion next turns to evidence on productivity levels and growth rates across disaggregated service and manufacturing subsectors. The subsequent section examines whether shifts in employment shares between sectors have tended to benefit or harm aggregate productivity. The final section looks at whether productivity convergence is unique to manufacturing or whether it is a feature of some service sectors as well.

Productivity in Services: Lagging Behind?

Many studies have stressed that productivity growth among the diverse set of market and nonmarket industries is likewise diverse, ranging from the slowest to the

[17]Convergence requires productivity to grow faster in countries where its initial level is relatively low.

[18]Productivity dynamics vary substantially within manufacturing activities, as well as across firms within narrowly defined manufacturing and nonmanufacturing industries. Hsieh and Klenow (2009) document that that the "misallocation" of capital and labor across manufacturing firms in China and India hinder economy-wide total factor productivity. Dias, Marques, and Richmond (2016) find that the extent of resource misallocation in Portugal is larger in the service sector than in manufacturing.

[19]In addition to being available for a small set of countries on a sectoral basis, TFP measures (unlike labor productivity measures) do not lend themselves to straightforward decompositions of within-sector and structural transformation effects.

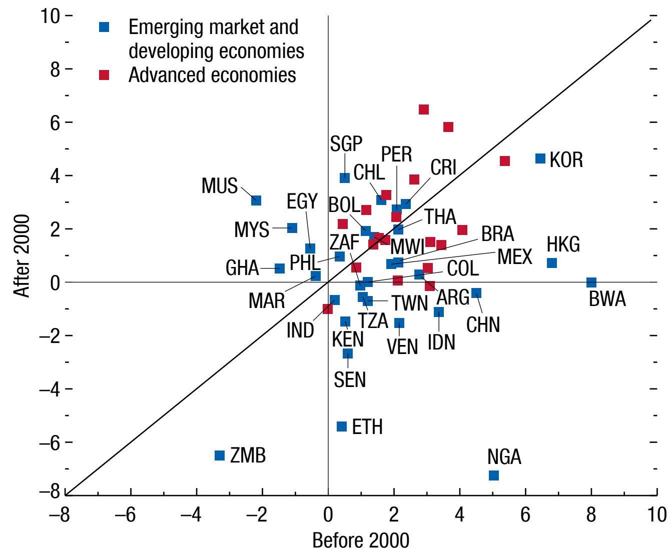
fastest in the economy.[20] Some service industries at the upper end of productivity growth are among the most intensive users of information and communication technologies (Stiroh 2002). Recent advances in those technologies are likely to have played an important role in boosting the productivity of the sectors that use them (Bosworth and Triplett 2003, 2007; Jorgenson and Timmer 2011).[21]

A first look at labor productivity by aggregated sector reveals that the manufacturing sector as a whole typically sees faster productivity gains than the service sector (most observations of the productivity growth differential between manufacturing and services are positive in Figure 3.13, both before and after 2000). However, the differential has shrunk since 2000 in most countries (that is, most observations lie below the 45-degree line in the same figure). Moreover, average productivity growth in services in many developing economies, including China, India, and some in sub-Saharan Africa, has recently exceeded that of manufacturing.

Disaggregated labor productivity data show that some service industries register as fast growth in output per worker as the top-performing manufacturing industries (Figure 3.14). The distribution of labor productivity growth in manufacturing industries over the past five decades is somewhat to the right of that of service industries. However, in a sample of 19 advanced and 43 developing economies during 1965–2010, labor productivity growth in some broad service industries is comparable to productivity growth in manufacturing as a whole (Figure 3.14, panel 1). A similar picture appears from data for 13 manufacturing industries and 13 service industries available for a smaller number of economies (Figure 3.14, panel 2). The data for the United States, which is available at a finer disaggregation level (20 manufacturing industries and 39 service industries), shows an even larger degree of overlap between labor productivity growth in manufacturing and service subsectors (Figure 3.14,

Figure 3.13. Difference in Labor Productivity Growth between Manufacturing and Services before and after 2000
(Percentage points)

The difference between productivity growth in manufacturing and services has shrunk since 2000 in most economies. The average productivity growth in the services sector has recently exceeded that of manufacturing in many developing economies.



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: The figure shows the average annual growth differential between labor productivity growth in manufacturing and services during 2000–15 on the *y*-axis and during 1965–99 on the *x*-axis. Observations below the diagonal line denote a decline in the productivity growth differential. Labor productivity is defined as value added per worker at constant national prices. Data labels use International Organization for Standardization (ISO) country codes.

panel 3).[22] The main takeaway is that there is a sizable overlap between productivity growth among the service and the manufacturing subsectors.

Finally, the levels of labor productivity for a sample of 19 advanced and 43 developing economies in 2005 suggest that, within each country, workers in goods-producing sectors are not necessarily more productive than service sector workers (Figure 3.15). More precisely, labor productivity in two out of four market service industries (transport and communications; financial intermediation and business activities) is comparable to, or higher than, in manufacturing.

The finding of strong productivity growth among services is good news for developing economies where the share of manufacturing in overall activity has

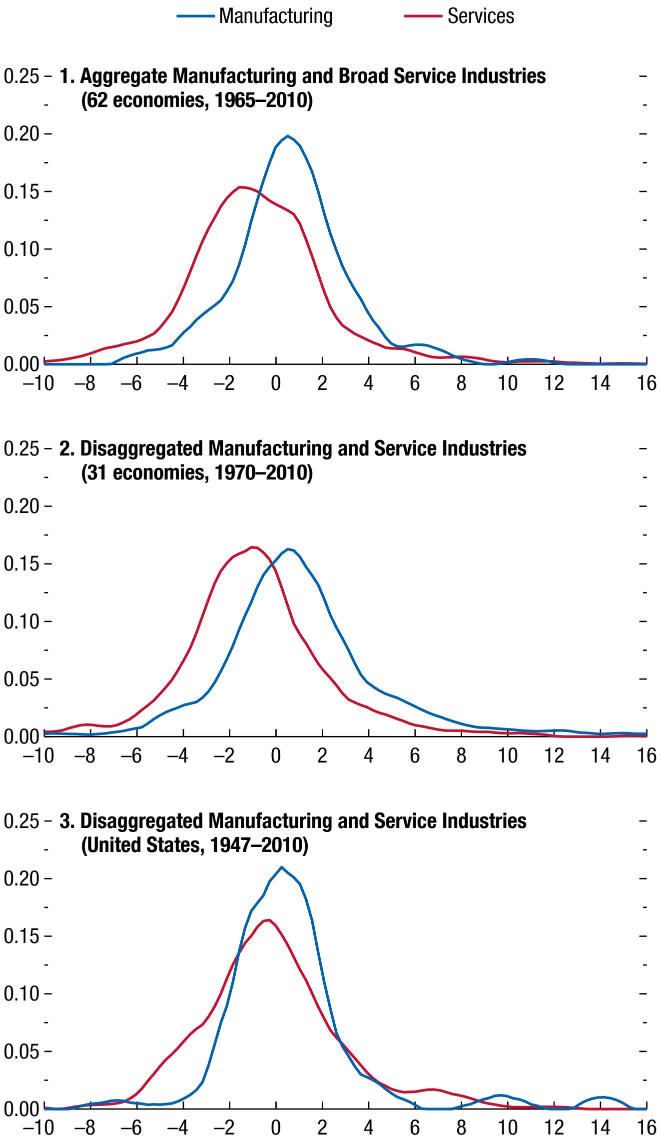
[20]See, for instance, Baumol, Blackman, and Wolff (1985); Jorgenson and Timmer (2011); Verma (2012); Young (2014); Duarte and Restuccia (2017); and Duernecker, Herrendorf, and Valentinyi (2017). Productivity in service industries is particularly difficult to measure (Triplett and Bosworth 2000), but previous work suggests that correction for mismeasurement of output in services would likely lead to higher productivity growth in services than recorded in official data (Gordon 1996).

[21]Communication and digital technologies may help increase productivity growth in some service industries by facilitating international trade in services (Heuser and Mattoo 2017; Loungani and others 2017; Box 3.2), which heightens competition, facilitates cross-border knowledge spillovers, and enhances economy of scale.

[22]TFP data also reveal substantial overlap between productivity growth in manufacturing and service subsectors (Annex Figure 3.3.1).

Figure 3.14. Distribution of Labor Productivity Growth of Individual Industries
(Kernel density)

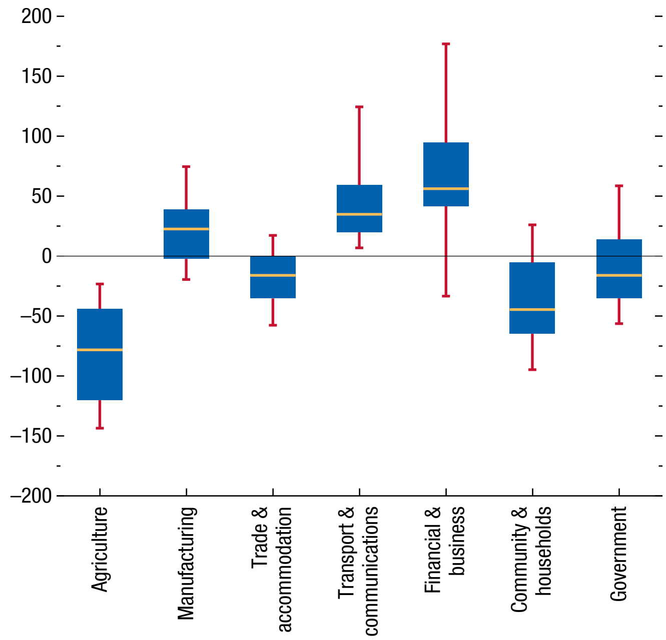
There is a sizable overlap between labor productivity growth among the service and the manufacturing subsectors, with some service industries exhibiting productivity growth rates as high as the top-performing manufacturing industries.



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: The figure shows the distribution of average labor productivity growth per decade in individual manufacturing and service industries (expressed as deviations from the average labor productivity growth across sectors in each country and decade). Panel 1 is based on data for aggregate manufacturing and 5 service industries in 19 advanced economies and 43 emerging market and developing economies. Panel 2 is based on data for 13 manufacturing and 13 service industries in 19 advanced economies and 12 emerging market and developing economies. Panel 3 is based on data for 20 manufacturing and 39 service industries in the United States (Jorgenson, Ho, and Samuels 2012). See Annex 3.3 for details.

Figure 3.15. Sectoral Labor Productivity, 2005
(Difference with respect to economy-wide labor productivity percentage points)

Within each economy, labor productivity is not necessarily lower in service industries than in goods-producing sectors. Labor productivity in two out of four market service industries is higher than the economy-wide average, and comparable or higher than in manufacturing.



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: The figure shows the cross-country distribution across 62 economies of the percentage difference between labor productivity in each sector (value added per worker) and aggregate labor productivity in 2005. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles.

leveled off. However, these productively dynamic service industries may not necessarily account for a large share of employment and thus may play a limited role in driving aggregate productivity. Moreover, their expansion in the future may be constrained by the availability of skilled workers or the pace of expansion in domestic demand. Ancillary evidence, however, suggests that these factors may not necessarily act as binding impediments to service-led productivity growth in the short term.

Service industries with favorable productivity dynamics account for a meaningful share of employment and can play a key role in driving aggregate productivity growth. For instance, the service industries that rank in the top third of the labor-productivity growth distribution (Figure 3.14, panel 2) during 2000–10 accounted, on average, for almost half of total employment in market services, about 30 percent of total service employment, and close to 20 percent of overall employment.[23] Some service industries simultaneously registered above-average labor productivity growth and rising employment shares during the 2000s, thanks to strong demand (for example, financial intermediation in Hungary, Russia, and Slovenia; postal services and telecommunications in Korea and Lithuania; and wholesale trade in the Czech Republic and Latvia). And although employment in some of the tradable service industries—such as financial intermediation—are skill intensive, the skill intensity of other service industries with relatively high labor-productivity growth, including telecommunications, is comparable to that of manufacturing (Annex Figure 3.3.3).

The growth of nontraded service sectors could indeed be constrained by the pace of expansion in domestic demand. Notwithstanding the increased tradability of services in the recent past, especially among highly productive services, such as telecommunications, financial intermediation, and business activities, international trade in services is still rather limited (Box 3.2). That said, recent studies suggest that the domestic demand for services exhibiting strong productivity growth may increase in relative terms over time as they become more affordable.[24] And, given that barriers to international trade are higher for services than for goods (Miroudot, Sauvage, and Shepherd 2013), there is potential for service exports to gather speed if appropriate policy actions are taken.

Has Structural Transformation Weighed on Aggregate Productivity Growth?

To gauge the impact of shifts in employment shares across disaggregated sectors, this section follows a decomposition analysis put forth by McMillan and Rodrik (2011) and Diao, McMillan, and Rodrik (2017). The approach recognizes that economy-wide labor productivity growth can be achieved in two ways.[25] First, productivity can increase within sectors through an increase in capital per worker, higher total-factor productivity, or a reallocation of labor and capital toward the more productive firms within the sectors. The so-called "within" component of the decomposition captures the contribution of productivity growth within sectors to economy-wide productivity growth. Second, economy-wide labor productivity can increase if workers shift from sectors where their productivity is low to sectors where it is high. This second part—the so-called "between" or "structural change" component—captures the effect of labor reallocations across sectors with varying productivity levels. When employment shares increase in high-productivity sectors, structural change will be beneficial for economy-wide labor productivity growth.

The results of the decomposition using data spanning 10 sectors in a sample of 62 economies covering 2000–10 confirm that productivity gains within sectors can account for the bulk of aggregate labor productivity growth in both advanced and developing economies (Figure 3.16, panel 1). Importantly, the results also show that structural change has not exerted a drag on aggregate productivity. In advanced economies, where employment shares have steadily shifted from manufacturing primarily to nonmarket service industries (Figure 3.16, panel 2) and intersectoral productivity gaps are relatively small, the contribution of structural change has been negative but quantitatively negligible. This finding is to be expected: as documented in McMillan and Rodrik (2011), gaps between productivity levels in sectors narrow over time as countries develop.

The contribution of structural change to aggregate productivity growth in developing economies has been positive in all regions since 2000—a period when labor has shifted from low-productivity agriculture to manufacturing in some cases, and to market services more prominently (Figure 3.16, panel 2). Consistent with the findings in McMillan, Rodrik, and Verduzco-Gallo (2014) and Diao, McMillan, and Rodrik (2017), the analysis shows that the positive contribution of structural change since 2000 has been particularly large in sub-Saharan Africa. This is explained by the strong labor shifts out of agriculture in the region during this period, combined with still-large productivity shortfalls in agriculture relative to manufacturing and market

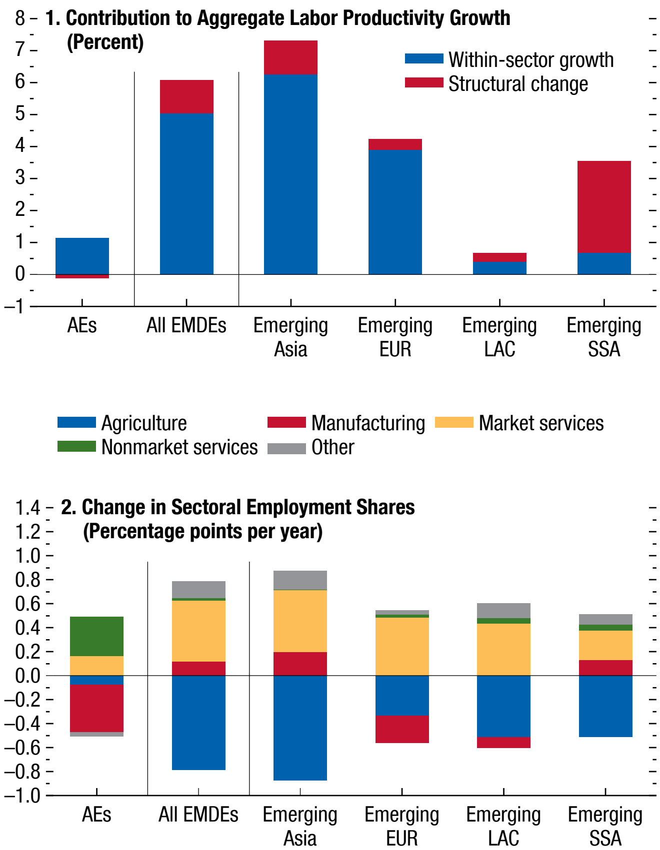
[23]The service industries that rank in the top third of the labor-productivity growth distribution during 2000–10 are postal services and telecommunications, financial intermediation, and wholesale and retail trade (Annex Figure 3.3.2).

[24]Duernecker, Herrendorf, and Valentinyi (2017) find that the elasticity of substitution between services with high and low productivity growth in the United States is larger than 1. This degree of substitutability implies that the demand for services with high productivity growth and declining relative prices can substitute for services with lower productivity growth, leading to an expansion of their employment share despite fast productivity gains.

[25]See Annex 3.3 for details.

Figure 3.16. Structural Transformation and Aggregate Labor Productivity Growth, 2000–10

The contribution of structural change in developing economies has been positive since 2000, when labor predominantly shifted from agriculture to market services.



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: Panel 1 shows the contribution of within-sector labor productivity growth and changes in sectoral employment shares to the (weighted average) annual aggregate labor productivity growth in each group of economies (economies are weighted by total employment) based on data for 10 broad sectors. See Annex 3.3 for details. Panel 2 shows the change in sectoral employment shares for five groups of sectors. Nonmarket services consists of government; education; and health. All other service industries are market services. See Annex 3.1 for a list of sectors, individual industries, and abbreviations. AEs = advanced economies; EMDEs = emerging market and developing economies; EUR = Europe; LAC = Latin America and the Caribbean; SSA = sub-Saharan Africa.

services (Annex Figure 3.3.4).[26] One concern, stressed by Diao, McMillan, and Rodrik (2017), however, is that the recent growth-enhancing structural change appears to have been driven by the particularly strong growth of aggregate demand in the region (supported by external transfers or higher commodity-based revenues), suggesting that overall productivity growth may slow down as demand loses momentum, unless productivity growth picks up within sectors.

That said, the growth of productivity within sectors differs widely and accounts for the bulk of the variation in overall productivity growth across regions (Figure 3.16, panel 1). The contribution to aggregate productivity growth of both manufacturing and market services in 2000–10 was much larger in Asia (1.9 percent and 2.1 percent a year, respectively) than in sub-Saharan Africa (almost nil in manufacturing and 0.8 percent in market services) and in Latin America (about 0.2 percent in each). Therefore, the challenge for many developing economies is not only to facilitate the reallocation of labor to high-productivity sectors, but also to raise productivity growth in all sectors.

Implications for Income Gaps across Countries

Labor shifts into sectors with relatively high and fast-growing productivity (by the standards of the country) may not be enough to narrow the gap vis-à-vis the frontier if productivity grows even faster at the frontier. Rodrik's (2013) finding of unconditional convergence in manufacturing suggests that the lack of income convergence at the country level might be a result of the relatively small share of manufacturing employment in developing economies and that convergence would hasten if the share of manufacturing employment could be raised.

Even if the productivity of the nonmanufacturing sector as a whole does not converge to the world economy's highest levels, some of its subsectors might. This section tests this proposition.[27]

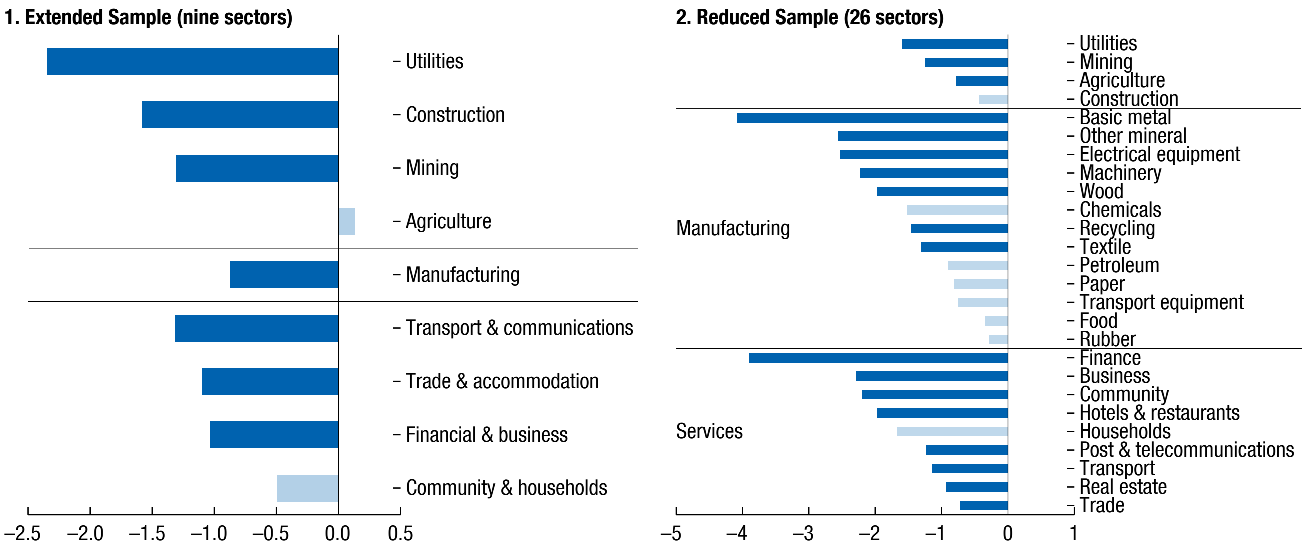
The empirical approach, following Bernard and Jones (1996) and Sorensen (2001), tests whether productivity growth in a sector is faster when the initial gap between its productivity level and productivity at the technological frontier is larger. This would imply that the greater the shortfall, the faster the convergence to the frontier

[26]In earlier work, McMillan and Rodrik (2011) find that structural change contributed negatively to economy-wide productivity growth in sub-Saharan Africa over 1990–2005, a period when the share of agriculture in employment declined by only 0.1 percentage point. In contrast, the share of agriculture within overall employment declined by 5 percentage points over 2000–10 and the bulk of this change occurred during the second half of the period.

[27]Testing unconditional productivity convergence for individual sectors is challenging because it requires data on output per worker at comparable international prices across countries. This section uses new data on sector-specific PPP from the Groningen Growth and Development Centre database. Nonmarket service industries are excluded from the analysis because of lack of reliable sectoral PPP data. See Annex 3.3 for details.

Figure 3.17. Estimation Results, Beta-Convergence
(Coefficient)

There is strong evidence of unconditional productivity convergence to the global frontier (that is, to the productivity level in the most productive countries) for manufacturing as well as for several service industries.



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: This figure shows the estimated coefficients from the unconditional convergence regression for each sector based on labor productivity. Solid bars denote that the coefficient is statistically significant at the 95 percent level. A negative and significant coefficient denotes evidence of productivity convergence across countries. Nonmarket service industries are excluded due to a lack of reliable sectoral purchasing-power-parity data. Panel 1 corresponds to an extended sample of 19 advanced economies and 20 emerging market and developing economies with data for nine market sectors from 1965 to 2015. Panel 2 corresponds to a reduced sample of 19 advanced economies and 11 emerging market and developing economies with data for 26 market sectors during 1970–2010. See Annex 3.3 for details.

level of productivity—a concept of convergence known as beta-convergence (Barro and Sala-i-Martin 1992).

Starting with a sample of 19 advanced economies and 20 developing economies, the analysis provides strong evidence of unconditional convergence of productivity to the frontier for manufacturing, in line with Rodrik (2013), as well as for several nonmanufacturing sectors (Figure 3.17, panel 1). Importantly, the results suggest significant convergence in three of the four market service sectors under study: trade and accommodation, transport and communications, and financial and business services.

In addition, this sample exhibits no unconditional convergence for agriculture, which employed about two-thirds of the workforce in developing economies in the 1970s and almost half as recently as the first decade of the 21st century. The lack of unconditional convergence in agriculture is an important finding because it may explain the difficulty in finding evidence of unconditional convergence in aggregate income per worker in broader samples of countries, including lower-income countries where agriculture still employs a large share of the workforce (see, for instance, the discussion in Chapter 2 of the April 2017 WEO and Box 1.3 of the October 2017 WEO).[28]

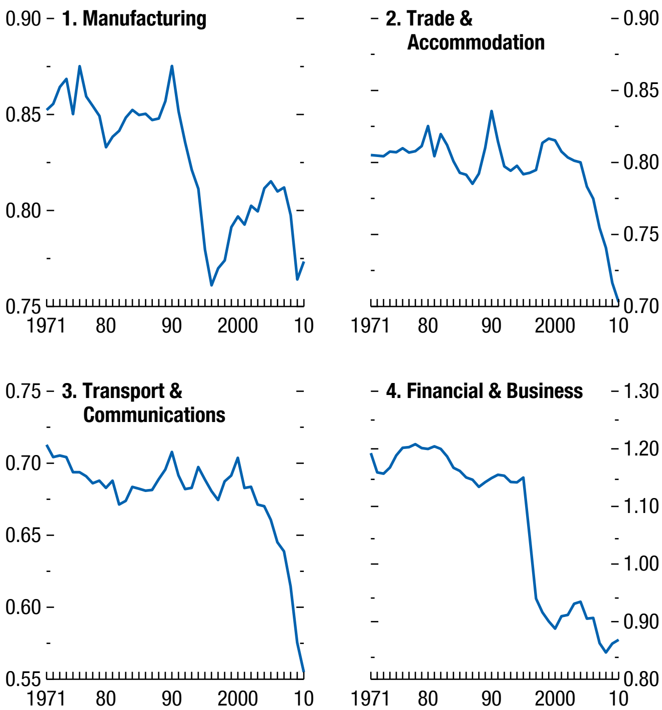
Another indicator of convergence describes whether the dispersion of sectoral productivity across countries has narrowed over time, a measure called sigma-convergence. Indeed, the dispersion of productivity across countries declined over time in all sectors that exhibited significant evidence of beta-convergence (Figure 3.18; Annex Figure 3.3.5).[29] In the case of the service sectors, the extent of convergence seems to have accelerated since the mid-1990s or early 2000s—a time when the trad-

[28]Sectoral convergence, however, does not necessarily imply aggregate convergence. Even if sectoral productivity has converged to the frontier level of productivity in all sectors, there will still be differences in aggregate productivity levels if the relative size of sectors varies across countries (Bernard and Jones 1996).

[29]Given that examination of sigma-convergence requires a balanced sample, Figure 3.18 is based on a smaller sample than the beta-convergence, comprising 28 countries for the period 1971–2010 (excluding eastern European countries for which sectoral data are available only since 1995).

Figure 3.18. Sigma-Convergence
(Standard deviation of log labor productivity, PPP adjusted)

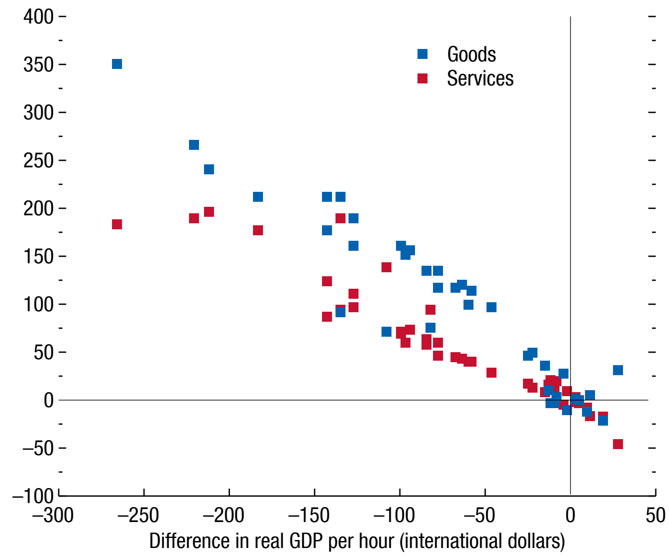
The dispersion of productivity levels across countries declined over time in several service industries, providing further evidence of convergence. The extent of productivity convergence in service industries has accelerated since the mid-1990s or early 2000s.



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: See Annex 3.3 for details. PPP = purchasing power parity.

Figure 3.19. Productivity Gap in 2005
(Difference in productivity level with respect to the United States, percentage points)

The productivity gap vis-à-vis the United States in 2005 was larger for goods-producing sectors than for the service sector. Resource shifts from goods-producing sectors to the service sector need not harm convergence prospects.



Sources: Inklaar and Timmer (2014); and IMF staff calculations.
Note: Productivity gap is calculated as the log difference between sector-specific purchasing-power-parity-adjusted value added per worker in the United States and that in each country. The goods-producing sector includes agriculture, mining, manufacturing, utilities, and construction. The services sector includes the rest.

ability of services increased considerably (Heuser and Mattoo 2017; Box 3.2).

Further analysis using a reduced sample of 19 advanced economies and 11 developing economies with more granular sectoral detail reveals that almost half of the manufacturing industries (including chemicals, food, paper, and rubber) show no evidence of convergence (Figure 3.17, panel 2). Among services, eight out of nine market industries show evidence of unconditional convergence (including financial intermediation, postal services and telecommunications, and business services).[30]

The evidence of convergence in services productivity notwithstanding, the level of productivity in services may be further away from the technological frontier than in agriculture or manufacturing. In that case, the prospects for narrowing the gaps in income per worker as labor shifts from goods-producing sectors to services would be jeopardized, at least temporarily. However, in most countries, the productivity gap vis-à-vis the United States in 2005 was larger for goods-producing sectors than for the service sector (Figure 3.19), especially among lower-income countries.

The main message that emerges from the various parts of analysis in this section is that skipping a traditional industrialization phase need not be a drag on economy-wide productivity growth for developing economies. Some service industries have the potential to boost the growth of aggregate productivity and aid the convergence of income per worker across countries. But sustaining the recent improvements in living standards in many developing countries will require policy actions to strengthen productivity growth within all sectors.

[30]There could be some concern that labor productivity convergence comes primarily from capital deepening. A robustness exercise on a reduced sample provides evidence of unconditional TFP convergence in some market service sectors (for example, financial intermediation, business services, and wholesale and retail trade; see Annex Table 3.3.2). See also the discussion in McMillan and Rodrik (2011).

Implications for Income Inequality

Historically, manufacturing industries are widely perceived to have been a major source of high-quality jobs. The decline in the share of manufacturing jobs in employment, especially among advanced economies, has thus fueled concern that the disappearance of what are thought to be relatively well-paying manufacturing jobs would hurt the living standards of affected workers and contribute to a variety of social ills.[31] Under this mechanism, the shift of workers from well-paying manufacturing to lower-paid jobs in the service sector contributes to the "hollowing out" of the income distribution by moving workers from the middle to the lower end of the income scale, leading to higher earnings inequality. A large body of research has investigated the causes of growing income inequality and polarization, focusing primarily on the roles of trade and automation.[32] Few studies, however, have sought to isolate the effects of structural transformation on the distribution of labor income.[33]

Against this backdrop, this section uses micro-level data for a set of advanced economies to examine if pay is systematically higher and more evenly distributed in the manufacturing sector, as is often assumed. It then gauges the extent to which changes in income inequality can be attributed to shifts in employment shares across sectors, exploiting the initial disparity of earnings within and across types of employment. The main takeaway of the analysis is that only a limited portion (less than one-fourth under an extreme assumption) of the rise in income inequality could have resulted from the shift between manufacturing and nonmanufacturing employment.

The micro-level data used for the analysis are from the Luxembourg Income Study database. Because of data limitations, the manufacturing sector is represented by the broader industrial sector.[34] The data used here cover labor income from household surveys in an unbalanced panel of 20 advanced economies since the 1980s.

Are earnings higher and more equal in industry than in services?

The data show that labor compensation in industry is indeed somewhat higher than in services for comparable skill levels (Figure 3.20).[35] For medium-skilled workers in the two sectors, earnings are practically indistinguishable. The median difference in labor earnings between industry and services for high- and low-skilled workers is about 6 percentage points and 9 percentage points, respectively. Nonetheless, the skill premium is more important in explaining the variation in earnings across workers than their sector of employment: the gap between earnings for middle- versus low-skilled workers within a sector is about twice as large as the gap between low-skilled workers in industry and services.

Similarly, there is somewhat less labor income inequality in the industrial sector than in the service sector (as indicated by the two leftmost boxes in Figure 3.21, panel 1). But the data also show that countries with a relatively high degree of earnings inequality within the service sector tend to have high inequality within the industrial sector as well (Figure 3.21, panel 2).[36]

[31] For example, Helper, Krueger, and Wial (2012) document that average earnings in manufacturing jobs are about 8 percent higher than in nonmanufacturing jobs when differences in worker and job characteristics are controlled for. Lawrence (2017) stresses that manufacturing has historically provided the opportunity for relatively unskilled workers to earn relatively high wages; he notes that in the United States, the manufacturing sector employed more than one-third of men without a college degree in 1970 and 17 percent in 2015. Autor, Dorn, and Hanson (2017) highlight the effects of the loss in manufacturing jobs on family formation dynamics.

[32] The literature on job polarization and labor income inequality has focused mostly on occupations rather than industries. It indicates that, since the 1980s, employment and wages in several advanced economies tended to grow faster for high- and low-skill occupations than for middle-skill occupations (Autor, Katz, and Kearney 2006; Goos, Manning, and Salomons 2014). Autor, Dorn, and Hanson (2013, 2016) and Acemoglu and Restrepo (2017) argue that trade and technology are changing the manufacturing sector in the United States by lowering the demand for labor, especially for the middle-skill group.

[33] An exception is Bárány and Siegel (2018), who argue that employment shifts across industries in the United States have enhanced the polarization of the job market.

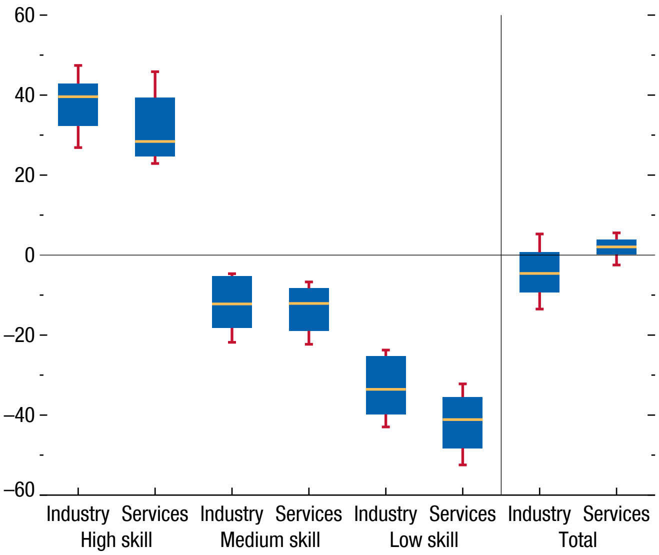
[34] The broad sectors considered for this analysis are agriculture, industry (which consists of manufacturing, construction, mining, and utilities), services, and a residual category. The Luxembourg Income Study database offers an alternative sectoral classification that distinguishes the manufacturing sector. However, using this classification would significantly reduce the sample size. Moreover, manufacturing accounts, on average, for about two-thirds of employment in the broad industrial sector, and distributional statistics on labor income for manufacturing and overall industry are comparable in countries where data are available for both sectors.

[35] Average labor earnings in services are higher than in manufacturing, but this is because the service sector as a whole employs more high-skilled workers than does manufacturing. Skill levels are determined according to the following classification of occupations in the International Standard Classification of Occupations (ISCO): managers and professionals (ISCO 1 and 2) are shown as high skill; laborers/elementary (ISCO 9) as low skill; and other skilled workers (ISCO 3–8, 10) as medium skill.

[36] While this section focuses on advanced economies, potentially lower earnings in expanding service sector jobs is also a concern for developing countries (Hallward-Driemeier and Nayyar 2017). Box 3.3 looks at the experience of individual workers in Brazil

Figure 3.20. Average Gross Wages in Industry and Services in the 2000s
(Difference with respect to average economy-wide gross wages, percentage points)

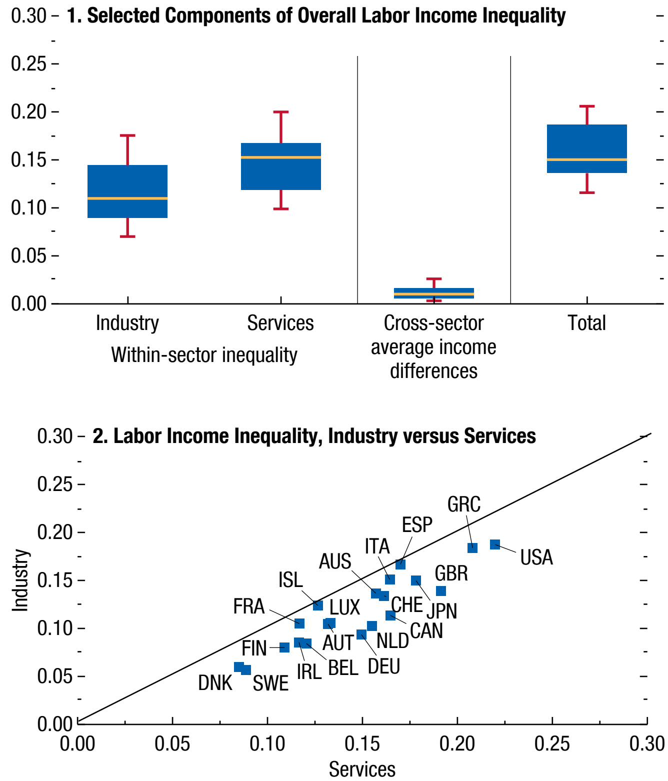
Labor earnings in industry are somewhat higher than in services for high- and low-skilled workers and broadly comparable for medium-skilled workers.



Sources: Luxembourg Income Study database; and IMF staff calculations.
Note: The figure shows the cross-country distribution of the difference between average (among individuals) gross wages by sector of employment and occupation and average economy-wide gross wages for full-time working household members for whom occupation data are available. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. The sample includes 12 countries; data correspond to the latest year available during 2000–09.

Figure 3.21. Labor Income Inequality in the 2000s
(Points)

Labor income inequality is somewhat lower in industry than in services, but country characteristics dominate in explaining within-sector inequality in both industry and services.



Sources: Luxembourg Income Study database; and IMF staff calculations.
Note: For each country, the analysis is based on data from the latest year available during 2000–09. The measure of inequality used is generalized entropy based on disposable income (see Annex 3.4 for details). Panel 1 shows the cross-country distribution of labor income inequality in industry and services; the contribution of differences in average earnings across sectors to aggregate inequality; and aggregate inequality. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. Data labels in panel 2 use International Organization for Standardization (ISO) country codes.

How did the shift in workers between industry and services affect the distribution of labor income?

To isolate the effects of shifts in sectoral employment shares on earnings inequality, the analysis offers a thought experiment. If the average pay differentials between sectors and the levels of inequality within them had stayed at their initial levels, how much would the shifts in sectoral employment shares have changed the inequality in earnings? A decomposition along these lines suggests that the shift in manufacturing workers to services would not have significantly worsened economy-wide income distribution if the level and distribution of earnings in each sector had remained at their initial levels. Shifts in employment shares between industry and services contributed only about 15 percent of the rise in economy-wide income inequality (keeping the dispersion and relative level of earnings constant at their initial values).[37] Instead, between the 1980s and

between 1996 and 2013—a period during which the service sector was expanding while manufacturing employment remained broadly stable. Though the findings cannot be generalized, the analysis does not find significant wage gains for workers who move to manufacturing jobs from other sectors.

[37]A definitive test of whether the shift of middle-skilled workers from manufacturing to services implies erosion of their income would require data over time at the individual level, which are not available for a broad set of countries.

2000s, most of the rise in earnings inequality within countries came from the rise in pay inequality within services and industry (Figure 3.22).[38]

The increase in earnings dispersion within sectors could result, however, in part from the movement of workers across sectors for two reasons. First, the dislocation of manufacturing workers to low-skill (and low-wage) jobs in services would "mechanically" increase the share of workers at the lower portion of the income distribution and raise income polarization and inequality. With the average income of middle-skilled workers in the industry sector almost 30 percent higher than that of low-skilled service sector workers (Figure 3.20), the disappearance of middle-skill manufacturing jobs could imply a large pay cut for workers in that group who move to low-skill jobs in the service sector. Second, a spurt in the number of workers competing for lower-skill jobs can put downward pressure on wages at the lower end of the earnings distribution, widening the gap between incomes at the high and low ends of the spectrum.

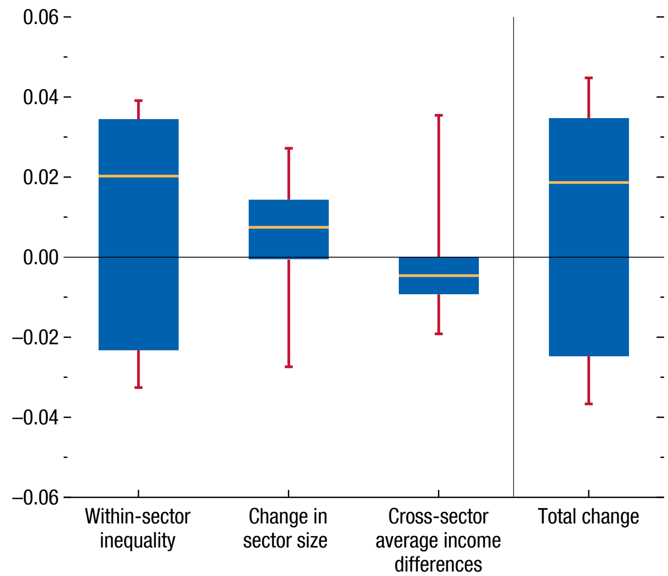
To assess the quantitative relevance of the first channel, a stylized exercise assumes that, in the eight economies with available data since the 1980s and where manufacturing employment fell in absolute terms, all manufacturing jobs lost between the 1980s and 2000s were those of middle-skilled workers who moved to low-skill and low-wage jobs in services (set to the 25th percentile of wages in low-skill service jobs). In this scenario, overall labor income inequality would have increased, on average, by about 9 percent of the actual increase in inequality between the 1980s and 2000s and up to one-fourth in any of the countries considered.

Testing whether the dislocation of manufacturing workers to low-skill jobs exerts downward pressure on wages for all workers at the lower end of the earnings distribution is beyond the scope of this chapter but could be a fruitful area for future research. Autor (2015) argues that the slow wage growth in low-skill jobs during 1999–2007 in the United States may have been related to middle-skilled workers—including those displaced from highly routinized jobs—taking low-skill jobs.

[38]The analysis is based on a decomposition of the overall change in labor income inequality between the 1980s and 2000s for a sample of 13 economies into the contribution of within-sector changes in inequality, changes in the relative size of each sector, and changes in average incomes across sectors. The year used for each country varies depending on survey data availability. See Annex 3.4 for details.

Figure 3.22. Contribution to Change in Overall Labor Income Inequality between the 1980s and 2000s
(Points)

Most of the increase in overall labor income inequality between the 1980s and 2000s is explained by rising inequality within sectors rather than by shifts in the relative size of employment between industry and services.



Sources: Luxembourg Income Study database; and IMF staff calculations.
Note: The figure shows the cross-country distribution of the change in aggregate labor income inequality between 1980–89 and 2000–09 and the contribution from changes in inequality within sectors, changes in the relative size of sectors, and changes in the difference of average income levels across sectors. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. The measure of inequality used is generalized entropy based on disposable income. The sample consists of 13 countries (see Annex 3.4 for details).

In summary, the findings in this section suggest that changes in aggregate labor income inequality are predominantly explained by rising labor income inequality within sectors. As analyzed widely in the literature, the key drivers behind greater pay inequality over time seem to be the dislocation of middle-skilled workers through technology and trade—and the resultant downward pressure on wages for medium- and low-skill jobs—rather than shifts in the relative size of employment between industry and services.

A word of caution regarding these findings is nonetheless warranted. First, displaced middle-skilled manufacturing workers may end up experiencing prolonged unemployment spells or dropping out of the labor force rather than taking low-wage jobs in services, leading to an increase in overall inequality that would not be captured in the analysis based on workers' labor earnings. Indeed, the analysis in Chapter 2 shows that workers in routinizable occupations were more likely to involuntarily drop out of the labor force. Second, some valuable nonwage attributes of manufacturing jobs appear less widespread in other sectors. Manufacturing jobs tend to be characterized by formal employment arrangements with associated benefits for workers, such as access to retirement plans, paid holidays and sick leave, and health and life insurance. They also tend to provide relatively stable arrangements, relying less on part-time or temporary contracts than other sectors (Chapter 2 of the October 2017 WEO), and may offer collective bargaining via unions (Jaumotte and Osorio Buitron 2015). Finally, even if shifts in employment shares between sectors contributed little to aggregate inequality, the negative consequences of declining manufacturing jobs can be sizable for some groups. Transitional costs associated with sectoral reallocation can be substantial for individual workers, due to both prolonged unemployment spells and lower earnings in subsequent jobs (Walker 2013). These individual costs can have nonnegligible aggregate incidence in regions that had developed as manufacturing hubs.

Conclusions and Policy Implications

This chapter finds that the decline in the share of manufacturing jobs in overall employment need not hurt growth or raise inequality. Some service sectors can match the productivity levels and growth rates of manufacturing, so the relative expansion of those services could help national income approach advanced economy levels in economies that appear to be bypassing a traditional industrialization phase. Some service sectors exhibit signs of productivity convergence to the frontier, and the shift of employment shares from agriculture toward services since the 2000s has benefited economy-wide productivity in many developing countries.

However, these findings do not necessarily mean that income convergence is assured—whether manufacturing is expanding or not—or that recent favorable trends in output per worker can be extrapolated into the future. Strong policy efforts are needed to facilitate the reallocation of activity toward higher-productivity sectors and bolster productivity growth across all sectors.[39]

Shifts of employment shares toward services during the past two decades may have been enabled in part by strong domestic demand, which has lost momentum in many developing economies, especially among commodity exporters. To help maintain productivity-benefiting structural change, policymakers need to ensure that the growth of domestic demand and available workforce skills do not impede the expansion of highly productive service activities. Reducing barriers to international trade and investment in services, which tend to be particularly high in developing economies (Miroudot, Sauvage, and Shepherd 2013; Koske and others 2015), would expand the service sector's opportunities for tradability, scale, and productivity growth. Adapting the rules in multilateral trade agreements to cover areas such as digital trade and e-commerce (as discussed in Chapter 1 and Box 2.2 of the October 2016 WEO) would also help in that regard. To facilitate the reallocation of workers to sectors where their efficiency is higher, policy should also ensure that workforce skills are aligned with those needed in highly productive and expanding sectors of the economy.

The analysis in the chapter also indicates that within-sector productivity growth remains anemic in developing economies outside East Asia. In many countries, raising productivity in agriculture—which remains the primary employer and still exhibits very low levels of productivity—is key to facilitate the transition of workers to dynamic industries in manufacturing and services. More generally, a comprehensive approach is needed to strengthen productivity across all sectors, including by bolstering human capital and physical infrastructure and improving the business and investment climate. Reforms aimed at removing obstacles to the efficient movement of factors of production between firms and promoting competition are also key, especially in services where barriers to entry tend to be higher and the extent of competition lower than in goods-producing sectors (Koske and others 2015; Chapter 3 of the April 2016 WEO). For example, the extent of government involvement in network sectors (such as electricity, gas, rail transportation, air transportation, postal services, and telecommunications) and barriers to entry in network sectors and other services (professional, freight transport, and retail distribution services) are still pervasive and partic-

[39]Policies that do not respond to a specific market failure but focus solely on the relative size of the manufacturing sector could be counterproductive as they might preserve low-productivity firms and postpone an efficient reallocation of resources (Fournier and Johansson 2016).

ularly large among developing economies. Services deregulation would facilitate the entry of new firms into the sector and promote competition (Koske and others 2015; Adler and others 2017). Moreover, the consequent productivity gains in services can generate positive spillovers for downstream and upstream industries, including in manufacturing (Fernandes and Paunov 2012; Bourlès and others 2013; Lanau and Topalova 2016).

The chapter also finds that changes in the inequality of labor income in advanced economies are predominantly explained by rising earnings inequality within all sectors. Higher pay inequality has nonetheless coincided with lower shares of employment in manufacturing and higher shares of service sector jobs, reflecting trends, such as automation, that have affected the demand for the types of skills required in routinizable occupations. To ensure inclusive gains from technological progress, policy should help workers cope with its adverse side effects. A range of factors—including financial constraints, strong ties to their local area, and lack of needed skills—may have prevented workers displaced from manufacturing jobs from taking adequate employment in other sectors. Expanding access to training and education programs aligned with the needs of the evolving economy (including job-search assistance and training) as well as safety nets and redistribution policies targeted at displaced workers can help soften the blow imposed by structural transformation on workers and their communities. Regions with a heavy reliance on declining manufacturing jobs may require specifically targeted policy measures to facilitate the transition.

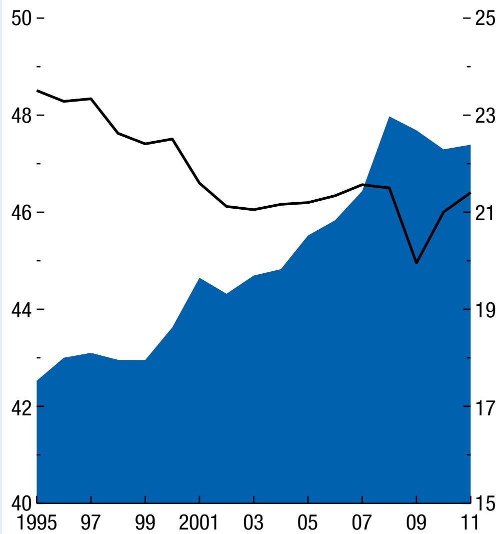
Box 3.1. The Changing Service Content of Manufactures

Services account for an increasing share of the total value of manufactured goods—an increase sometimes called the "servicification" of manufacturing.[1] The change in input-output linkages between the service and manufacturing sectors from 1995 to 2011 implies that the share of service inputs in the total production value of manufactures increased by about 6 percentage points, on average, across countries. This increase can reflect, for instance, rising consumer demand for goods that are more intensive in service inputs (for instance, design and software), or the fact that combining production inputs that are increasingly diffused geographically requires more service inputs (for instance, logistics and communications). However, service inputs in manufactured goods account for a small fraction (about 12 percent) of overall value added in the service sector, and the share of manufactures in total final expenditure has been steadily declining during this period (Figure 3.1.1). The lion's share of the expansion of services in aggregate value added—6 percentage points out of 7 percentage points, on average, between 1995 and 2011—corresponds to an increase in final expenditure on services—rather than to an increase in the share of service inputs used by other sectors.

Services can augment the value of finished manufactured goods in two ways: (1) as inputs in the manufacturing process, or (2) as auxiliary activities bundled with finished goods when sold to consumers. Examples of service inputs include design, research and development, and information technology; examples of auxiliary service activities include financing, logistics, and installation.

Input-output tables contain information on supply-use relations between industries within and across countries. To date, studies measuring the extent of servicification have been limited to individual countries or exports rather than overall output.[2] This box uses worldwide input-output data to quantify the service content of manufacturing gross output.[3,4]

Figure 3.1.1. Nonmanufacturing Value-Added Content in Gross Manufacturing Output, 1995–2011
(Percent)



Sources: World Input-Output Database; and IMF staff calculations.
Note: The solid line (right scale) shows global spending on manufactures as a share of global total spending. The shaded area (left scale) depicts the share of nonmanufacturing value-added content in gross manufacturing output.

At the global level, the contribution to gross manufacturing output by nonmanufacturing activities—such as agriculture, mining, and services—increased from 42 percent of total gross manufacturing output in 1995 to 47 percent in 2011 (Figure 3.1.1). About two-thirds of the nonmanufacturing contribution to gross

The author of this box is Wenjie Chen.

[1]This term is used in Baldwin, Forslid, and Ito (2015); Miroudot and Cadestin (2017); and Hallward-Driemeier and Nayyar (2017), among others.

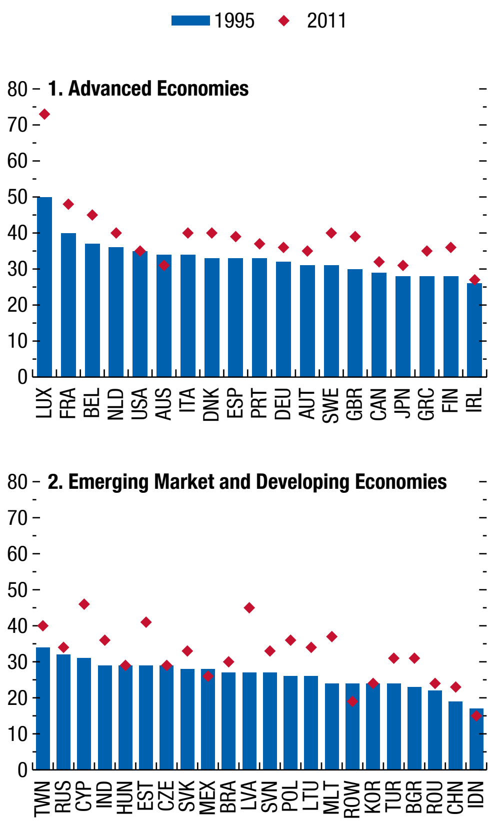
[2]For instance, the National Board of Trade of Sweden (2010) and Lodefalk (2013) show that, in Sweden, the services share of total inputs used in manufacturing doubled over 1975–2005, with most of the gains reached by 1995. Baldwin, Forslid, and Ito (2015) use input-output data for a group of Asian economies and document a surge in the value-added share of services in manufactured exports. Heuser and Mattoo (2017) use the Organisation for Economic Co-operation and Development Trade in Value-Added database to document the evolution of services trade in global value chains.

[3]The data used for this analysis come from the 2013 release of the World Input-Output Database, which covers the world economy over 1995–2011 (including data for 40 individual economies, accounting for more than 85 percent of world GDP) and from the corresponding socioeconomic accounts (Timmer and others 2015). The computations used for this box are described in Annex 3.2.

[4]The gross output of the manufacturing sector is the sum of the value added of the sector and the intermediate inputs it uses, whether produced domestically or abroad. Domestic gross output can be constructed by extracting the foreign value-added content of intermediate inputs.

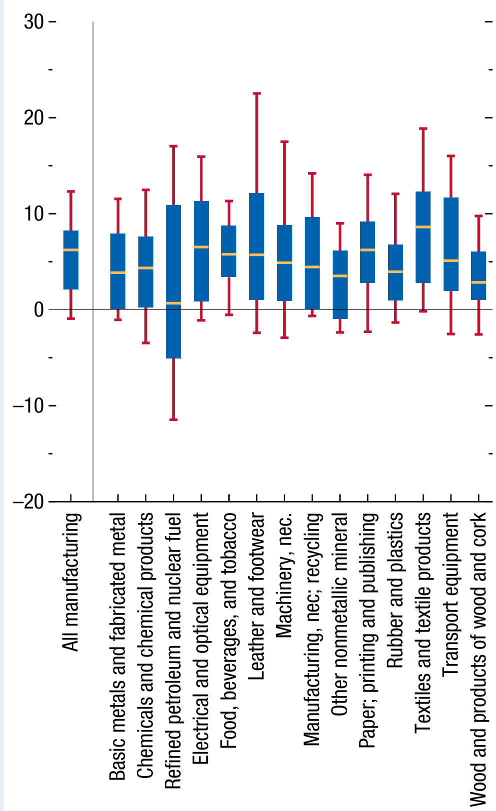
Box 3.1 *(continued)*

Figure 3.1.2. Services Value-Added Content in Gross Manufacturing Output, 1995 and 2011
(Percent)



Sources: World Input-Output Database; and IMF staff calculations.
Note: Data labels use International Organization for Standardization (ISO) country codes. ROW = rest of the world.

Figure 3.1.3. Change in Services Value-Added Content in Manufacturing Gross Output, 1995–2011
(Percentage points)



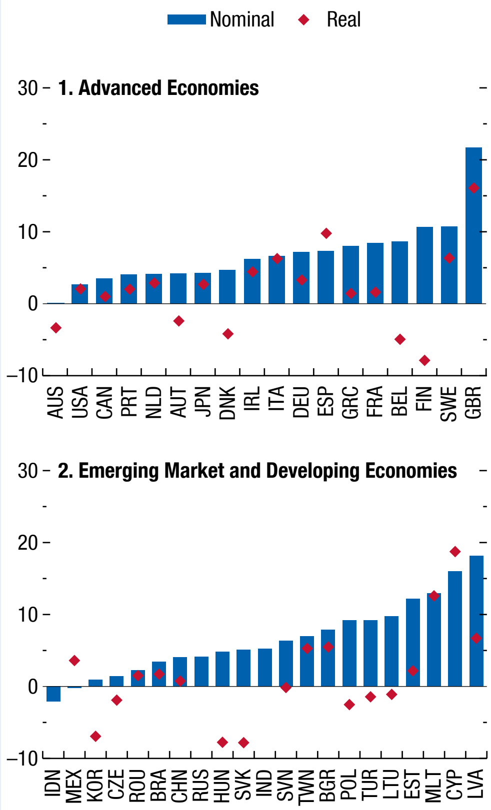
Sources: World Input-Output Database; and IMF staff calculations.
Note: The figure shows the cross-country distribution of changes in the service value-added content in gross manufacturing output between 1995 and 2011 for each of the 14 manufacturing industries. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. nec = not elsewhere classified.

manufacturing output come specifically from service industries. For the median economy in the sample, the contribution of services to gross manufacturing output was about one-third of manufacturing gross output in 2011 (Figure 3.1.2), albeit with considerable variation, ranging from about 15 percent in Indonesia to 50 percent in France and 70 percent in Luxembourg. Across all economies in the sample, the services value-added share in gross manufacturing output increased by an average of about 6 percentage points, or about 0.4 percentage point a year between 1995 and 2011. The services contribution increased across the whole spectrum of manufacturing industries (Figure 3.1.3).

As documented in the main text, the prices of manufactures relative to services have been declining in most economies. The increase in the share of services in the total production value of manufactures could thus reflect that the price of services value added has outpaced that of manufacturing. Indeed, when calculated at constant (real) prices, the rise in the services share of gross manufacturing output is smaller than it is at current prices, and even declined

Box 3.1 *(continued)*

Figure 3.1.4. Change in Services Nominal and Real-Value-Added Content in Manufacturing Gross Output, 1995–2009
(Percentage points)



Sources: World Input-Output Database; and IMF staff calculations.
Note: Data labels use International Organization for Standardization (ISO) country codes.

in many economies over the 1995–2009 period (Figure 3.1.4).[5] Nonetheless, the share measured in real prices increased in about two-thirds of the sample economies.

Finally, despite the higher service content of manufactures documented above, the increase in the share of service inputs in the total production value of manufactures during 1995–2009 did not play an important role in the overall expansion of services in the economy. The expansion of services value added as a share of total value added (by almost 7 percentage points, on average, between 1995 and 2011) was mostly due to an increase in final demand for services (about 6 percentage points, on average), rather than due to an increase in the use of services as intermediate inputs by other sectors.

[5]Data limitations restrict the comparison to the 1995–2009 period. The results for 1995–2007 are similar.

Box 3.2. The Rise of Services Trade

Cross-border trade in services has been growing steadily over the past four decades, and now accounts for about one-fifth of global exports (Figure 3.2.1). The service share of exports has expanded in most advanced and developing economies (Figure 3.2.2, panel 1), with the expansion being particularly pronounced in the latter group. In one-fourth of these economies, the service share of exports increased by more than 20 percentage points since the early 1980s.

Much of the rise in the share of service exports comes from the decline in trading costs, in turn resulting from advances in information and communication technologies.[1] The rise of global value chains (GVCs) has also been intricately linked to the rise of services trade. As in the case of goods, the emergence of GVCs has allowed for international specialization in service tasks, and services have been increasingly traded as components within GVCs.[2] Indeed, many services have become as tradable as manufactured goods (see Gervais and Jensen 2014). As a result, cross-border trade as a share of global services output has risen from about 3 percent in 1970 to 10 percent in 2014 (Figure 3.2.1). The increase in the tradability of services is widespread across countries (Figure 3.2.2, panel 2).

In terms of industries, the increase in service exports has been particularly large in "modern" services that can be delivered at a distance, such as telecommunications, computer and information services, intellectual property, financial intermediation, and other business activities, including research and development and professional services (Figure 3.2.3).[3] The share of modern services exports in total services

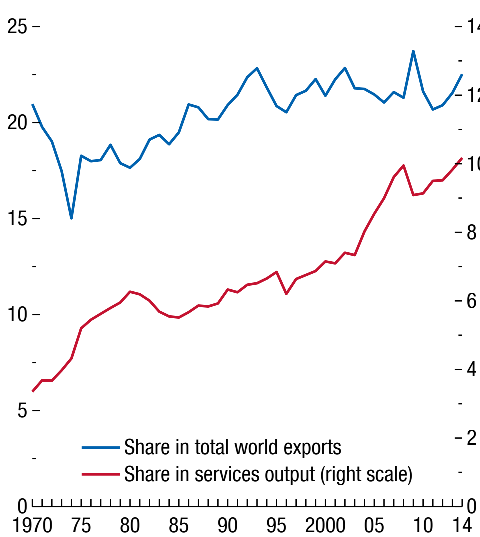
The author of this box is Ke Wang.

[1]Copeland and Mattoo (2007) and Francois and Hoekman (2010) review the growing literature on trade in services.

[2]Heuser and Mattoo (2017) provide a comprehensive overview of the role of services trade within global value chains.

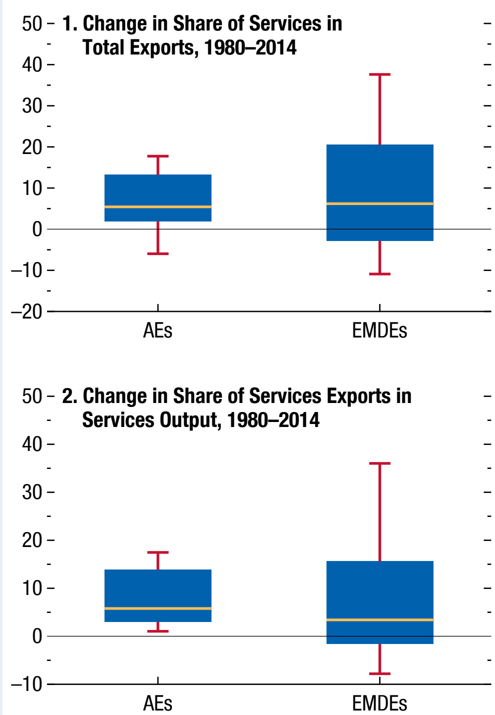
[3]Following Loungani and others (2017), modern services typically refer to those that do not require the physical proximity of buyer and seller. All other services are classified as traditional, although the boundaries between traditional and modern are becoming increasingly blurred as technology evolves.

Figure 3.2.1. Exports of Services
(Percent)



Sources: Loungani and others (2017); and IMF staff calculations.

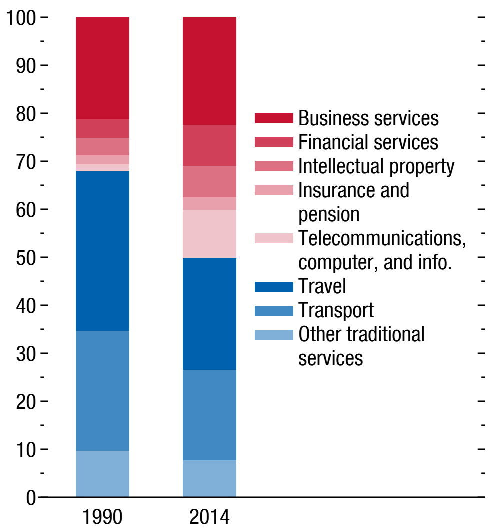
Figure 3.2.2. Increase in Service Trade, 1980–2014
(Percentage points)



Sources: Loungani and others (2017); and IMF staff calculations.
Note: The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. AEs = advanced economies; EMDEs = emerging market and developing economies.

Box 3.2 *(continued)*

Figure 3.2.3. Services Exports by Industry, 1990–2014
(Percent)



Sources: Loungani and others (2017); and IMF staff calculations.
Note: Blue (red) shades represent traditional (modern) services.

exports increased from about 32 percent in 1990 to 50 percent in 2014. The fastest-growing segment was telecommunications and computer and information services industries, whose exports in 2014 reached 10 percent of total services exports, up from 1 percent in 1990. The travel industry accounts for a sizable fraction of the services exports of developing economies, although its relative importance has diminished over time.

Barriers to international trade are larger for service exports than for goods, and particularly large in developing countries (Miroudot, Sauvage, and Shepherd 2013; Koske and others 2015; Heuser and Mattoo 2017). Moreover, service sectors facing lower trade costs tend to be more productive and exhibit higher productivity growth (Miroudot, Sauvage, and Shepherd 2013). Policy action to reduce barriers to trade in the service sector would enhance its tradability and help boost productivity growth in services.

Box 3.3. Are Manufacturing Jobs Better Paid? Worker-Level Evidence from Brazil

Jobs in the service sector, rather than in manufacturing, are increasingly replacing agricultural employment in developing economies. This box uses a rich micro-level data set from Brazil to answer the following questions: Are wages higher in manufacturing than in services for workers with comparable skills? Do workers who switch to manufacturing jobs from jobs in agriculture or services obtain initial wage gains and faster wage growth? Are labor earnings more uniformly distributed in manufacturing than in services?

About 10 percent of Brazil's workforce moved from agriculture to service activities between 1996 and 2013, while the share of manufacturing jobs remained broadly stable (Figure 3.3.1). Wage inequality fell during that period. A panel data set that tracks the wages of Brazilian workers and their sector of employment allows for an examination of the relationship between the rising role of service employment and wage inequality.[1]

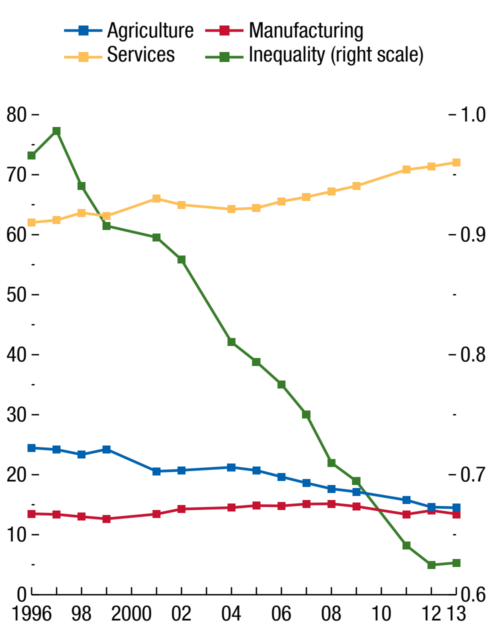
Wages in manufacturing are not much higher than in services (Figure 3.3.2). After controlling for age, education, and labor market regions of workers, the wage gap across sectors at the outset of the period was only about 6 percentage points, and by 2013 it was close to zero.

In line with a moderate differential between wages in manufacturing and elsewhere, workers who switched from agriculture or services to the manufacturing sector during the sample period did not obtain much of an initial wage gain. The average boost was no larger than

The author of this box is Jorge Alvarez.

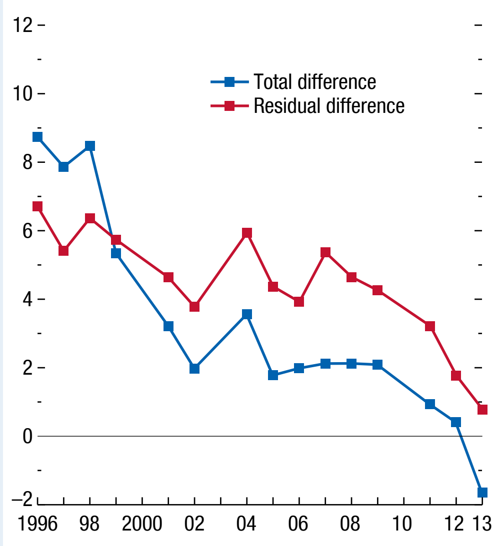
[1]The data are from household surveys and a large matched set of employer-employee records on workers' income, hours, education, and other demographic characteristics.

Figure 3.3.1. Sectoral Employment Shares and Wage Inequality
(Percent, unless noted otherwise)



Sources: Alvarez (2017); and IMF staff calculations.
Note: The measure of inequality is the variance of log wages based on the the Pesquisa Nacional por Amostra de Domicílios household survey data. Survey data are not available for 2000, 2003, and 2010.

Figure 3.3.2. Wage Gap between Manufacturing and Services
(Percentage points)

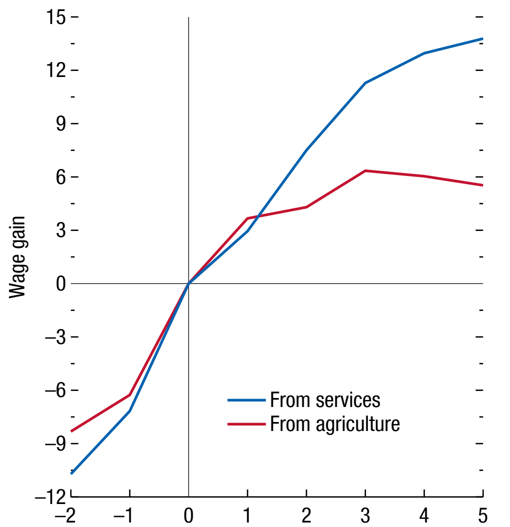


Sources: Alvarez (2017); and IMF staff calculations.
Note: The figure shows the average difference in mean log wages between workers in manufacturing and those in services based on household surveys from the Pesquisa Nacional por Amostra de Domicílios. The residual difference is the average difference after controlling for the age, education, gender, race, and region of individual workers. Survey data are not available for 2000, 2003, and 2010.

Box 3.3 *(continued)*

Figure 3.3.3. Wages of Workers Switching to Manufacturing Jobs

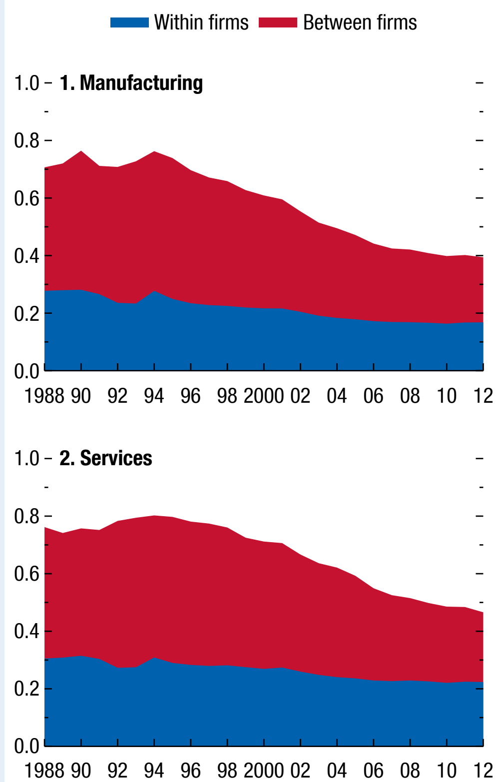
(Wage relative to level at time of switching sectors, percentage points)



Source: Calculations from Alvarez (2017) using Relação Anual de Informações Sociais panel data on formal workers.
Note: The figure shows the average relative wage of individual workers who shifted to manufacturing jobs (relative to their wage level at the time of the transition), controlling for time and worker fixed effects. *X*-axis labels indicate the number of years before and after switching sectors (1 = first year in new sector).

Figure 3.3.4. Inequality in Manufacturing and Services

(Variance of log labor earnings)



Sources: Alvarez and others (2018); and IMF staff calculations.
Note: The measure of inequality used is the variance of log labor earnings and is computed using Relação Anual de Informações Sociais panel data on formal workers.

the expected gain from an additional year of experience in the original sector (Figure 3.3.3).[2]

Moreover, wage gains for workers who switched to a manufacturing job were no faster in the subsequent years than they were before the switch, once the common trend in wages across all workers and worker characteristics are accounted for.

At least in the formal sector, wage inequality is not higher in services than in manufacturing, and the decline of inequality in the two sectors over the past few decades is very similar (Figure 3.3.4). The analysis also shows that the dispersion of wages across firms within the two sectors plays an important role in explaining the overall level of inequality in each sector and the decline since the mid-1990s. Less important is inequality within service sector firms versus that within manufacturing firms.

In sum, differences between the services and manufacturing sectors in terms of the level and dispersion of wages have remained small in Brazil over two decades that saw an expansion of the services share of employment and a decline in overall inequality. Changes that affect all sectors, such as the increase in the minimum wage (Engbom and Moser 2018), and other firm-level factors (Alvarez and others 2018), appear to have played a more prominent role in driving overall labor income inequality than changes in the relative size of manufacturing versus service jobs in overall employment.

[2]The analysis shows gains from transitioning after controlling for time effects. As discussed in Alvarez (2017), these expected gains are equivalent to the sectoral premiums after controlling for differences in both observable and unobservable characteristics of workers in the two sectors. Similar trends are seen when using wages or earnings.

Annex 3.1. Data Sources and Country Coverage

All data sources used in the chapter are listed in Annex Table 3.1.1. The country coverage for the different sections is presented in Annex Table 3.1.2. In this chapter, advanced economies are those that are classified as such by the *World Economic Outlook* in 1996. All other economies are considered emerging market and developing economies (developing economies for short).

Annex Table 3.1.3 provides a summary of the main sectoral compositions used throughout the chapter and the correspondence with United Nations International Standard Industrial Classification (Revision 3.1) sectors.

Data from multiple sources are used to enhance the coverage of sectoral employment and output series (Annex Table 3.3.1): Groningen Growth and Development Centre (GGDC), Organisation for Economic

Annex Table 3.1.1. Data Sources

Indicator	Source
Final Expenditure on Manufacturing Goods	IMF staff calculations based on World Input-Output Database
Generalized Entropy	IMF staff calculations based on Luxembourg Income Study database
Gross Hourly Wage	IMF staff calculations based on Luxembourg Income Study database
Manufacturing Consumption Share	IMF staff calculations based on World Bank, International Comparison Program database
Manufacturing Gross Output	IMF staff calculations based on World Input-Output Database
Purchasing Power Parity	Penn World Table 9.0
Real GDP per Capita	IMF, World Economic Outlook database
Relative Price of Manufactured Goods	IMF staff calculations based on GGDC; UN National Accounts Official Country Data database
Sectoral Employment	Felipe and Mehta (2016); GGDC; ILO; national sources; OECD; UNIDO; World KLEMS database
Sectoral Labor Productivity	GGDC; World KLEMS database
Sectoral Purchasing Power Parity	GGDC; Inklaar and Timmer (2009); World KLEMS database
Sectoral TFP	Jorgenson, Ho, and Samuels (2013); World KLEMS database
Sectoral Value Added (at current and constant prices)	GGDC; UN National Accounts Official Country Data database; World KLEMS database

Source: IMF staff compilation.
Note: GGDC = Groningen Growth and Development Centre; ILO = International Labour Organization; TFP = total factor productivity; UN = United Nations; WTO = World Trade Organization.

Annex Table 3.1.2. Sample of Economies Included in the Analytical Exercises

Group[1]	Economies[2]	Exercise[3] I	II	III	IV	V	VI
A	Argentina,* Australia, Austria, Belgium, Brazil,* Canada, Chile,* China,* Denmark, Finland, France, Germany, Greece, India,* Indonesia,* Ireland, Italy, Japan, Korea,* Luxembourg, Mexico,* Netherlands, Poland,* Portugal, South Africa,* Spain, Sweden, United Kingdom, United States	X	X	X			
B	Bolivia,* Botswana,* Colombia,* Costa Rica,* Egypt,* Ethiopia,* Ghana,* Hong Kong SAR,* Kenya,* Malawi,* Malaysia,* Mauritius,* Morocco,* Nigeria,* Peru,* Philippines,* Senegal,* Singapore,* Taiwan Province of China,* Tanzania,* Thailand,* Venezuela,* Zambia*	X	X				
C	Bangladesh,* El Salvador,* Guatemala,* Honduras,* Norway, Pakistan,* Panama,* Puerto Rico,* Romania,* Suriname,* Switzerland, Syria,* Trinidad and Tobago*	X					
D	Cyprus,* Czech Republic,* Estonia,* Hungary,* Latvia,* Lithuania,* Malta,* Russia,* Slovak Republic,* Slovenia*		X	X			
E	Austria, Finland, Germany, Ireland, Netherlands, United States				X	X	X
F	Australia, Canada, Denmark, France, Italy, Sweden, United Kingdom				X	X	
G	Belgium, Greece, Iceland, Luxembourg, Spain, Switzerland				X		X
H	Japan				X		

[1] Group of economies according to their use in different analytical exercises.
[2] Asterisk (*) denotes emerging market and developing economies as classified by the IMF, *World Economic Outlook*, plus economies used in the exercises that have been reclassified as advanced economies since 1996 (Cyprus, Czech Republic, Estonia, Hong Kong SAR, Korea, Latvia, Lithuania, Malta, Puerto Rico, Singapore, Slovak Republic, Slovenia, Taiwan Province of China).
[3] Analytical exercises performed in the chapter: I = stylized facts (Figures 3.1, 3.4–3.7, 3.9, 3.10); II = sectoral employment (Figure 3.2) and productivity (Figures 3.12–3.16); III = beta convergence (Figure 3.17); IV = inequality decomposition, 2000s (Figure 3.21); V = inequality decomposition over time (Figure 3.22); VI = wages (Figure 3.20).

Annex Table 3.1.3. Sectors, Individual Industries, and Abbreviations Used in the Chapter

Sector Group	10-Sector Name	Sectors Included (ISIC Revision 3.1)	Examples of Industries Included
Agriculture	Agriculture	Agriculture; fishing	
Manufacturing	Manufacturing	Manufacturing	Food, tobacco, textiles, apparel, leather, wood, paper, coke, chemicals, rubber, other nonmetallic products, basic metals, electrical equipment, machinery, transport equipment, recycling, petroleum
Market Services	Trade & accommodation	Wholesale and retail trade; repair of goods; hotels and restaurants	Wholesale and retail trade; sale, maintenance, and repair of motor vehicles
	Transport & communications	Transport, storage and communications	Land, water, and air transport; post and telecommunications
	Financial & business	Financial intermediation; real estate and business activities	Financial intermediation, insurance and pensions, real estate, renting of machinery and equipment, computer (including hardware consulting, production of software, and data processing), research and development, other business activities (including professional services)
	Community & households	Community and personal services; activities of private households	Sewage and sanitation; recreational and other service activities; activities of private household as employers of domestic staff
Nonmarket Services	Government	Public administration and defense; education; health	Public administration and defense; education; health
Other	Utilities	Electricity, gas, and water supply	
	Construction	Construction	
	Mining	Mining and quarrying	

Source: IMF staff compilation.
Note: ISIC = International Standard Industrial Classification.

Co-operation and Development (OECD), World KLEMS, International Labour Organization (ILO), United Nations Industrial Development Organization database (UNIDO), and Felipe and Mehta (2016). The main source for sectoral employment data is the GGDC 10-sector database. The country and time coverage are extended using, in order of preference, World KLEMS, OECD, UNIDO, and ILO, as well as national sources for individual countries.[40] Data from Felipe and Mehta (2016) provide manufacturing employment data for additional countries. Sectoral value-added data are from the GGDC 10-sector database, World KLEMS, UN National Accounts Official Country Data database, and national authorities.

The analysis on inequality relies on the Luxembourg Income Study database and the Standardized World Income Inequality database.

Annex 3.2. Value-Added Decomposition

Data from the World Input-Output Database (WIOD) is used for the analysis underlying Figure 3.11 and Box 3.1. The WIOD provides data on global input-output linkages across countries and industries for each year between 1995 and 2011. It covers 40 economies (19 advanced and 21 developing economies, representing more than 85 percent of world GDP), along with a residual for the noncovered part of the world economy, and 35 industries. The data also contain final expenditure and value added by industry for each country.[41]

The analysis follows the consumption value-added procedure described in Herrendorf, Rogerson, and Valentinyi (2013) to decompose a given value of final expenditure into its underlying value-added components. Using this approach on global input-output data allows to decompose the value of global final spending on finished manufactured products into the value added from each country and sector (that is, both manufacturing and nonmanufacturing) that is embedded in those manufactures. Summing the resulting decomposed value added across sectors for a given country gives the measure of domestic gross output of manufactures underlying the calculations in Figure 3.11. Summing the resulting value added across nonmanufacturing sectors in all countries gives the measure reported in Figure 3.1.1 (Box 3.1). The results reported in Figure 3.1.2 are

[40]National sources are used for Australia, Canada, China, Brazil, Costa Rica, El Salvador, Guatemala, India, Korea, Malaysia, Philippines, Thailand, and Trinidad and Tobago.

[41]Timmer and others (2015) provide more details about the construction of the database and discuss additional features.

obtained by summing the decomposed value added across service industries in each country while those in Figure 3.1.3 correspond to the decomposed value added in each service industry. The calculation of value added in constant (real) prices in Figure 3.1.4 requires the use of the sector specific value-added price indices in the WIOD Socio Economic Accounts data.

Annex 3.3. Sectoral Productivity, Aggregate Growth, and Convergence

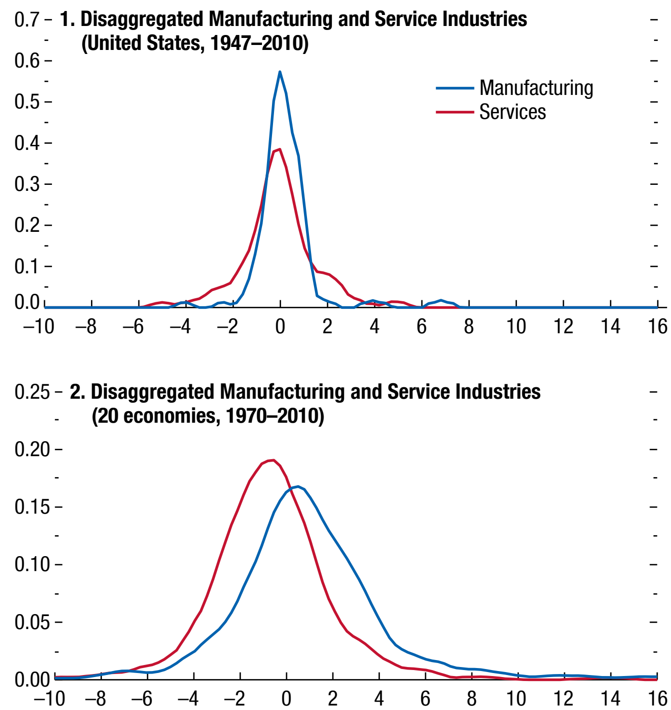
This annex provides additional details on the analysis shown in the section "Growth and Development beyond Manufacturing." Annex Table 3.1.2 presents the sample of economies included in the analyses in this section.

Sectoral Productivity Analysis

Data

Sectoral labor productivity is constructed as value added at constant prices in a given sector divided by the number of workers in that sector (Figure 3.14, panel 1), or divided by total hours worked in the sector (Figure 3.14, panels 2 and 3), using data from the Groningen Growth and Development Centre (GGDC) 10-sector database; World KLEMS; Jorgenson, Ho, and Samuels (2013); and national sources (see Annex Table 3.1.1). The data reported in Figure 3.14, panel 1, are available for a sample of 62 economies (19 advanced and 43 developing economies) spanning 10 broad sectors during 1965–2015. Data at a more disaggregated sectoral level are available for fewer countries: a sample of 31 economies (19 advanced and 12 developing economies) for 1970–2010 spanning 13 manufacturing and 13 service industries (Figure 3.14, panel 2), and data for the United States for 1947–2010 spanning 20 manufacturing and 39 service industries (Figure 3.14, panel 3). Total factor productivity (TFP) data based on sectoral value added (reported in Annex Figure 3.3.1) are available for a reduced set of 20 economies (16 advanced and 4 developing economies).[42,43]

Annex Figure 3.3.1. Distribution of Total Factor Productivity Growth of Individual Industries
(Kernel density)



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: The figure shows the distribution of average total factor productivity growth per decade in individual manufacturing and service industries (expressed as deviations from the average total factor productivity growth across sectors in each country and decade). Panel 1 is based on total factor productivity growth data for 20 manufacturing and 39 service industries in the United States (Jorgenson, Ho, and Samuels 2013). Panel 2 is based on total factor productivity growth data for 13 manufacturing and 13 service industries in 16 advanced economies (including the United States) and 4 emerging market and developing economies.

Annex Figure 3.3.2 is based on the same sample of countries and industries as Figure 3.14, panel 2, but shows the cross-country distribution of the average relative sectoral labor productivity growth (relative to economy-wide labor productivity growth) over 2000–10 for 13 individual service industries and manufacturing as a whole. The average sectoral labor productivity growth across countries during that period is then used to split service industries into two groups: a high-productivity-growth group, corresponding to the four industries that have on average the highest labor productivity growth (postal services and telecommunications, financial intermediation, wholesale trade, and retail trade); and a low-productivity-growth group,

[42]The source of sectoral TFP data is World KLEMS *Growth and Productivity Accounts* (ISIC Rev. 3, 2011 release, and Rev. 4, 2017 release).

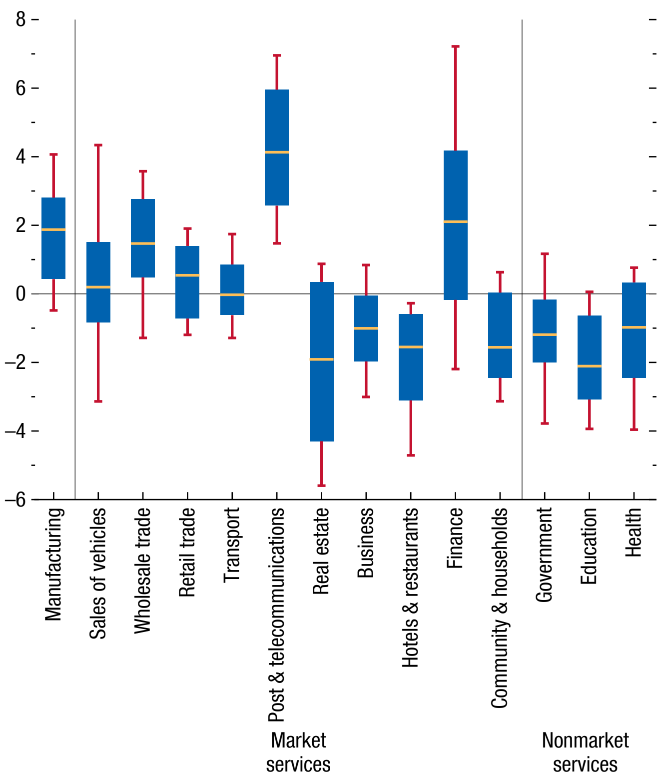
[43]Under the assumptions of perfect competition, full capacity utilization, and constant return to scale, TFP growth for each sector is calculated based on the standard growth accounting methodology:

$$\Delta \ln TFP_t^i = \Delta \ln Y_t^i - \bar{v}_t^{k,i} \Delta \ln K_t^i - \bar{v}_t^{L,i} \Delta \ln L_t^i - \left(1 - \bar{v}_t^{k,i} - \bar{v}_t^{L,i}\right) \Delta \ln M_t^i,$$

in which i denotes country, $\bar{v}_t^{k,i}$ and $\bar{v}_t^{L,i}$ denote the two-period average (t and $t-1$) share of capital and labor input in nominal gross output. Y_t^i denotes the (constant-price-based) gross output, K_t^i measures capital service, L_t^i is labor input, and M_t^i is intermediate input.

Annex Figure 3.3.2. Sectoral Labor Productivity Growth, 2000–10

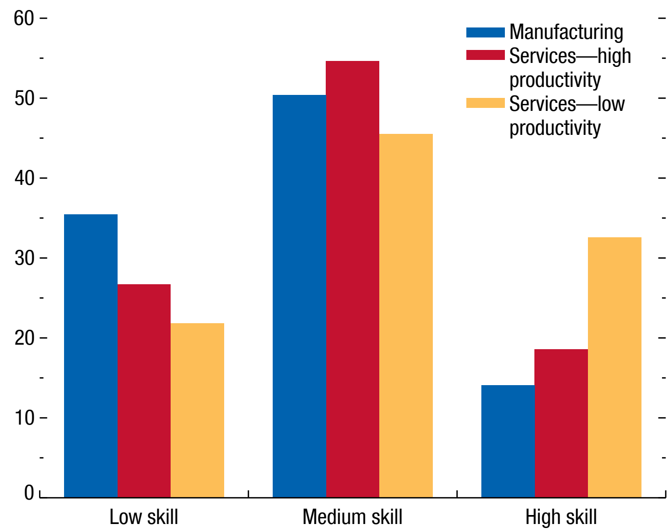
(Difference with respect to economy-wide labor productivity growth, percentage points)



Source: IMF staff calculations.
Note: The figure shows the cross-country distribution across 19 advanced economies and 12 emerging market and developing economies of the percentage difference between average labor productivity growth in each sector and aggregate labor productivity growth over 2000–10. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. Nonmarket services consist of government, education, and health. All other service industries are market services.

Annex Figure 3.3.3. Skill Composition of Workers by Sector, 2000–07

(Share of workers by skill level, percent)



Source: IMF staff calculations.
Note: High (low) productivity services correspond to the service industries that rank in the top third (bottom two-thirds) of the labor-productivity growth distribution during 2000–10 for the sample used in Figure 3.14, panel 2. The share of low-, medium-, and high skilled-workers corresponds to the average in each group of industries over 2000–07 and across the 40 economies included in the World Input-Output Database. Skill categories are based on the level of education (see Timmer and others 2015).

which includes the remaining service industries. Annex Figure 3.3.3 shows the skill intensity of employment in these two groups of service industries, as well as in manufacturing as a whole, based on industry-level data on educational attainment from the World Input-Output Database for 40 economies (19 advanced and 21 developing economies) over 2000–07.

Decomposition of Aggregate Labor Productivity

This section describes the decomposition exercise conducted to gauge the contribution of structural change reported in Figure 3.16. Aggregate value added per worker can be expressed as the (employment-share-weighted) average of value added per worker in each individual industry:

$$y_t = \Sigma_i y_t^i \theta_t^i, \tag{3.1}$$

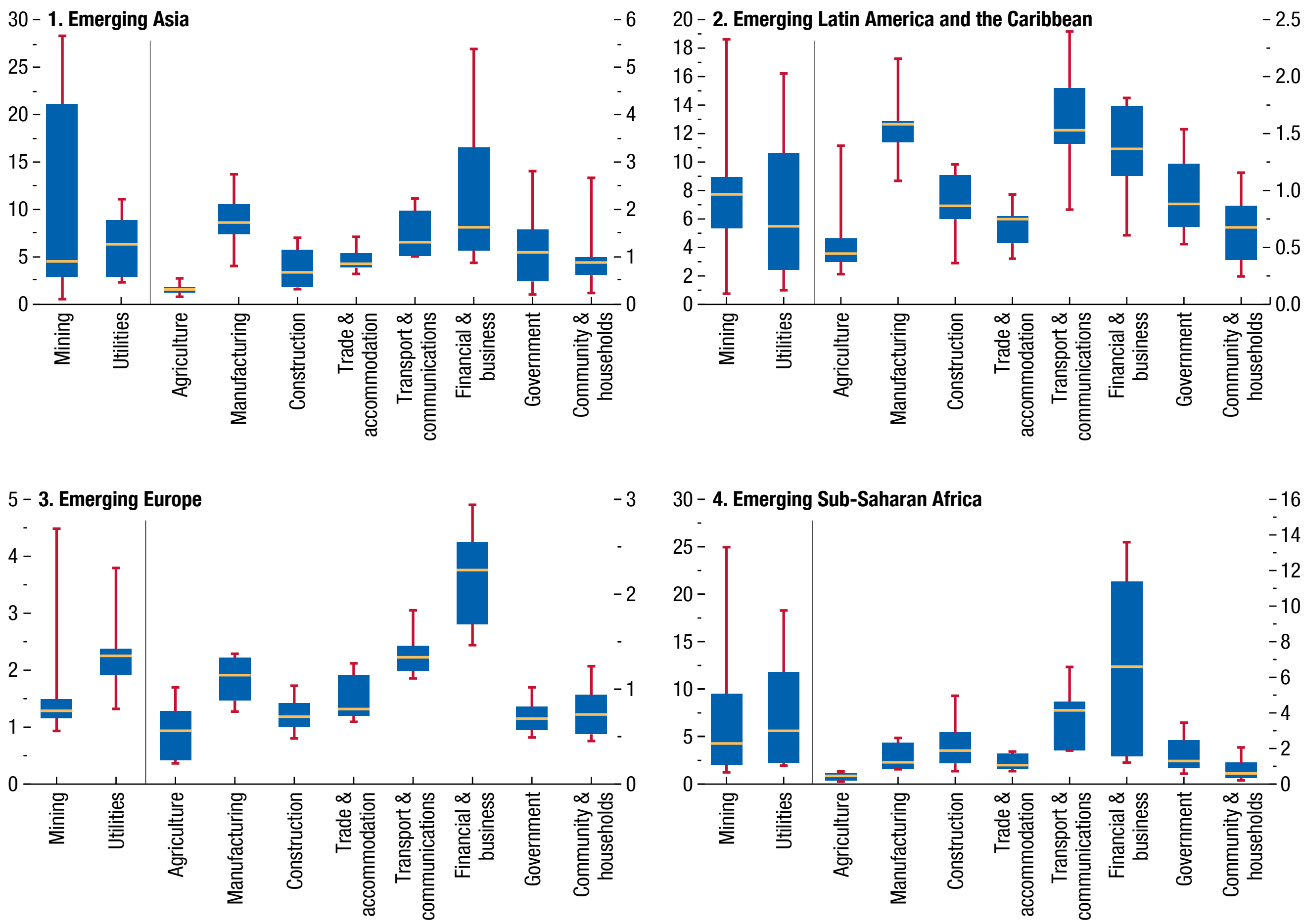
in which y_t denotes the aggregate value added per worker (at constant prices); y_t^i is value added per worker in sector i; and θ_t^i is the employment share of sector i. The economy-wide growth rate of labor productivity can then be decomposed in two components:

$$g_{t-k,t} = \underbrace{\Sigma_i \theta_{t-k}^i \frac{y_{t-k}^i}{y_{t-k}} g_{t-k,t}^i}_{\textit{within-sector growth}} + \underbrace{\Sigma_i \frac{y_{t-k}^i}{y_{t-k}} \left(1 + g_{t-k,t}^i\right)\left(\theta_t^i - \theta_{t-k}^i\right)}_{\textit{structural change}}, \tag{3.2}$$

where $g_{t-k,t} = \frac{y_t}{y_{t-k}} - 1$ is aggregate productivity growth from period $t-k$ to t; $g_{t-k,t}^i = \frac{y_t^i}{y_{t-k}^i} - 1$ is productivity growth in sector i; and $\frac{y_{t-k}^i}{y_{t-k}}$ is the relative productivity level in sector i.

The first component measures the "within" effect—the growth contribution of sector i holding the shares and the level of productivity as in the initial period. The second component measures the aggregate contribution of the movement of workers across sectors with different levels and growth rates of productivity. Following Timmer and others (2015); and Diao, McMillan,

Annex Figure 3.3.4. Sectoral Labor Productivity, 2010
(Ratio with respect to economy-wide labor productivity)



Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: The figure shows the distribution across economies in each region of the ratio of labor productivity (value added per worker) in each sector with respect to economy-wide labor productivity in 2010 (at 2005 prices). The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. Values for mining and utilities are reported on the left scale.

and Rodrik (2017), a year-by-year growth rate is first calculated (that is, k is set to 1), and then the average annual growth rates for the within and between terms in a given period T (that is, 2000–10) for each sector are reported by taking the simple average:

$$g_T^{within} = \frac{1}{T}\sum_{t\in T}\sum_i \theta^i_{t-1}\frac{y^i_{t-1}}{y_{t-1}}g^i_t, \quad (3.3)$$

$$g_T^{structural} = \frac{1}{T}\sum_{t\in T}\sum_i \frac{y^i_{t-1}}{y_{t-1}}(1+g^i_t)(\theta^i_t-\theta^i_{t-1}). \quad (3.4)$$

Cross-Country Productivity Convergence Analysis

Data

Testing for productivity convergence across countries requires a cross-comparison of their sectoral productivity. Sectoral purchasing-power-parity (PPP) conversion rates are needed to convert sectoral value added expressed in national currencies to units that are comparable across countries. Using PPP rates for aggregate output would be problematic as they fail to capture the systematic differences in sectoral relative prices across countries (Sorensen 2001; Rogerson 2008). Following Rodrik (2013), the baseline analysis is based on sectoral labor productivity data. TFP data based on sectoral value added are used in robustness exercises. Nonmarket service industries, such as government, health, and education, are excluded from the convergence exercise because public funding and provision make output prices hard to measure (Heston 2013).

The analysis is conducted using two samples that offer different country and sectoral coverage:

Annex Table 3.3.1. Estimation Results, Beta-Convergence—Extended Sample (Nine Sectors)

	A. Baseline Specification Full Sample				B1. Baseline Specification Balanced Panel				B2. Cross-Section Regression Balanced Panel			
Sector	Beta	S.E.	*t*	R^2	Beta	S.E.	*t*	R^2	Beta	S.E.	*t*	R^2
Agriculture	0.13	0.18	0.73	0.34	0.27	0.19	1.41	0.44	0.01	0.23	0.04	0.00
Mining	–1.31	0.30	–4.39	0.37	–1.00	0.33	–3.03	0.35	–0.67	0.31	–2.16	0.15
Manufacturing	–0.87	0.26	–3.37	0.27	–0.58	0.28	–2.07	0.28	–1.16	0.49	–2.39	0.23
Utilities	–2.35	0.50	–4.67	0.29	–1.77	0.42	–4.21	0.38	–1.39	0.27	–5.18	0.48
Construction	–1.58	0.40	–3.94	0.46	–1.49	0.44	–3.36	0.49	–0.20	0.63	–0.32	0.01
Trade and Accommodation	–1.10	0.33	–3.35	0.40	–0.94	0.33	–2.87	0.45	–0.78	0.26	–3.06	0.18
Transport and Communications	–1.31	0.45	–2.94	0.19	–1.19	0.47	–2.55	0.18	–0.95	0.40	–2.39	0.24
Financial and Business	–1.04	0.35	–2.95	0.13	–0.99	0.36	–2.79	0.13	–1.62	0.42	–3.87	0.50
Community and Households	–0.50	0.37	–1.33	0.16	–0.64	0.33	–1.91	0.21	–0.46	0.22	–2.12	0.16

Sources: Groningen Growth and Development Centre database; World KLEMS database; and IMF staff calculations.
Note: Robust standard errors are reported. Panel A shows the estimation results based on 10-year nonoverlapping windows with decade dummies and an unbalanced panel of 39 countries. Panel B1 shows the results for a balanced panel of 28 countries. Panel B2 is based on a cross-section regression over the same sample as panel B1. S.E. = standard errors.

- *Extended sample*, based on GGDC and World KLEMS data—an unbalanced panel of value added per worker for nine market sectors for 39 countries during 1965–2015. Data on sectoral PPP in 2005 are obtained from the GGDC productivity level database.[44]
- *Reduced sample*, based on World KLEMS—an unbalanced panel covering 26 market sectors during 1970–2007 with data on value added per hour for 30 countries and data on TFP for 20 countries. Internationally comparable data on sectoral TFP and labor productivity levels are from the 1997 benchmark World KLEMS database (for details, see Inklaar and Timmer 2009).[45]

Following Sorensen (2001), the industry-specific productivity growth series for each country are used to extrapolate the productivity level of 2005 or 1997 over the whole sample period.

Methodology and Baseline Results

The baseline specification for testing unconditional productivity convergence in each sector follows the specification in Bernard and Jones (1996) and Sorensen (2001):

$$\hat{P}_{i,t} = \alpha + \beta \ln P_{i,t} + D_t + \varepsilon_{i,t}, \qquad (3.5)$$

in which $\hat{P}_{i,t}$ denotes the trend growth rate of productivity (labor productivity or TFP) for a given sector in country i relative to the United States over the time period t; $P_{i,t}$ is the sector-specific PPP-adjusted productivity level in country i relative to the United States in the initial year of the period; D_t is the period dummy that controls for common factors; and $\varepsilon_{i,t}$ indicates an average relative productivity shock between the two countries.[46] Each period corresponds to a 10-year nonoverlapping window.

A negative estimate of β for a given sector indicates evidence of productivity convergence across countries: the larger the initial gap in productivity between two countries, the higher the rate of productivity growth in the country with lower sectoral productivity (relative to growth in the higher-productivity country). This concept of convergence is known as beta-convergence.

The estimation results using the extended sample covering nine market sectors are shown in Annex Table 3.3.1. The results in panel A are based on the baseline regression on labor productivity based on 10-year nonoverlapping periods and a broad sample of 39 countries during 1965–2015 as shown in Figure 3.17 (panel 1).[47] The estimation results using a reduced sample covering 26 sectors are reported in Annex Table 3.3.2, in which panel A corresponds to

[44]The internationally comparable level of industry productivity is computed as the nominal value added in 2005 per worker in a given industry-country deflated by the output PPP in the same industry-country. See Inklaar and Timmer (2014) for details.

[45]The measures of industry productivity from World KLEMS are adjusted not only by PPPs for gross output but also by PPPs for intermediate input (a so-called double deflation method). Double deflation is preferable but is not possible in the GGDC 10-sector sample due to data limitations.

[46]$\hat{P}_{i,t}$ is constructed as the trend coefficient from a regression of the log level on a constant and a linear trend to minimize the problems associated with measurement error, business cycles and end-sample issues, as in Bernard and Jones (1996).

[47]Excluding observations from 2008 onward, which could reflect developments associated with the global financial crisis, does not change the results.

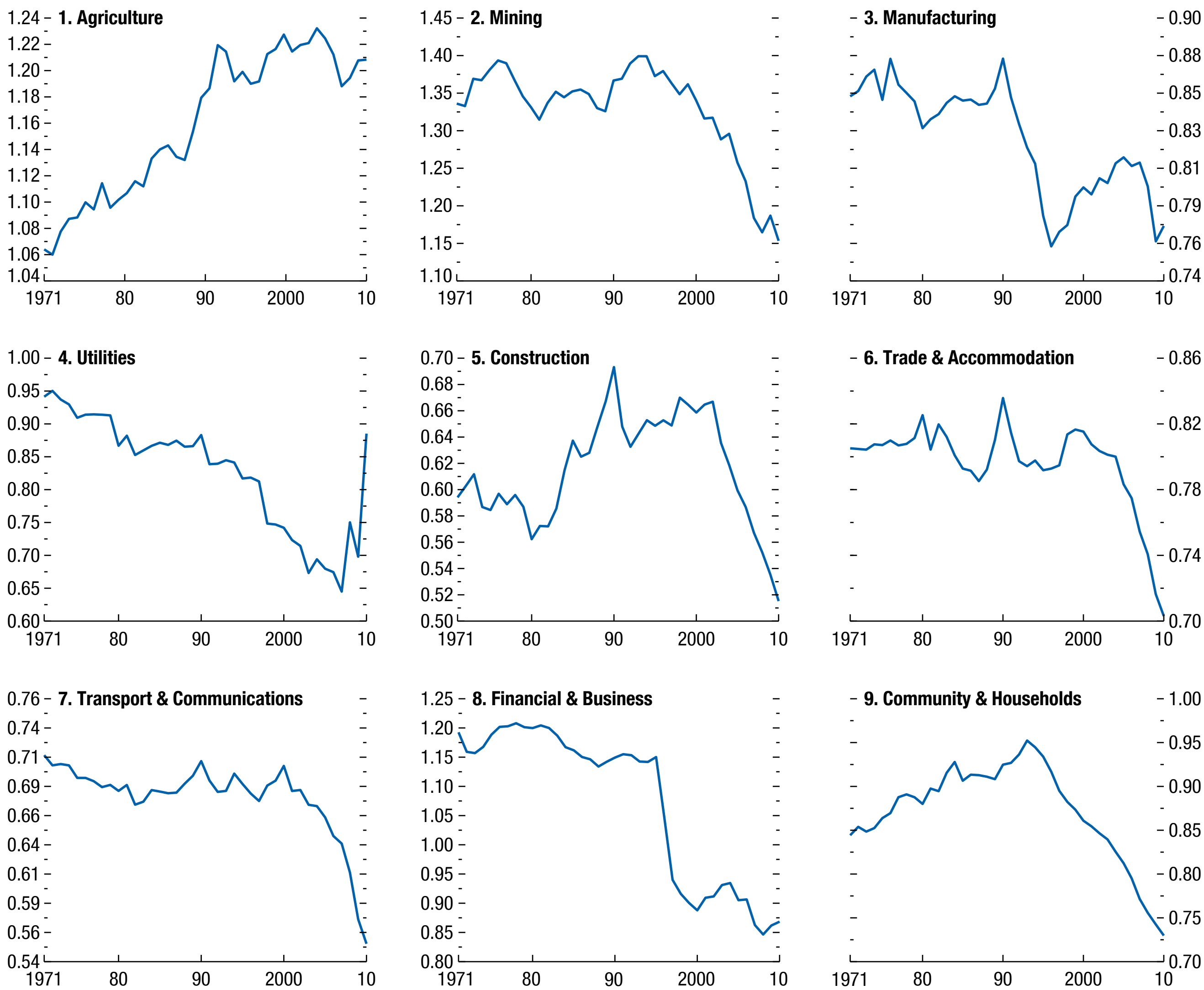
Annex Table 3.3.2. Estimation Results, Beta-Convergence—Reduced Sample (26 Sectors)

	A. Baseline Specification, Labor Productivity				B1. Baseline Specification, Labor Productivity, Balanced Panel				B2. Cross-Section Regression, Labor Productivity, Balanced Panel				C1. Baseline Specification, Labor Productivity, Sample as C2				C2. Baseline Specification, Total Factor Productivity			
Sector	Beta	S.E.	t	R^2	Beta	S.E.	t	R^2	Beta	S.E.	t	R^2	Beta	S.E.	t	R^2	Beta	S.E.	t	R^2
Agriculture	–0.78	0.38	–2.04	0.37	–0.49	0.35	–1.41	0.47	–0.36	0.32	–1.10	0.08	–0.51	0.46	–1.12	0.57	–0.24	0.49	–0.48	0.58
Mining	–1.26	0.52	–2.40	0.52	–0.92	0.63	–1.46	0.53	–0.94	0.62	–1.52	0.16	–1.31	0.82	–1.60	0.49	–2.40	0.95	–2.54	0.47
Utilities	–1.60	0.50	–3.21	0.32	–2.09	0.48	–4.38	0.48	–1.78	0.28	–6.32	0.69	–2.10	0.87	–2.42	0.56	–2.99	0.57	–5.23	0.46
Construction	–0.44	0.37	–1.18	0.54	–0.49	0.42	–1.18	0.50	–0.94	0.58	–1.61	0.11	0.15	0.56	0.26	0.60	0.10	0.67	0.15	0.57
Manufacturing																				
Food	–0.34	0.42	–0.81	0.15	–0.36	0.36	–1.01	0.21	–1.03	0.59	–1.74	0.15	0.33	0.68	0.48	0.26	–0.11	0.80	–0.14	0.28
Textiles	–1.31	0.60	–2.18	0.21	–1.71	0.74	–2.30	0.25	–0.98	0.57	–1.72	0.11	–0.55	0.76	–0.72	0.26	–0.84	0.73	–1.16	0.15
Wood	–1.97	0.63	–3.12	0.37	–1.51	0.75	–2.02	0.43	–1.38	0.71	–1.93	0.27	–0.40	0.50	–0.79	0.48	–0.99	0.58	–1.73	0.48
Paper	–0.82	0.49	–1.68	0.31	–0.87	0.63	–1.37	0.39	–1.59	0.41	–3.92	0.30	0.50	0.78	0.64	0.36	0.17	0.72	0.24	0.15
Petroleum	–0.90	1.40	–0.64	0.63	–2.99	1.04	–2.88	0.82	–3.22	0.52	–6.25	0.64	–1.12	1.29	–0.87	0.72	–0.82	1.11	–0.74	0.72
Chemicals	–1.52	0.83	–1.84	0.19	–0.81	0.86	–0.94	0.33	–1.08	0.70	–1.54	0.09	–1.08	0.68	–1.59	0.42	–1.47	1.05	–1.40	0.55
Rubber	–0.28	0.65	–0.43	0.25	–0.45	0.46	–0.98	0.39	–0.61	0.53	–1.15	0.07	–0.30	0.67	–0.45	0.38	0.66	0.55	1.21	0.41
Other Mineral	–2.57	0.52	–4.93	0.35	–1.67	0.59	–2.80	0.28	–1.23	0.37	–3.31	0.25	–1.24	0.61	–2.04	0.38	–0.99	0.59	–1.67	0.42
Basic Metal	–4.08	0.61	–6.69	0.64	–3.22	0.58	–5.58	0.49	–2.32	0.32	–7.16	0.73	–2.97	0.81	–3.65	0.57	–3.40	0.83	–4.08	0.55
Machinery	–2.22	0.61	–3.65	0.31	–1.95	0.45	–4.30	0.38	–2.06	0.47	–4.34	0.48	–1.61	0.91	–1.77	0.25	–1.03	1.12	–0.92	0.37
Electrical Equipment	–2.52	0.78	–3.22	0.55	–2.96	0.79	–3.75	0.59	–3.82	0.54	–7.02	0.71	–0.04	1.40	–0.03	0.62	0.55	1.72	0.32	0.60
Transport Equipment	–0.75	0.57	–1.32	0.17	–0.77	0.41	–1.87	0.30	–0.88	0.23	–3.85	0.25	–0.78	0.46	–1.70	0.45	–0.86	0.53	–1.62	0.40
Recycling	–1.46	0.39	–3.79	0.41	–1.03	0.40	–2.60	0.53	–0.86	0.32	–2.66	0.26	–1.02	0.40	–2.57	0.67	–1.19	0.41	–2.89	0.63
Market Services																				
Trade	–0.72	0.31	–2.36	0.49	–0.19	0.29	–0.67	0.54	–0.25	0.32	–0.77	0.02	–1.10	0.46	–2.39	0.59	–1.23	0.45	–2.73	0.59
Hotels and Restaurants	–1.97	0.57	–3.49	0.30	–1.43	0.51	–2.77	0.38	–1.05	0.22	–4.82	0.58	–0.41	0.51	–0.81	0.28	–0.46	0.56	–0.82	0.23
Transport	–1.15	0.34	–3.41	0.30	–0.86	0.34	–2.50	0.41	–0.92	0.38	–2.41	0.27	–0.50	0.32	–1.57	0.35	–0.32	0.33	–0.95	0.37
Post and Telecomm.	–1.23	0.37	–3.36	0.59	–1.41	0.46	–3.05	0.63	–1.22	0.54	–2.25	0.42	–1.13	0.69	–1.63	0.61	–1.45	0.87	–1.67	0.57
Finance	–3.90	0.81	–4.81	0.48	–4.64	0.61	–7.60	0.58	–2.46	0.24	–10.15	0.79	–4.59	0.67	–6.90	0.62	–3.95	1.23	–3.22	0.49
Real Estate	–0.94	0.47	–2.00	0.33	–0.67	0.48	–1.41	0.36	–0.84	0.26	–3.24	0.18	–0.75	0.46	–1.63	0.56	–1.07	0.66	–1.61	0.45
Business	–2.29	0.62	–3.71	0.22	–2.83	0.59	–4.83	0.31	–1.94	0.40	–4.86	0.51	–2.57	0.57	–4.50	0.37	–3.25	0.71	–4.56	0.39
Community	–2.19	0.73	–3.02	0.22	–1.69	0.58	–2.92	0.34	–1.31	0.25	–5.19	0.60	–2.03	0.93	–2.18	0.35	–3.81	0.90	–4.23	0.42
Households	–1.67	1.58	–1.06	0.11	–3.51	0.65	–5.38	0.33	–2.34	0.31	–7.44	0.81	–4.56	0.75	–6.08	0.38	–5.92	1.19	–4.98	0.61

Sources: Inklaar and Timmer (2009); World KLEMS database; and IMF staff calculations.

Note: Robust standard errors are reported. Panel A is shows the estimation results from the baseline specification (using 10-year nonoverlapping windows with decade dummies) over an unbalanced panel of 30 countries. Panel B1 shows the results from the baseline specifcication using a balanced panel of 20 countries over 1973–2007, and panel B2 the results based on a cross-section regression over the same sample. Panel C1 shows the results from the baseline specification using a unbalanced panel of 20 countries over 1970–2007 and panel C2 shows the results from the baseline specification over the same sample but using total factor productivity instead of labor productivity. See Annex Table 3.1.2 for countries used in each regression. S.E. = standard errors.

Annex Figure 3.3.5. Sigma-Convergence
(Log standard deviation of PPP-adjusted labor productivity)



Sources: World KLEMS database; and IMF staff calculations.
Note: Each graph shows the cross-country log standard deviation of purchasing-power-parity-adjusted labor productivity (sigma-convergence) for each of the nine market sectors available in the Groningen Growth and Development Centre 10-sector database. PPP = purchasing power parity.

the results based on labor productivity on 10-year nonoverlapping periods during 1970–2010, as shown in Figure 3.17 (panel 2).[48]

Beta-convergence across sectors is a necessary but not sufficient condition for convergence in productivity levels. Even if beta-convergence holds, if shocks to the growth process are relatively large, sigma-convergence may not be achieved (Young, Higgins, and Levy 2008). Annex Figure 3.3.5 shows the standard deviation of log labor productivity across countries for each of the nine market sectors in the GGDC 10-sector database.

Robustness Exercises

Mean Reversion. One concern with using 10-year nonoverlapping windows is that the evidence on con-

[48]Annex Tables 3.3.1 and 3.3.2 report robust standard errors. Clustering standard errors at the country level does not change the results of the analysis.

vergence may reflect mean reversion over the business cycle. Panel C of Annex Table 3.3.1 shows the results from a robustness exercise using a cross-section analysis over a balanced panel. For each sector, the trend growth rate of labor productivity over the period 1965–2010 is regressed on its level in 1965 and a constant. The results reported in panel B2 confirm that the baseline results are not due to mean reversion (panel B1 shows for comparability purposes the results from the baseline specification but using the same balanced sample).

The robustness exercise for the reduced (26 sectors) sample is shown in Annex Table 3.3.2, panel B2 (panel B1 shows for comparability purposes the results from the baseline specification but using the same balanced sample). For each sector, the trend growth rate of labor productivity over the period 1973–2007 is regressed on its level in 1973 and a constant.[49] The results are broadly unchanged.

Total Factor Productivity. Given that changes in labor productivity may reflect capital deepening rather than actual productivity, an additional robustness exercise uses the standard TFP instead of labor productivity. The results are reported in Annex Table 3.3.2, panel C2 (panel C1 shows for comparability purposes the results using labor productivity over the same sample). The results are similar to those based on labor productivity in a comparable sample: (1) several manufacturing industries show no evidence of beta-convergence, and (2) several service sectors show significant evidence of beta-convergence.

Annex 3.4. Manufacturing and Inequality

This annex provides additional details on the analysis carried out in the section "Implications for Income Inequality."

The analysis in the section on income inequality uses micro data from the Luxembourg Income Study (LIS) to compute labor earnings inequality at the sectoral and the aggregate level. The LIS offers survey-based data at the household and personal level on labor income, employment sector, and occupation for a broad set of countries, including a set of advanced economies since the early 1980s. Given that surveys are conducted at irregular time intervals that differ across countries, the cross-country statistics reported in the chapter correspond to the latest survey year available for each country within a specific range, as noted in the analysis. Because of data limitations, three broad sectors are considered: agriculture, industry (which consists of manufacturing, mining, electricity and construction), and services.[50]

The analysis on labor earnings across sectors and skills reported in Figure 3.20 uses LIS data on gross hourly wage of full-time working household members for whom skill data are available.[51] The skill levels—high, medium, and low—are based on the International Standard Classification of Occupations (ISCO) classification of occupations into managers and professionals (ISCO 1 and 2), other skilled workers (ISCO 3–8, 10), and laborers/elementary (ISCO 9), respectively. Average gross hourly wages for each sector-skill are expressed relative to average economy-wide wages.

The measure of inequality used is the Generalized Entropy (GE[0]) index, or mean log deviation, which has the advantage of being decomposable, unlike the Gini coefficient (Shorrocks 1980; Mookherjee and Shorrocks 1982). The mean log deviation, or $GE(0)$, is given by:[52]

$$GE(0) = -\frac{1}{n}\sum_i \ln\left(\frac{y_i}{\bar{y}}\right), \tag{3.6}$$

in which n is the number of households, y_i is income of household i, and $\bar{y}$ is the mean of y_i.

The economy-wide GE(0) index can be decomposed as a weighted sum of the extent of inequality in each sector (within-sector inequality) and the contribution arising from differences between average incomes across sectors (between-sector inequality):

[49] 1973 is chosen as the initial year to maximize the country coverage, as data for Japan starts from only 1973. Given that data for countries in Central and Eastern Europe are not available before 1995, this cross-sectional analysis includes fewer country observations (20 countries).

[50] The information on the sector of employment might not be available if the household head is unemployed or out of the labor force, or if the data are missing. In those cases, the household is assigned to a separate "missing data" sector to ensure that the aggregate inequality measure is calculated for the entire population and the sum of the components equals the economy-wide level of inequality.

[51] The hourly wages are top and bottom coded to address extreme values. At the bottom, negative or zero wages are set to "missing." At the top, wages greater than 10 times the median for a given country-year are set to 10 times the median.

[52] The general formula for Generalized Entropy is

$$GE(\alpha) = \frac{1}{n\alpha(\alpha - 1)}\sum_i\left[\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right],$$

when $\alpha \neq 0,1$. When $\alpha = 0$, GE is defined as in equation 3.6.

$$GE(0) = \underbrace{\sum_k v_k GE(0)_k}_{within} + \underbrace{\sum_k v_k \ln\left(\frac{1}{\lambda_k}\right)}_{between}, \tag{3.7}$$

in which $v_k = \frac{n_k}{n}$ is the population share of sector k, and $\lambda_k = \frac{\bar{y}_k}{\bar{y}}$ is the relative mean income of sector k. The sector of employment of the household head is used to calculate inequality at the sector level. The cross-sector average income differences reported in Figure 3.21 correspond to the between-sector inequality term.

Changes in inequality over time can be analyzed by applying the difference operator to both sides of equation 3.7:

$$\begin{aligned} GE(0)_{t+1} - GE(0)_t = {} & \sum_k v_{k,t} \Delta GE(0)_k \\ & + \sum_k GE(0)_{k,t+1} \Delta v_k \\ & - \sum_k \ln\left(\lambda_{k,t+1}\right) \Delta v_k \\ & - \sum_k v_{k,t} \Delta \ln\left(\lambda_k\right). \end{aligned} \tag{3.8}$$

Equation 3.8 is an exact decomposition of the change in generalized entropy over time into four terms that can be interpreted as (1) the effect of intertemporal changes in within-sector inequality, (2) the effect of changes in sectoral employment shares on the "within" component, (3) the effect of changes in sectoral employment shares on the "between" component, and (4) the effect of changes in the relative average sectoral income levels (Mookherjee and Shorrocks 1982). In the analysis reported in Figure 3.22, the second and third terms are added and referred to as "changes in sector size."

References

Acemoglu, Daron, and Pascual Restrepo. 2017. "Robots and Jobs: Evidence from US Labor Markets." NBER Working Paper 23285, National Bureau of Economic Research, Cambridge, MA.

Adler, Gustavo, Romain Duval, Davide Furceri, Sinem Kiliç Çelik, Ksenia Koloskova, and Marcos Poplawski-Ribeiro. 2017. "Gone with the Headwinds: Global Productivity." Staff Discussion Note 17/04, International Monetary Fund, Washington, DC.

Alvarez, Jorge. 2017. "Structural Transformation and the Agricultural Wage Gap." IMF Working Paper 17/289, International Monetary Fund, Washington, DC.

Alvarez, Jorge, Felipe Benguria, Christian Moser, and Niklas Engbom. 2018. "Firms and the Decline in Earnings Inequality in Brazil." *American Economic Journal: Macroeconomics* 10 (1): 49–89.

Autor, David H. 2015. "Why Are There Still So Many Jobs? The History and Future of Workplace Automation." *Journal of Economic Perspectives* 29 (3): 3–30.

Autor, David H., David Dorn, and Gordon H. Hanson. 2013. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." *American Economic Review* 103 (6): 2121–68.

———. 2016. "The China Shock: Learning from Labor-Market Adjustment to Large Changes in Trade." *Annual Review of Economics* 8: 205–40.

———. 2017. "When Work Disappears: Manufacturing Decline and the Falling Marriage-Market Value of Young Men." NBER Working Paper 23173, National Bureau of Economic Research, Cambridge, MA.

Autor, David H., Lawrence F. Katz, and Melissa S. Kearney. 2006. "The Polarization of the US Labor Market." *American Economic Review* 96 (2): 189–94.

Baldwin, Richard. 2016. "Factory-Free Europe?" In *The Factory-Free Economy: Outsourcing, Servitization, and The Future of Industry*, edited by Lionel Fontagné and Ann Harrison. Oxford: Oxford University Press.

Baldwin, Richard, Rikard Forslid, and Tadashi Ito. 2015. "Unveiling the Evolving Sources of Value Added in Exports." Papers and Reports: Joint Research Program Series 161, Institute of Developing Economies–Japan External Trade Organization.

Bárány, Zsófia L., and Christian Siegel. 2018. "Job Polarization and Structural Change." *American Economic Journal: Macroeconomics* 10 (1): 57–89.

Barro, Robert J., and Xavier Sala-i-Martin. 1992. "Convergence." *Journal of Political Economy* 100 (2): 223–51.

Baumol, William J. 1967. "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis." *American Economic Review* 57 (3): 415–26.

Baumol, William J., Sue Anne Batey Blackman, and Edward N. Wolff. 1985. "Unbalanced Growth Revisited: Asymptotic Stagnancy and New Evidence." *American Economic Review* 75 (4): 806–17.

Berlingieri, Giuseppe. 2014. "Outsourcing and the Rise in Services." CEP Discussion Paper 1199, Centre for Economic Performance, London School of Economics.

Bernard, Andrew, and Charles Jones. 1996. "Comparing Apples to Oranges: Productivity Convergence and Measurement across Industries and Countries." *The American Economic Review* 86 (5): 1216–238.

Bernard, Andrew, Valerie Smeets, and Frederic Warzynski. 2017. "Rethinking Deindustrialization." *Economic Policy* 32 (89): 5–38.

Boppart, Timo. 2014. "Structural Change and the Kaldor Facts in a Growth Model with Relative Price Effects and Non-Gorman Preferences." *Econometrica* 82 (6): 2167–196.

Bosworth, Barry P., and Jack E. Triplett. 2003. "Services Productivity in the United States: Griliches' Services Volume Revisited." Paper prepared for CRIW Conference in Memory of Zvi Griliches, Brookings Institution, Washington, DC, September.

———. 2007. "Services Productivity in the United States: Griliches." In *Hard-to-Measure Goods and Services: Essays in Honor of Zvi Griliches*, edited by Ernst R. Berndt and C. R. Hulten. Chicago: University of Chicago Press.

Bourlès, Renaud, Gilbert Cette, Jimmy Lopez, Jacques Mairesse, and Giuseppe Nicoletti. 2013. "Do Product Market Regulations in Upstream Sectors Curb Productivity Growth? Panel Data Evidence for OECD Countries." *Review of Economics and Statistics* 95 (5): 1750–768.

Buera, Francisco J., and Joseph P. Kaboski. 2009. "Can Traditional Theories of Structural Change Fit the Data?" *Journal of the European Economic Association* 7 (2–3): 469–77.

———. 2012. "The Rise of the Service Economy." *American Economic Review* 102 (6): 2540–569.

Copeland, Brian, and Aaditya Mattoo. 2007. "The Basic Economics of Services Trade." In *A Handbook of International Trade in Services*. Oxford: Oxford University Press.

Crozet, Matthieu D., and Emmanuel Milet. 2017. "The Servitization of French Manufacturing Firms." In *The Factory-Free Economy: Outsourcing, Servitization, and the Future of Industry*, edited by Lionel Fontagné and Ann Harrison. Oxford: Oxford University Press.

Dasgupta, Sukti, and Ajit Singh. 2006. "Manufacturing, Services, and Premature Deindustrialization in Developing Countries: A Kaldorian Analysis." UNU-WIDER, United Nations University Research Paper 2006/49.

Diao, Xinshen, Margaret McMillan, and Dani Rodrik. 2017. "The Recent Growth Boom in Developing Economies: A Structural Change Perspective." NBER Working Paper 23132, National Bureau of Economic Research, Cambridge, MA.

Dias, Daniel A., Carlos Robalo Marques, and Christine Richmond. 2016. "Misallocation and Productivity in the Lead Up to the Eurozone Crisis." *Journal of Macroeconomics* 49: 46–70.

Duarte, Margarida, and Diego Restuccia. 2017. "Relative Prices and Sectoral Productivity." NBER Working Paper 23979, National Bureau of Economic Research, Cambridge, MA.

Duernecker, Georg, Bethold Herrendorf, and Ákos Valentinyi. 2017. "Structural Change within the Service Sector and the Future of Baumol's Disease." Manuscript.

Engbom, Niklas, and Christian Moser. 2018. "Earnings Inequality and the Minimum Wage: Evidence from Brazil." CESifo Working Paper Series 6393, CESifo Group, Munich.

Engel, Ernst. 1895. "Die Lebenskosten Belgischer Arbeiter-Familien Früher und Jetzt." C. Heinrich.

Felipe, Jesus, and Aashish Mehta. 2016. "Deindustrialization? A Global Perspective." *Economics Letters* 149: 148–51.

Fernandes, Ana M., and Caroline Paunov. 2012. "Foreign Direct Investment in Services and Manufacturing Productivity: Evidence for Chile." *Journal of Development Economics* 97 (2): 305–21.

Fournier, Jean-Marc, and Åsa Johansson. 2016. "The Effect of the Size and the Mix of Public Spending on Growth and Inequality." OECD Economics Department Working Paper 1344, OECD Publishing, Paris.

Francois, Joseph, and Bernard Hoekman. 2010. "Services Trade and Policy." *Journal of Economic Literature* 48 (3): 642–92.

Gervais, Antoine, and J. Bradford Jensen. 2014. "The Tradability of Services: Geographic Concentration and Trade Costs." Discussion Paper CES 14–03, US Census Bureau, Washington, DC.

Goos, Maarten, Alan Manning, and Anna Salomons. 2014. "Explaining Job Polarization: Routine-Biased Technological Change and Offshoring." *The American Economic Review* 104 (8): 2509–526.

Gordon, Robert J. 1996. "Problems in the Measurement and Performance of Service-Sector Productivity in the United States." NBER Working Paper 5519, National Bureau of Economic Research, Cambridge, MA.

Hallward-Driemeier, Mary, and Gaurav Nayyar. 2017. "Trouble in the Making? The Future of Manufacturing-Led Development." World Bank, Washington, DC.

Helper, Susan, Timothy Krueger, and Howard Wial. 2012. "Why Does Manufacturing Matter? Which Manufacturing Matters?" Brookings: Metropolitan Policy Program.

Herrendorf, Berthold, Richard Rogerson, and Ákos Valentinyi. 2013. "Two Perspectives on Preferences and Structural Transformation." *The American Economic Review* 103 (7): 2752–789.

———. 2014. "Growth and Structural Transformation." In *Handbook of Economic Growth*, edited by Philippe Aghion and Steven N. Durlauf. Amsterdam: Elsevier.

Heston, Alan. 2013. "Government Services: Productivity Adjustments." In *Measuring the Real Size of the World Economy: The Framework, Methodology, and Results of the International Comparison Program—ICP.* Washington, DC: World Bank.

Heuser, Cecilia, and Aaditya Mattoo. 2017. "Services Trade and Global Value Chains." Policy Research Working Paper Series 8126, World Bank, Washington, DC.

Hsieh, Chang-Tai, and Peter J. Klenow. 2009. "Misallocation and Manufacturing TFP in China and India." *Quarterly Journal of Economics* 124 (4): 1403–448.

Huneeus, Federico, and Richard Rogerson. 2016. "Industrialization among Early and Late Developers." Manuscript.

Imbs, Jean. 2016. "Structural Change in the OECD: Some Facts." In *The Factory-Free Economy: Outsourcing, Servitization, and the Future of Industry*, edited by Lionel Fontagné and Ann Harrison. Oxford: Oxford University Press.

Inklaar, Robert, and Marcel P. Timmer. 2009. "Productivity Convergence across Industries and Countries: The Importance of Theory-Based Measurement." *Macroeconomic Dynamics* 12 (S2): 218–40.

———. 2014. "The Relative Price of Services." *Review of Income and Wealth* 60 (4): 727–46.

Jaumotte, Florence, and Carolina Osorio Buitron. 2015. "Inequality and Labor Market Institutions." IMF Staff Discussion Note 15/14, International Monetary Fund, Washington, DC.

Johnson, Simon, Jonathan D. Ostry, and Arvind Subramanian. 2007. "The Prospects for Sustained Growth in Africa:

Benchmarking the Constraints." IMF Working Paper 07/52, International Monetary Fund, Washington, DC.

Jones, Benjamin F., and Benjamin A. Olken. 2005. "The Anatomy of Start-Stop Growth." NBER Working Paper 11528, National Bureau of Economic Research, Cambridge, MA.

Jorgenson, Dale W., Mun S. Ho, and Jon Samuels. 2013. "A Prototype Industry-Level Production Account for the United States, 1947–2010." In *Second World KLEMS Conference.* Cambridge: Harvard University.

Jorgenson, Dale. W., and Marcel Timmer. 2011. "Structural Change in Advanced Nations: A New Set of Stylized Facts." *Scandinavian Journal of Economics* 113 (1): 1–29.

Kaldor, Nicholas. 1967. "*Strategic Factors in Economic Development*." Ithaca: New York State School of Industrial and Labor Relations, Cornell University.

Kongsamut, Piyabha, Sergio Rebelo, and Danyang Xie. 2001. "Beyond Balanced Growth." *Review of Economic Studies* 68 (4): 869–82.

Koske, Isabell, Isabelle Wanner, Rosamaria Bitetti, and Omar Barbiero. 2015. "The 2013 Update of the OECD's Database on Product Market Regulation: Policy Insights for OECD and Non-OECD Countries." OECD Economics Department Working Paper 1200, OECD Publishing, Paris.

Kuznets, Simon. 1966. *Economic Growth and Structure*. Portsmouth, NH: Heinemann Educational Books.

Lanau, Sergi, and Petia Topalova. 2016. "The Impact of Product Market Reforms on Firm Productivity in Italy." IMF Working Paper 16/119, International Monetary Fund, Washington, DC.

Langdon, David, and Rebecca Lehrman. 2012. "The Benefits of Manufacturing Jobs." United States Department of Commerce, Economics and Statistics Administration Working Paper 01–12, Washington, DC.

Lawrence, Robert Z. 2017. "Recent Manufacturing Employment Growth: The Exception That Proves the Rule." NBER Working Paper 24151, National Bureau of Economic Research, Cambridge, MA.

Lodefalk, Magnus. 2013. "Servicification of Manufacturing—Evidence from Sweden." *International Journal of Economics and Business Research* 6 (1): 87–113.

Loungani, Prakash, Saurabh Mishra, Chris Papageorgiou, and Ke Wang. 2017. "World Trade in Services: Evidence from A New Dataset." IMF Working Paper 17/77, International Monetary Fund, Washington, DC.

Matsuyama, Kiminori. 2009. "Structural Change in an Interdependent World: A Global View of Manufacturing Decline." *Journal of the European Economic Association* 7 (2–3): 478–86.

McMillan, Margaret, and Dani Rodrik. 2011. "Globalization, Structural Change, and Productivity Growth." NBER Working Paper 17143, National Bureau of Economic Research, Cambridge, MA.

McMillan, Margaret, Dani Rodrik, and Íñigo Verduzco-Gallo. 2014. "Globalization, Structural Change, and Productivity Growth, with an Update on Africa." *World Development* 63: 11–32.

Miroudot, Sébastien, Jehan Sauvage, and Ben Shepherd. 2013. "Measuring the Cost of International Trade in Services." *World Trade Review* 12 (4): 719–35.

Miroudot, Sébastien, and Charles Cadestin. 2017. "Services in Global Value Chains: From Inputs to Value-Creating Activities." OECD Trade Policy Papers 197, OECD Publishing, Paris.

Mookherjee, Dilip, and Anthony Shorrocks. 1982. "A Decomposition Analysis of the Trend in UK Income Inequality." *The Economic Journal* 92 (368): 886–902.

National Board of Trade of Sweden. 2010. "Servicification of Swedish Manufacturing." National Board of Trade, Sweden.

Ngai, L. Rachel, and Christopher A. Pissarides. 2007. "Structural Change in a Multisector Model of Growth." *American Economic Review* 97 (1): 429–43.

Pilat, Dirk, and Anita Wölfl. 2005. "Measuring the Interaction between Manufacturing and Services." OECD Science, Technology, and Industry Working Paper 2005/05, OECD Publishing, Paris.

Rodrik, Dani. 2013. "Unconditional Convergence in Manufacturing." *Quarterly Journal of Economics* 128 (1): 165–204.

———. 2016. "Premature Deindustrialization." *Journal of Economic Growth* 21: 1–33.

Rogerson, Richard. 2008. "Structural Transformation and the Deterioration of European Labor Market Outcomes." *Journal of Political Economy* 116 (2): 235–59.

Shorrocks, Anthony. 1980. "The Class of Additively Decomposable Inequality Measures." *Econometrica* 48 (3): 613–25.

Solt, Frederick. 2016. "The Standardized World Income Inequality Database." *Social Science Quarterly* 97 (5): 1267–81.

Sorensen, Anders. 2001. "Comparing Apples to Oranges: Productivity Convergence and Measurement across Industries and Countries: Comment." *American Economic Review* 91 (4): 1160–67.

Stiroh, Kevin J. 2002. "Information Technology and the US Productivity Revival: What Do the Industry Data Say?" *American Economic Review* 92 (5): 1559–576.

Swiecki, Tomasz. 2017. "Determinants of Structural Change." *Review of Economic Dynamics* 24: 95–131.

Timmer, Marcel. P., Erik Dietzenbacher, Bart Los, Robert Stehrer, and Gaaitzen J. de Vries. 2015. "An Illustrated User Guide to the World Input–Output Database: The Case of Global Automotive Production." *Review of International Economics* 23 (3): 575–605.

Triplett, Jack E., and Barry P. Bosworth. 2000. "Productivity in the Services Sector." In *Presentation at the American Economic Association Meetings*.

Uy, Timothy, Kei-Mu Yi, and Jing Zhang. 2013. "Structural Change in an Open Economy." *Journal of Monetary Economics* 60 (6): 667–82.

Verma, Rubina. 2012. "Can Total Factor Productivity Explain Value Added Growth in Services?" *Journal of Development Economics* 99 (1): 163–77.

Walker, W. Reed. 2013. "The Transitional Costs of Sectoral Reallocation: Evidence from the Clean Air Act and the Workforce." *Quarterly Journal of Economics* 128 (4): 1787–835.

Wood, Adrian. 2017. "Variation in Structural Change around the World, 1985–2015: Patterns, Causes, and Implications." WIDER Working Paper 2017/34.

Young, Alwyn. 2014. "Structural Transformation, the Mismeasurement of Productivity Growth, and the Cost Disease of Services." *American Economic Review* 104 (11): 3635–667.

Young, Andrew T., Matthew J. Higgins, and Daniel Levy. 2008. "Sigma Convergence versus Beta Convergence: Evidence from US County-Level Data." *Journal of Money, Credit and Banking* 40 (5): 1083–903.

CHAPTER 4

IS PRODUCTIVITY GROWTH SHARED IN A GLOBALIZED ECONOMY?

How easily do knowledge and technology flow across countries? Has this relationship changed over the past decades, a period when the world has become economically more integrated and the international competition landscape transformed? And did this help productivity growth, both at the country and the global level? These questions are important because technology tends to advance at different speeds across countries. As a consequence, making new technologies more widely available creates opportunities for raising productivity and incomes. Against this backdrop, the chapter offers new empirical evidence on the evolution of international technology diffusion and its impact on productivity. Using a rich data set on patents, cross-patent citations, research and development spending, and productivity, it finds that globalization has indeed intensified the global diffusion of knowledge and technology and helped spread growth potential across countries. The positive impact has been particularly strong for emerging market economies, fostering cross-country income convergence, thanks to their increased use of the available foreign knowledge. But technology leaders can also benefit from the innovation of others. The right set of policies maximizes benefits for all involved, including policies to enhance interconnectedness and build absorptive capacity. An appropriate degree of protection for intellectual property rights is key to preserve the ability of innovators to recover costs while ensuring that new knowledge supports growth globally.

Introduction

Technology is a key driver of improvements in income and standard of living. Historically, technological developments have been concentrated in a few large industrialized economies (Figure 4.1). Therefore, the way technology diffuses across countries is central to how global growth is generated and shared across countries. Globalization has likely changed the diffusion process, with a large body of literature highlighting the importance of trade and foreign direct investment (Keller 2004, 2010).

Against this background, this chapter takes a closer look at the process of international technology diffusion. It examines whether globalization means that knowledge from technology leaders is spreading faster than it used to, and how this impacts the capacity of other economies to innovate and be more productive. The methodology also lends itself to discussing the influence of another aspect of globalization—increased international competition. Better understanding of how productivity growth is shared across the global economy can help explain cross-country differences in income per capita and technology and shed light on the policies that can influence them.

Specifically, the chapter will ask:

- How has the technological innovation landscape evolved?
- How strong is the diffusion of knowledge across countries? Has knowledge become more globalized?
- Do foreign knowledge flows increase domestic innovation and productivity, both in advanced economies and emerging market economies?
- What impact does greater international competition have on innovation and technology diffusion?
- Which policies help increase inward technology diffusion?

To answer these questions, the chapter exploits a high-quality micro patenting data set, the Worldwide Patent Statistical Database (PATSTAT). The database, which is maintained by the European Patent Office, can be used to construct measures of technological innovation (patenting) and diffusion (cross-patent citations) across countries and across different sectors.[1]

Use of patent and research and development (R&D) data allows precise identification of knowledge generation and diffusion. At the same time, these data have limits in that not all innovations are patented. Innovations in services, for example, are less patentable and typically are protected through forms of intellectual property that tend to be more difficult to document across countries and over time. Therefore, the patent

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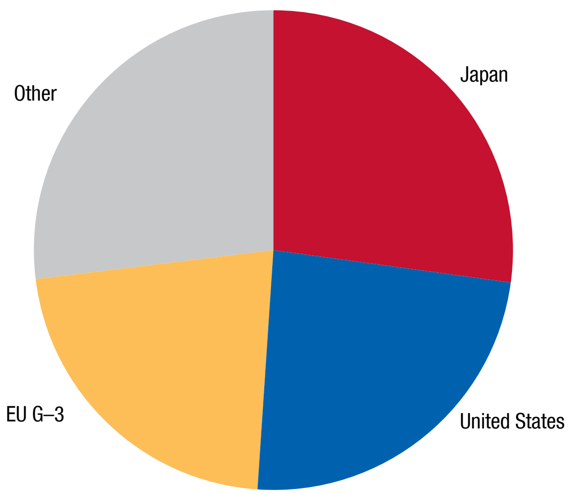
[1]For previous work using patents or citations data, see Branstetter (2001); Peri (2005); MacGarvie (2006); Madsen (2007); and Aghion, Howitt, and Prantl (2015).

Figure 4.1. International Patent Families by Publication Year
(Average 1995–2014)



Sources: European Patent Office, PATSTAT database; and IMF staff calculations.
Note: EU G–3 = France, Germany, and the United Kingdom.

analysis in this chapter is complemented by an examination of productivity measures to establish whether the identified patterns of international technology diffusion are accurate indicators of productivity developments.

The first part of the chapter lays out a conceptual model for the production and diffusion of innovation. It also documents trends in R&D, patenting, and productivity, both at the technology frontier and in other advanced and emerging market economies. The strength of international technology diffusion and its effects on productivity are then examined, with estimates of the impact of technology leaders' knowledge flows on innovation and productivity in economies that are recipients of that knowledge. Because global value chains (GVCs) are a potentially important channel of knowledge spillovers, the analysis is complemented by a detailed look at their effect on technology diffusion in emerging market economies. The final part of the chapter discusses the complex relationship between international competition, market concentration, and innovation. It provides some evidence of the impact of such structural changes on innovation and technology diffusion.

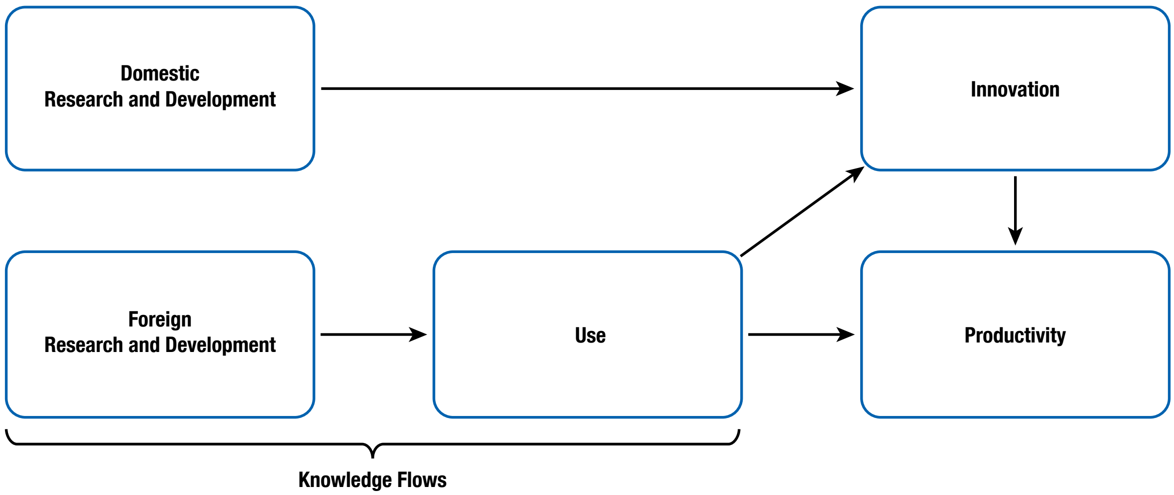
The findings of the chapter show that globalization has intensified the diffusion of knowledge and technology across borders, helping to spread potential growth among countries and boost it at the global level. This productivity spillover is important because, until recently, the production of knowledge and technology has been concentrated mostly in a handful of large industrialized economies. Innovation sharing has taken place through many channels, including the international use of patents and trade. Another mechanism through which globalization appears to have boosted the diffusion of knowledge and technology is by increasing international competition, which in turn has raised incentives to innovate and adopt foreign technologies.

By making increasing use of available foreign knowledge and technology, emerging market economies have boosted their own innovation activity and lifted productivity. Indeed, increased diffusion of knowledge to emerging market economies has partly offset the effects of the recent slowdown in innovation at the technology frontier. More intense diffusion of leading technologies to emerging market economies helps explain why their productivity growth has generally been stronger than in advanced economies, helping to drive cross-country income convergence for many countries in recent years. The effects have been substantial: over 2004–14, knowledge and technology flows from the global frontier explain about 40 percent of average sectoral productivity growth in emerging market economies.

Finally, knowledge and technology do not flow only in one direction—indeed, the chapter finds evidence that technology leaders themselves benefit from each other's innovation. This underlines the production and diffusion of knowledge and technology as a key mechanism through which globalization delivers global benefits. And even though until recently much of the production of knowledge and technology was concentrated in a small number of advanced economies, China and Korea have now emerged as significant contributors to the global technology frontier. Therefore, there may be scope in the future for spillovers from these new innovators to the traditional innovators.

This chapter is a contribution to the ongoing debate on the benefits and drawbacks of globalization. While the negative side effects of globalization have received much attention in public debates, the chapter highlights that there are upsides too: globalization helps the diffusion of knowledge and technology across borders, spreading their benefits more globally. From a policy perspective, greater global interconnectedness is thus key to maximizing inward technology diffusion and boosting economies' growth potential. But as economists have long emphasized, assimilating and productively using foreign knowledge often requires investments in domestic R&D and in human capital, which enhance absorptive capacity (for example, Cohen and Levinthal 1989; Griffith, Redding, and Van Reenen 2004).

Figure 4.2. Technology Diffusion



Source: IMF staff illustration.

The chapter provides some evidence suggesting that strong institutions that uphold the rule of law benefit innovation, but it does not examine specifically the optimal extent of intellectual property rights protection, which includes patents. This is a complex issue and could not be dealt with conclusively at this chapter's broad level of analysis. Protection for innovators' ideas provides appropriate incentives and the ability to recover costs. But the policy design should maintain sufficient competition and allow for follow-on innovations by competitors, as well as prevent the abuse of power to the detriment of consumers. Finally, concerns that globalization may exacerbate inequality within countries also apply to the growth benefit from inward technology diffusion. It is therefore important for policymakers to ensure that these growth benefits are shared broadly across the population.

Conceptual Framework

Domestic innovation draws on knowledge generated by domestic and foreign research efforts (Figure 4.2).[2] While domestic R&D can affect domestic innovation directly, it is useful to distinguish the steps through which foreign knowledge influences domestic innovation: the availability of foreign knowledge, the extent of its use domestically, and the impact of knowledge flows on domestic innovation and productivity more generally.

- *Available foreign knowledge:* A common measure is the cumulated stock of past R&D spending, corrected for the loss of some of the knowledge's relevance over time (see Annex 4.1). This is the main measure of foreign knowledge used in the analysis.
- *Extent of use of the stock of foreign knowledge:* Foreign knowledge is transmitted internationally through various channels. The strength of this transmission determines to what extent foreign knowledge is domestically usable. However, measuring transmission is difficult. The main channels mentioned in the literature are foreign direct investment (FDI), international trade, and migration (see Keller 2004 and 2010 for an extensive discussion of the empirical evidence).[3] Within these channels, knowledge flows can entail market transactions—for instance, trade or the licensed use of foreign patents—or occur through demonstration effects and outright copying of patented or nonpatented foreign innovations that have become domestically available. In this case, knowledge flows incorporate a significant externality component.
- *Impact of foreign knowledge flows on the production of domestic innovation and on the economy's productivity:* Foreign knowledge flows—as measured by the product of the available foreign knowledge and the

[2]See Grossman and Helpman (1991) for models of endogenous growth, based on the idea that knowledge gained from past research efforts increases the productivity of current research efforts.

[3]Most empirical studies test only one channel at a time. In practice, all the channels are correlated, making it difficult to disentangle individual contributions. Testing for the role of trade or FDI is also subject to endogeneity concerns, as trade and FDI linkages with technology leaders will likely be influenced by the innovativeness or productivity of the country examined.

extent to which that stock of knowledge is used—do impact domestic innovation. They can also contribute to raising domestic productivity, not only by boosting domestic innovation, but also directly through the adoption of foreign technologies in the production process (for example, through the licensing of foreign technology or technology embodied in imports or FDI).

Measuring Innovation

Measuring innovation is no simple task. This section discusses the advantages and limitations of the approach taken in the chapter. The analysis is centered on two variables widely used in the literature: R&D spending and patent data. These measures have two advantageous attributes:

- *Direct quantification of innovation activity:* R&D spending captures firms' research *input*. Patent data are a measure of the *outcome* of research activity. To be patentable, an idea needs to be *novel*, *inventive* ("non-obvious to persons skilled in the art"), and *capable of industrial application* (OECD 2009). Both variables are available internationally and at disaggregated levels and can be used to study the strength of the innovation link between industries and across countries.
- *A proxy for the domestic use of foreign knowledge:* Patent citations provide a direct way to quantify the strength of international knowledge flows—the extent to which recipient countries actually make use of the available stock of global knowledge. Citation data are readily available, thanks to the need for precise and comprehensive citations for patent registration.

Nevertheless, patent and R&D measures have their limitations. First, patenting can be a noisy measure of innovation capacity. There are multiple reasons why the incentive to patent an innovation can differ between countries and across time, including differences in the procedures and requirements of patent offices. As a result, the number or economic value of ideas per patent can vary significantly, which makes international comparison of simple patent counts harder. To improve comparability, this chapter follows the practice developed in the literature to construct quality-adjusted patent measures (Box 4.1 discusses the concepts and measurement issues related to patent indicators). The preferred measures focus on international or top three patent "families," which group individual applications for the same underlying technology.

An international patent family features one patent application in at least two distinct patent offices. The idea is to exclude many patents with lower economic value, as the low expected payoff would not warrant the extra cost of application, examination, and maintenance in a foreign country. The approach also reduces the impact of possible idiosyncrasies in patenting activity across patent offices.

The top three patent families include an application to at least one of the top three patent offices (European Patent Office, Japan Patent Office, United States Patent and Trademark Office). Relative to the previous measure, this implies more consistency as it involves a very limited number of patent offices. The drawback is that count measures tend to favor inventors and applicants from Europe, Japan, and the United States.

In recognition that there is no perfect measure, the empirical analyses—which use sector- or firm-level data for each country—include country-year fixed effects to absorb the fiscal, institutional, cultural, and legal factors that affect incentives to patent or cite other patents across countries and time.[4]

A second drawback of using patent data is that not all innovations are patentable. Certain sectors, such as manufacturing, display more patentability than others—such as services, which rely more on forms of intellectual property protection that are less systematically recorded.[5] This and related data issues make it hard to investigate technology diffusion in nonmanufacturing activities, and suggest a focus on manufacturing sectors. Therefore, the degree to which this chapter's results extend to other sectors depends on how well patenting correlates with overall innovation activities, including those that do not lead to patenting. While impossible to test precisely, some support is found for this assumption.[6] Nevertheless, macroeconomic interpretation requires some care.

[4]This would also address the case where local firms have a lower propensity to patent either domestically, because the actual protection of patents in the domestic economy is weak, or internationally, because the domestic market is large enough that they do not need to patent abroad. Similar points can also be made for R&D spending, since incentives to precisely measure and classify innovation efforts are subject to significant heterogeneity across sectors and countries, including their tax treatment; differing public support systems; and other legal, institutional, and cultural differences.

[5]For example, copyrights, which are used to protect the intellectual ownership of texts, software, and other expressions of creative work, do not generally require registration, which complicates record keeping even if the information is public. By definition, this also holds for trade secrets. Open-source software is another example of technology diffusion that does not involve patents or patent citations.

[6]For instance, recent country rankings based on broader measures of innovativeness by Bloomberg Finance L.P. correlate strongly with those based on the patent measures used in this analysis.

Despite some limitations, patents are an attractive measure to capture innovation, which is also reflected in their frequent use in the economic literature. Patents are related to new ideas with the objective of, or at least potential for, economic exploitation. The key advantage is, however, the precision with which the idea can be attributed to its creator at a particular moment and to other ideas through the link of citations.

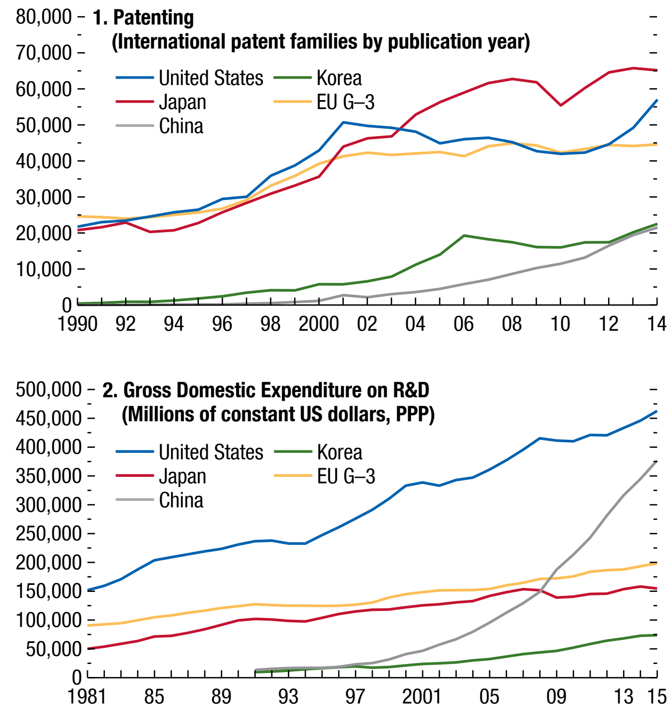
Technology diffusion can stimulate innovation, but may also affect productivity directly through simple adoption of existing technology. To test for this more direct channel, various productivity indicators are examined. This provides a broader, albeit less precise, measure of technological progress and complements the patent-data analysis. The disadvantages of these measures compared with patent counts are that their quantification is subject to significant measurement uncertainty (especially for total factor productivity) and that they include components extraneous to innovation (for example, labor productivity increases with investments in physical and human capital). Their main advantage is that all innovations, regardless of their specific channel of diffusion, are expected to translate into changes in productivity eventually. Use of productivity measures also helps to disentangle the effect of foreign R&D on domestic innovation (patents) from its contribution to the efficiency of domestic production (productivity).

A final issue is whether patent citations are a good proxy for the extent to which foreign knowledge becomes available for domestic use through the various transmission channels. For instance, a popular alternative proxy is the intensity of international trade. This approach has its own drawbacks, however, as a significant fraction of trade in goods is not associated with any technology diffusion. Indeed, a key advantage of using the propensity to cite foreign patents is that it provides a direct measure of knowledge use and, at the same time, correlates well with other indirect measures, such as the propensity to import.[7] On balance, patent citations are the more attractive indicator of the extent of use of foreign knowledge, but the chapter also offers estimates based on the intensity of trade as a robustness check.

The Innovation Landscape

The evolution of innovation can be tracked by examining data across different measures, countries, and time periods, which confirms that global technological advances have been concentrated in a few large industrialized countries.

Figure 4.3. Patenting and Research and Development at the Frontier



Sources: European Patent Office, PATSTAT database; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: EU G–3 = France, Germany, and the United Kingdom; PPP = purchasing power parity.

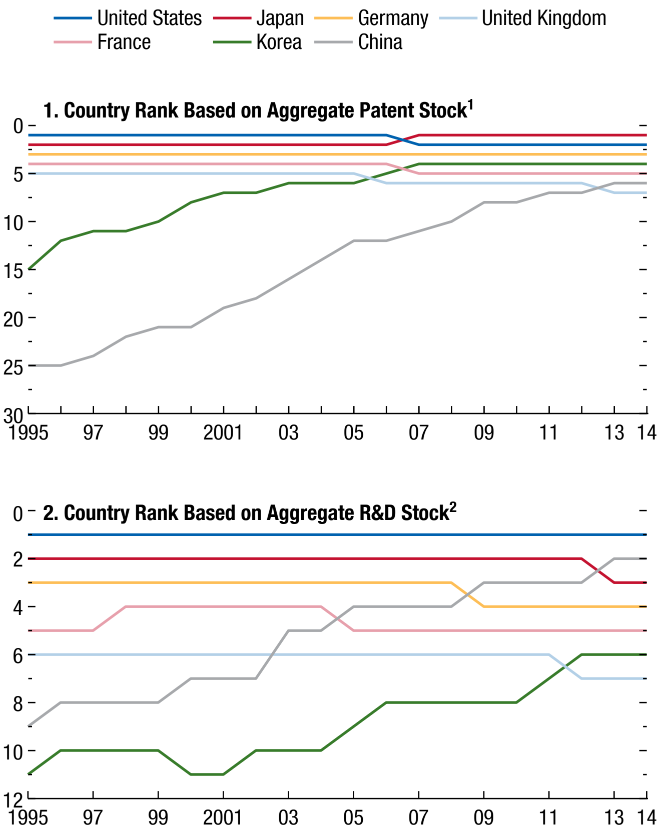
The United States, Japan, Germany, France, and the United Kingdom (henceforth the G5) accounted for about three-fourths of international patent families during 1995–2014 (see Figure 4.1). They are also responsible for the bulk of R&D spending over those years (Figure 4.3). For this reason, the aggregated activity of the G5 is used as a proxy for the global technology frontier and as the main source of technology diffusion worldwide in the chapter's analysis.

However, this is not to imply that other emerging market or advanced economies have not contributed to the evolution of global knowledge. For example, in recent years Korea and China have joined the top five leaders in a number of sectors, either based on the stock of R&D and/or the stock of international patents (Figure 4.4). Their rise is particularly pronounced in the electrical and optical equipment sector and, for Korea especially, in machinery equipment.

The dynamics in innovation between economies at the technology frontier and others are diverg-

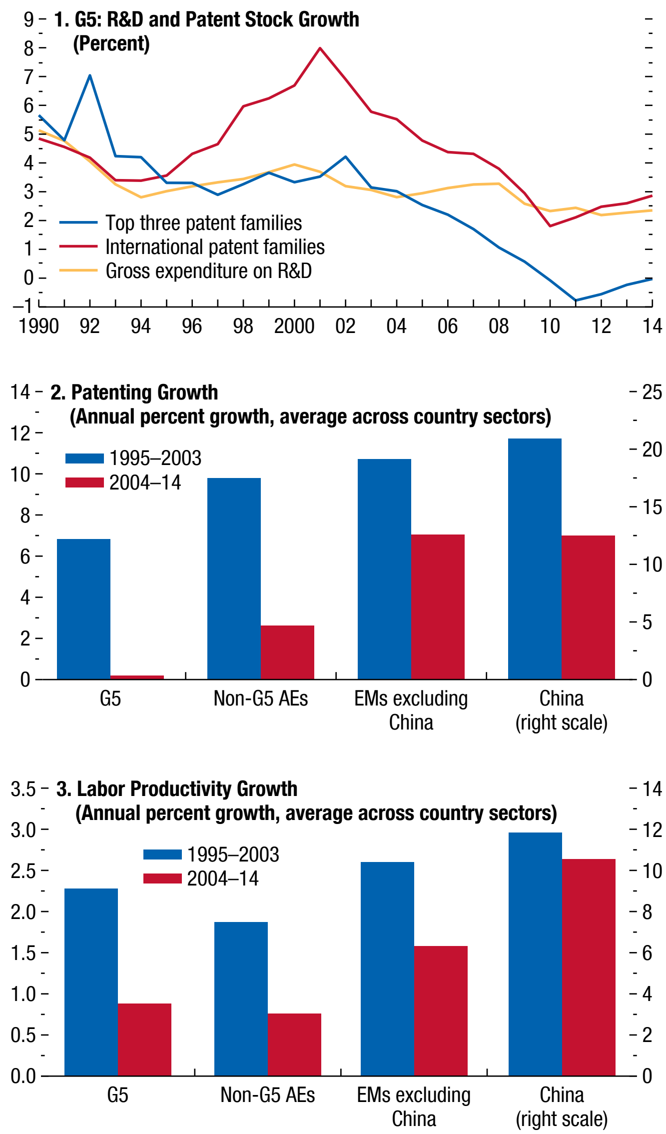
[7]See for example MacGarvie (2006).

Figure 4.4. Countries at the Technology Frontier



Sources: European Patent Office, PATSTAT database; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: R&D = research and development.
[1]Based on international patent families.
[2]Cumulated gross domestic expenditure on R&D (in millions of constant US dollars at purchasing power parity).

Figure 4.5. Slowing Patenting and Productivity



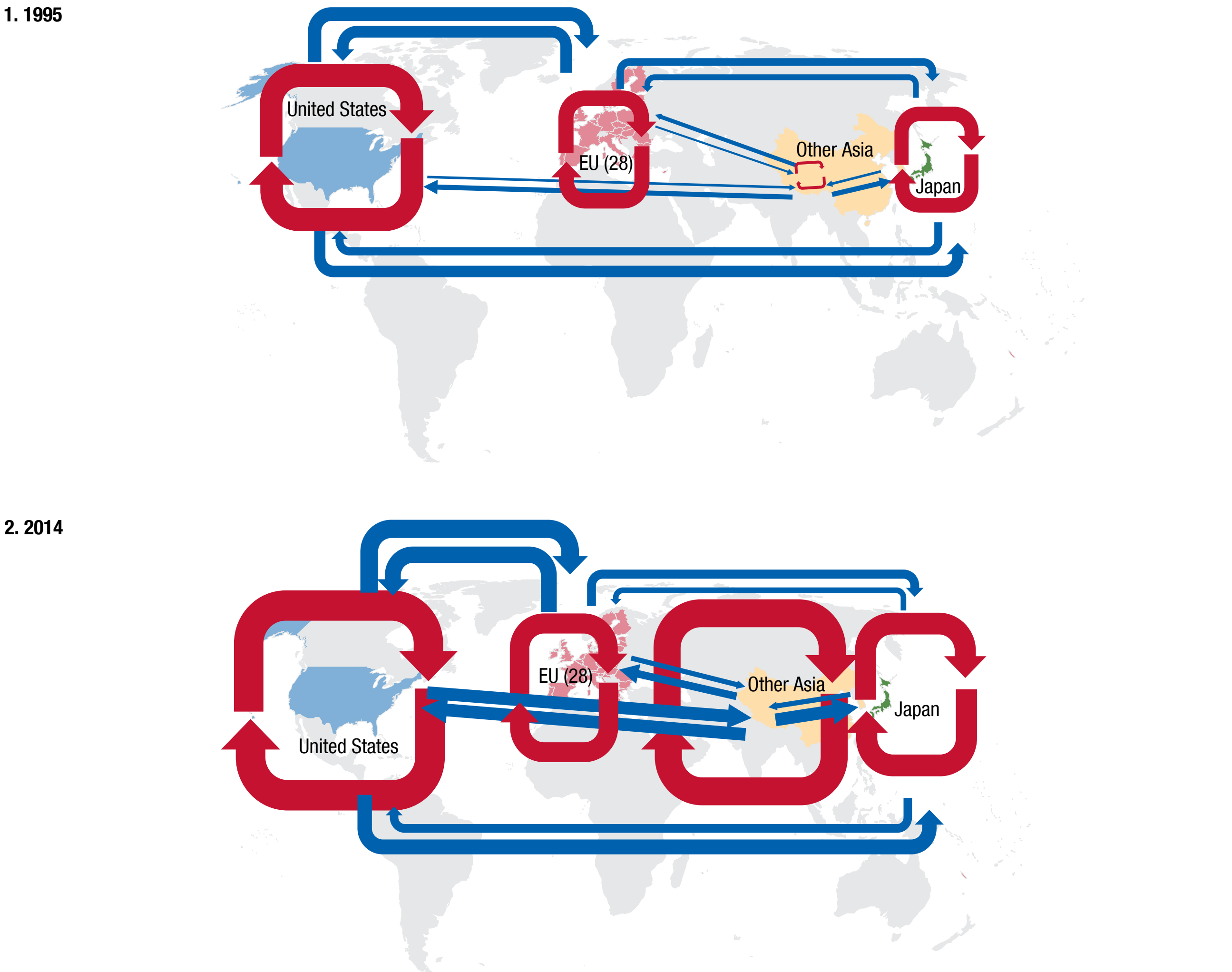
Sources: European Patent Office, PATSTAT database; KLEMS database; Organisation for Economic Co-operation and Development; United Nations Industrial Development Organisation; and IMF staff calculations.
Note: AEs = advanced economies; EMs = emerging market economies; G5 = France, Germany, Japan, the United Kingdom, and the United States; R&D = research and development.

ing (Figure 4.5). Since the early 2000s, the G5 has experienced a pronounced slowdown in growth of patenting—and to a lesser extent R&D—mirroring the well-documented slowdown in labor productivity and total factor productivity.[8] The slowdown was much milder in advanced economies outside the G5 and in emerging market economies. Growth in innovation and productivity held up much better, especially in emerging market economies. Diverging dynamics could reflect issues particular to the frontier and/or changes in the way innovation is diffused from the frontier to other regions. To elaborate:

- *Issues specific to the frontier:* There are two main hypotheses behind the slowdown at the frontier. One proposes that the impact of the most recent large wave of innovation related to advances in information and communication technology (ICT) is fading, while ongoing progress in the digital domain, artificial intelligence, automation, and machine learning will be felt some years after their introduction (Brynjolfsson, Rock, and Syverson 2017) because the benefits take time to materialize as new general-purpose technologies. More pessimistic views (for example, Gordon 2012; Bloom and others 2017) contend that really

[8]Patenting in the United States has picked up in recent years, however.

Figure 4.6. The Evolution of Cross-Patent Citations within and across Regions



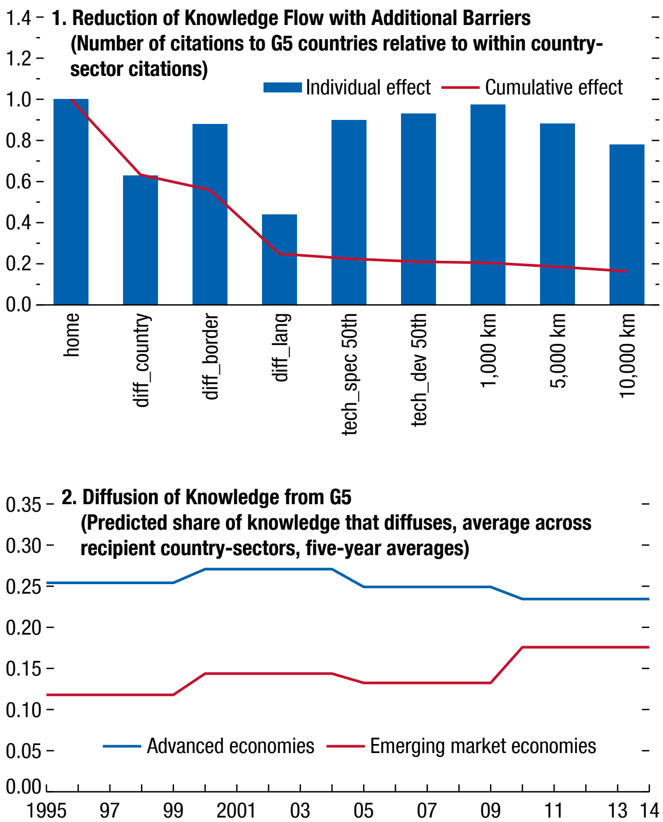
Sources: European Patent Office, PATSTAT database; and IMF staff calculations.
Note: Figure shows the evolution in citation flows between (blue) and within (red) key countries and regions. For a given year, the thickness of the arrows is proportional to the respective numbers of citations. For visibility, the increase in citations over time could not be reflected proportionally (approximate scaling factor 2014 versus 1995 is 1.5 in the figure; actual is 2.5). EU (28) = AUT, BEL, BGR, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HRV, HUN, IRL, ITA, LTU, LUX, LVA, MLT, NLD, POL, PRT, ROU, SVK, SVN, SWE; Other Asia = China and Korea. Data labels use International Organization for Standardization (ISO) country codes.

good ideas become harder to come by over time, leading to a secular decline in productivity growth. Keeping productivity growth constant would require increasingly larger R&D investment in this scenario.[9]

[9]Autor and others (2016) have pointed to the increased trade competition from China as a possible explanation for the decline in US firms' innovation, since it reduced profits and overall operations, including R&D spending, of trade-exposed firms. This conclusion, however, is at odds with that of Bloom, Draca, and Van Reenen (2016), who find a positive effect of the China shock on European innovation activity, and seems less consistent with aggregate data, which show no protracted slowdown in R&D spending in the United States.

- *Changes in technology diffusion:* While knowledge creation at the frontier seems to have slowed for now, past ICT progress and increases in globalization have opened the potential for knowledge to travel faster and farther. Figure 4.6 shows a map of knowledge flows in which the red arrows represent cross-patent citations within a country or region, and the blue arrows point to citations across countries or regions. Similar to other measures, the map illustrates a changing international constellation. While in 1995 the United States and—to a lesser extent—Europe and Japan were dominating global patent citations,

Figure 4.7. Knowledge Diffusion across Barriers over Time



Source: IMF staff calculations.
Note: G5 = France, Germany, Japan, the United Kingdom, and the United States. Panels are derived from coefficients of same-sector regression on citations to G5 countries. Tech_spec 50th denotes the 50th percentile of the variable tech_spec; and tech_dev 50th denotes the 50th percentile of the variable tech_dev. km = kilometers.

China and Korea (depicted together as "other Asia") have become increasingly more integrated into global citations. The map in Figure 4.6 also shows a general intensification of patent citations over time, captured by the increase in the size of the arrows. However, this alone does not mean that the stock of global knowledge was diffusing faster. As discussed earlier, citations are a function of the amount of innovation as well as the propensity to patent and cite other patents, which is influenced by institutional and legal differences across countries and over time. The next section derives a measure of knowledge flows that deals with these issues.

Determinants of Knowledge Flows

The strength of knowledge flows from the technology frontier, and how those flows have changed, can be measured in a more formal way than in the previous section. Many economists believe knowledge flows are localized, because barriers, such as geography, language, or technological differences, weaken their diffusion. These barriers can attenuate knowledge diffusion directly or indirectly, because they reduce economic transactions such as trade, FDI, and migration, which are important channels for the transfer of knowledge. This section uses a gravity model to estimate the impact of these barriers on the intensity of knowledge flows and then examines whether their effect has become less important over time (see Annex 4.2 and Peri 2005).

The focus is on international knowledge diffusion from the frontier, proxied by the G5 countries and within broadly defined industrial sectors.[10] Focusing on the G5 countries misses the changing role of some economies, particularly China and Korea, but captures the bulk of the contribution to global patenting and R&D stocks for most of the sample. Korea and China are thus treated as recipients, even though, in the future, they are likely to become more important sources of global knowledge flows.[11,12]

The analysis uses country-sector rather than economy-wide data, which makes it possible to control for factors specific to each citing and cited country sector in each period. Such factors include the quantity of patenting and institutional or cultural characteristics that influence the propensity to patent or to cite other patents. The sectoral approach is also appropriate for studying knowledge diffusion because the potential for technological progress varies across industries, and the sectoral composition of a country's economic activity influences the extent of knowledge and technology diffusion. A drawback of using sector-level data is that it limits the extent to which conclusions can be drawn about the aggregate economy. Nevertheless, the average sector-level effects provide a sense of the broader effects on the economy.

A key summary of the analysis is the predicted relative frequencies of citations for each country sector (henceforth denoted $\hat{\phi}$ and used in the subsequent section). These can be interpreted as the share of knowledge that diffuses from the cited to the citing relative to what diffuses within the cited country sector (see Annex 4.2). Figure 4.7 (top panel) shows the share of

[10]Intrasectoral spillovers are significantly stronger than spillovers across sectors, reflecting in part the broad definition of the sectors used in the analysis. Annex 4.2 provides evidence substantiating this.

[11]Annex 4.2 shows that the empirical results are robust to excluding China.

[12]In the case of China, an additional consideration is the absence of sufficiently long historical sectoral R&D data.

knowledge diffusing from the G5 across cumulative barriers between same-sector pairs over 1995–2014. While naturally at 1 in the home country sector, this share declines by roughly ½ when information crosses a national border (diff_country). While the effect of contiguity (diff_border) is more moderate, a different language (diff_lang) again significantly decreases this share. Differences in technological specialization (tech_spec) and in technological development (tech_dev) also lead to a reduction in knowledge flows. Adding technological, linguistic, and geographic distances results in average shares of knowledge diffusion of 15–20 percent. Thus, knowledge flows are relatively localized.

Next, the analysis investigates how knowledge diffusion from the G5 has changed over time, based on different regressions for each five-year period. Figure 4.7 (panel 2) shows the evolution of the average degree of knowledge diffusion for advanced and emerging market economies. While emerging market economies have notably increased their access to information available at the frontier over time, this does not hold for advanced economies, which—particularly since the global financial crisis of 2008—have experienced less diffusion of knowledge, possibly related to the postcrisis slowdown in trade. The deepening integration of emerging market economies in knowledge flows is mostly driven by a change in the effect of the distance in technological development (tech_dev). In earlier periods, knowledge flows weakened with distance from the technological frontier, but this source of divergence has faded and has been replaced by a convergence trend in more recent years. These patterns remain the same even when excluding China, suggesting a broader pattern across emerging market economies.

Impact on Innovation and Productivity

The previous section focused on knowledge flows between the technology frontier and other countries. It has shown that national and linguistic borders are important, but that the combined effect of gravity has decreased for emerging market economies, increasing their access to knowledge available at the frontier.

This section examines the impact of these knowledge flows on innovation activity and productivity in recipient countries. Again, the analysis uses country-sector data instead of aggregate data. This better identifies the effects of interest, as it controls for aggregate trends that could affect domestic innovation but be mistakenly attributed to the trend in foreign knowledge flows. The sector-level effects are later aggregated to provide evidence suggestive of the impact on the broader economy.[13]

Knowledge flows are measured by weighting the G5 knowledge stock—measured by their R&D stock—with the time-varying bilateral shares of knowledge flows $\hat{\phi}$ estimated in the previous section (see Figure 4.2).[14] As discussed, the weighting method used here implicitly captures various channels of knowledge transmission, including trade, FDI, and migration. An alternative and simpler weighting method based on time-varying trade linkages at the sectoral level is also used in a robustness exercise, capturing more directly possible knowledge transmission through trade exposure with technology leaders (Annex 4.3).

The analysis then estimates how innovation (patent *flow*) or productivity in the recipient country sector (P) depends on its own R&D stock (R_c) and the weighted total R&D *stock* of the five technology leaders (R_l). Building on the work of Peri (2005), Coe, Helpman, and Hoffmaister (2009), and Acharya and Keller (2009), the approach can be summarized as

$$lnP_{i,c,t} = D_{c,t} + \gamma lnR_{i,c,t} + \mu \ln \sum_{l \neq c} \phi_{i,c,l,t} R_{i,l,t} + \varepsilon_{i,c,t}, \qquad (4.1)$$

in which i denotes the industrial sector, c the country receiving spillovers, l the technology leaders (that is, the G5 countries), and t the time period. The coefficient on the weighted foreign R&D stock (μ) captures the average efficiency of use of foreign knowledge. The equation is estimated using sector-level data for a broad sample of advanced and emerging market economies from 1995 to 2014. The regression includes country-year fixed effects to control for time-varying factors that may drive innovation or productivity trends.

Impact on Innovation

The estimates suggest that knowledge flows from the G5 are important in stimulating the flow of domestic innovation, as proxied by patenting, indicating significant learning from the technological frontier

[13]In general, the sectoral approach clearly establishes the causality of the effect, but it does not capture aggregate general equilibrium effects.

[14]Using the predicted values rather than actual values helps avoid a potential endogeneity problem because they are based on highly exogenous variables and exclude the fixed effects.

Table 4.1. Impact of Foreign Knowledge on Domestic Innovation and Productivity

Dependent Variable	Patent Flow		Labor Productivity		Total Factor Productivity	
	(1)	(2)	(3)	(4)	(5)	(6)
Sample Period (1995–2014)	Baseline	Changing Diffusion	Baseline	Changing Diffusion	Baseline	Changing Diffusion
Foreign R&D Stock, weighted[1]	0.350***	0.199***	0.057***	0.040*	0.053**	0.018
	[0.055]	[0.057]	[0.020]	[0.022]	[0.021]	[0.037]
Foreign R&D Stock*2000–04		0.137***		0.039***		0.026*
		[0.031]		[0.012]		[0.014]
Foreign R&D Stock*2005–09		0.191***		0.043**		0.052**
		[0.039]		[0.018]		[0.024]
Foreign R&D Stock*2010–14		0.259***		–0.009		0.072**
		[0.048]		[0.026]		[0.030]
Own R&D Stock	0.448***	0.441***	0.118***	0.118***	0.060**	0.058*
	[0.061]	[0.060]	[0.022]	[0.022]	[0.023]	[0.030]
Observations	3,487	3,487	3,721	3,721	1,192	959
R^2	0.779	0.784	0.758	0.759	0.958	0.955
Country-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Source: IMF staff calculations.
Note: R&D = research and development. Robust standard errors (clustered at country-sector level) in brackets.
***p < 0.01, **p < 0.05, *p < 0.1.
[1]Regression equations for labor productivity and total factor productivity use the lag value of the weighted foreign R&D stock variable.

(Table 4.1, column [1]). For example, on average, a 1 percent increase in the knowledge-flow-weighted foreign R&D stock is associated with about a ⅓ of 1 percent increase in the count of patent families by the recipient country sector. Moreover, cross-border technology diffusion seems to have intensified, as indicated by the steady and significant increase in the coefficient on the weighted foreign R&D stock between 1995 and 2014 (Table 4.1, column (2)). And while the acceleration in technology diffusion over time is visible for recipients in advanced economies, it is more pronounced for emerging market recipients (see Annex 4.3 for details).

An alternative specification using simple trade weights instead of citation weights to proxy for the use of the foreign R&D stock produces broadly consistent estimates, demonstrating the robustness of the results (Annex Table 4.3.1). These results are also robust to sensitivity checks, including the use of other quality-adjusted patent measures, or the alternative estimation method provided by dynamic ordinary least squares (OLS).[15] Measuring the stock of G5 knowledge by their weighted patent stock—instead of their weighted stock of R&D—to capture foreign knowledge flows confirms that G5 patents make a significant contribution to innovation in other countries. Using a similar framework, Box 4.2 presents firm-level evidence that foreign knowledge boosts the innovation capacity of firms, and highlights the role played by technology sourcing—the research carried out in the main technological leaders—to circumvent the local character of knowledge and access the knowledge of technological leaders.

Impact on Productivity

Foreign knowledge also plays a role in boosting domestic productivity (Table 4.1, columns [3] and [5]). This is true for both emerging market economies and advanced economies, though the effect is larger for emerging market economies. Separate estimations for recipients indicate that industries in emerging market economies benefit significantly more than those in advanced economies from the role of foreign knowledge flows in channeling technological transfer into higher labor productivity (Annex Table 4.3.2).

Interestingly, while the impact of foreign knowledge flows on innovation has remained strong (and even strengthened) over time, the picture is mixed for the spillover to productivity (Table 4.1, columns [4] and [6]). Indications are that the impact on total factor productivity has strengthened over the past two decades,[16] but the effect on labor productivity seems

[15]Dynamic OLS can address possible nonstationarity and cointegration of the patent and R&D series in a panel setting.

[16]The estimation sample for total factor productivity is smaller and consists mainly of advanced economies.

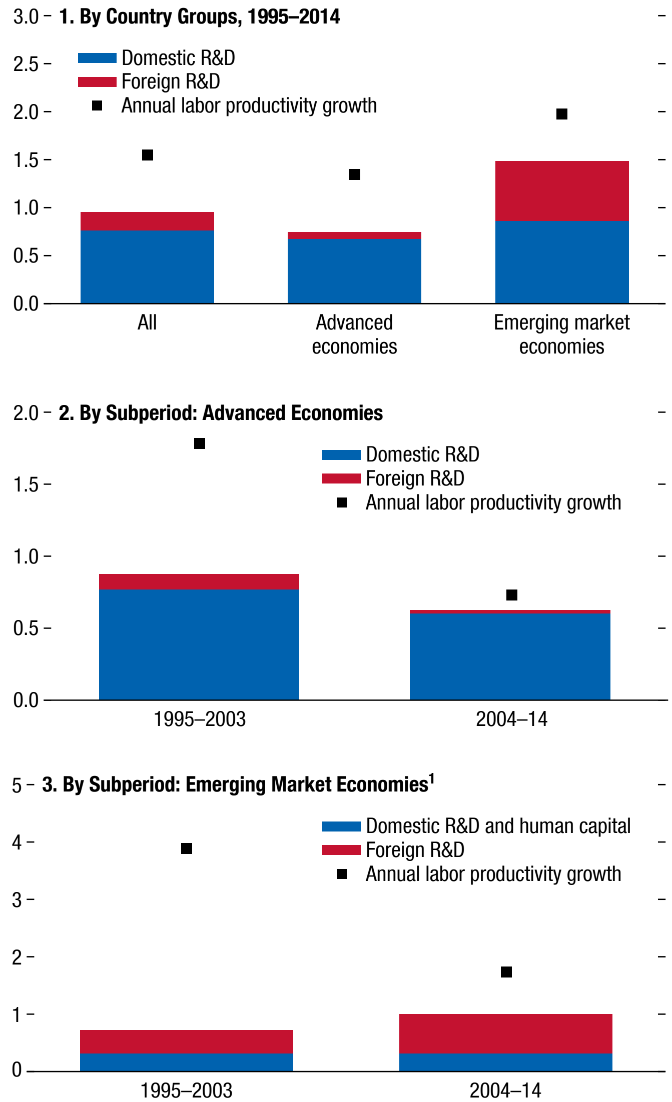
to have weakened in the postcrisis years of 2010–14.[17] This could be consistent with arguments discussed earlier—that innovations make increasingly less impact (Bloom and others 2017). Another—more benign—explanation could be that the protracted period of subdued investment following the global financial crisis reduced technology diffusion, as investment goods are an important conduit for embodied new technologies to integrate into production processes (Adler and others 2017).

Although based on sector data alone, the effects of foreign knowledge flows on labor productivity are economically meaningful. For illustrative purposes, using the estimates in Table 4.1, one can calculate the effect of observed changes in the weighted foreign R&D stock and domestic R&D stock on the growth in domestic labor productivity in each country-sector—assuming everything else remains the same (see Annex 4.3).[18] These contributions can then be averaged over countries and sectors included in the analysis to give a sense of the magnitude of the effects. The estimates suggest that during 1995–2014, developments in domestic and foreign R&D combined would have generated about 1 percentage point average sectoral labor productivity growth a year, which is about 60 percent of the observed sectoral labor productivity growth, consistent with there being other sources of productivity improvements. The impact of knowledge flows from the G5 alone amounted to about 20 percent of the *explained* average growth in sectoral labor productivity in the sample and one-eighth of the *observed* average growth in sectoral productivity (Figure 4.8).

The effects vary for advanced economies and emerging market economies in the following ways:

- Technology diffusion boosted productivity growth in emerging markets more strongly, providing a counteracting force to the slowing innovation trends at the frontier. From 2004 to 2014, foreign knowledge accounted for about 0.7 percentage point of labor productivity growth a year, or 40 percent of observed sectoral productivity growth, compared with 0.4 percentage point annual growth during 1995–2003 (see Figure 4.8). Greater use of existing foreign knowledge by emerging market economies—combined with the stronger impact of these knowledge flows on industries in emerging market economies than on those in advanced economies—has been a significant factor in maintaining the better labor productivity performance

Figure 4.8. Contribution of Foreign Knowledge to Labor Productivity Growth
(Annual percent growth, average across country sectors)

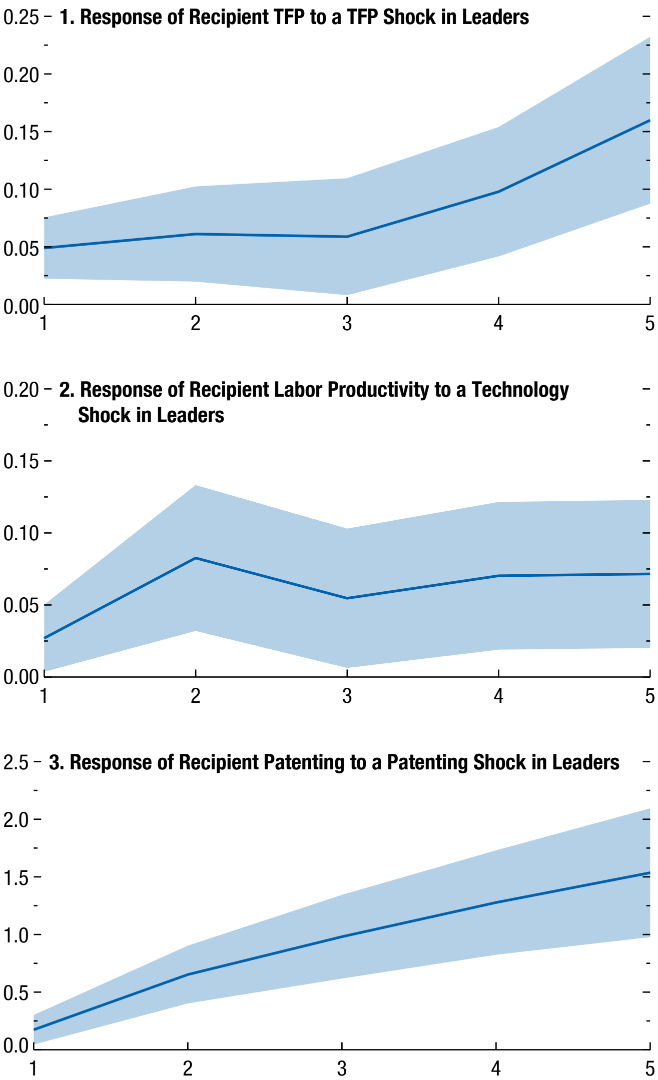


Source: IMF staff estimates.
Note: R&D = research and development.
[1]The decomposition by subperiods for emerging market economies is based on a slightly different regression specification with a less demanding data requirement, which allows for having a significantly broader sample of emerging market economies (Annex 4.3).

[17]This is consistent with OECD (2015), which, looking at a sample of firms in advanced economies, finds evidence of a rising gap in productivity growth between global frontier firms and other firms. See also Andrews, Criscuolo, and Gal (2016).

[18]To assess the impact of aggregate (country-level) variability on the coefficients estimated in equation (4.1), the regression was also run without country-time fixed effects. The estimated impact of the weighted foreign R&D stock on labor productivity was broadly unchanged.

Figure 4.9. The Dynamics of Technology Diffusion
(Percent)



Source: IMF staff estimates.
Note: TFP = total factor productivity. Blue shade denotes 90 percent confidence band. Impulse responses to a 1 percent TFP/labor productivity/patent shock estimated using local projections. *X*-axes denote years; *t* = 1 is the year of the shock.

of these economies compared with that of advanced economies. Results are robust to excluding China, which suggests that emerging market economies, more broadly, have benefited.

- In advanced economies, the contribution of foreign knowledge to labor productivity growth was much smaller, given the slowdown at the frontier and the absence of further improvements in use of foreign knowledge (this use even declined after the global financial crisis).

Estimating Short-Term Dynamics

As a complementary approach to the long-term framework and robustness check, this section investigates the short-term dynamics of technology diffusion using the local projection method (see Jordà 2005). Extending the analysis in Duval and others (forthcoming), this approach focuses on the short-term impact of a productivity or innovation shock in the technology leaders on productivity or innovation in the recipient country sector (see Annex 4.4 for details and for definition of the shocks). Shocks to innovation are taken to be changes in the total patent stock of the technology leaders. Again, shocks in the leaders are weighted by the bilateral shares of knowledge that flow from the G5. The empirical specification includes country-time fixed effects to capture factors that drive the short-term dynamics of a country's productivity and innovation at the country level, such as business cycles.

The impact of technology shocks is significantly stronger in the case of innovation measures. On average, a 1 percent patent shock in the leaders would raise the patent stock in the recipient by at least 1 percent after five years (Figure 4.9). This suggests that an acceleration of innovation in technology leaders has a particularly strong effect on innovation in other countries.[19] But the effects are also significant for broad productivity measures: in response to a 1 percent total factor productivity (or labor productivity) shock in the technology leaders, total factor productivity (labor productivity) in the average recipient country sector is estimated to increase by about 0.15 (0.07) percent after five years. The results indicate that technology spillovers tend to happen relatively quickly—within a few years of the initial shock—and the size is not negligible.

Flows within the Technology Frontier

What about the G5 themselves? So far, the empirical approach has focused on the predominant pattern of knowledge and technology flows in the sample period analyzed—that is, from the frontier to other countries. However, this does not mean that flows have been going in one direction only. One way to shed light on this question is to apply the empirical approach developed above (see equation [4.1]) to estimating knowledge and technology diffusion among

[19]This suggests that follow-on innovations respond more than proportionally to the initial innovation.

the G5. The exercise is subject to additional econometric concerns, as it is more difficult to ensure the absence of endogeneity and simultaneity bias than in the earlier exercises. With this caveat in mind, the results suggest that G5 countries themselves benefited from knowledge flows from other technology leaders, boosting their domestic innovation. Indeed, a 1 percent increase in the knowledge-flow-weighted R&D stock of "other" G5 countries is associated with about a ½ percent increase in the count of patent families in the G5 country considered—slightly larger than the ⅓ of 1 percent increase obtained in the baseline for non-G5 recipient countries (Table 4.1, column [1]). Using firm-level data to examine knowledge spillovers through technology sourcing, Box 4.2 also provides evidence that knowledge spillovers between technology leaders are strong—possibly even stronger than for nonleader recipients.

The Impact of Global Value Chains on Patenting: A Firm-Level Analysis

While the preceding sections aimed to assess the strength of international technological spillovers and their effects on productivity, this section explores one specific channel through which such transmission occurs: firms' participation in global value chains (GVCs). Firms are increasingly part of complex production networks—often centered around multinational enterprises—that process diverse goods and services inputs from other domestic and foreign firms. Potential gains to firms in emerging market economies could be economically significant, because multinational enterprises are typically at the global productivity frontier (OECD 2015). Engagement with multinational enterprises through GVCs provides opportunities for knowledge spillovers to local firms along the value chains, by pooling knowledge with domestic suppliers and encouraging new practices, specialization in productive tasks, and the use of new varieties and higher-quality foreign goods, services, and intangible inputs.

In this way, the emerging pattern of decentralized global production represents a key channel for firms in emerging markets to build innovative capacity, with potentially positive effects for the rest of the economy. However, opposing forces may be at work:

- On the one hand, innovative activity by Western firms in emerging market economies has increased dramatically, albeit from relatively small levels, driven by a handful of large multinational firms (UNCTAD 2005). Griffith and Miller (2011) look at examples of how multinationals in western Europe create new knowledge using inventors located in emerging market economies.
- On the other hand, recent analysis suggests that GVC participation often implies that innovation is relocated within multinational firms to where it can be most efficiently undertaken (Stiebale 2016). A considerable increase in the postacquisition innovation of a merged entity is driven by inventors in the acquirer's country, while innovation in the country of the acquired entity tends to decline. In the case of emerging market economies, in particular, the relocation of multinational firms' innovative activities could reflect efforts to overcome inefficiencies associated with weak institutions, including weak intellectual property regimes (see Zhao 2006). Western firms respond by holding the intellectual property that results from emerging markets' innovation in the location of the parent.[20]

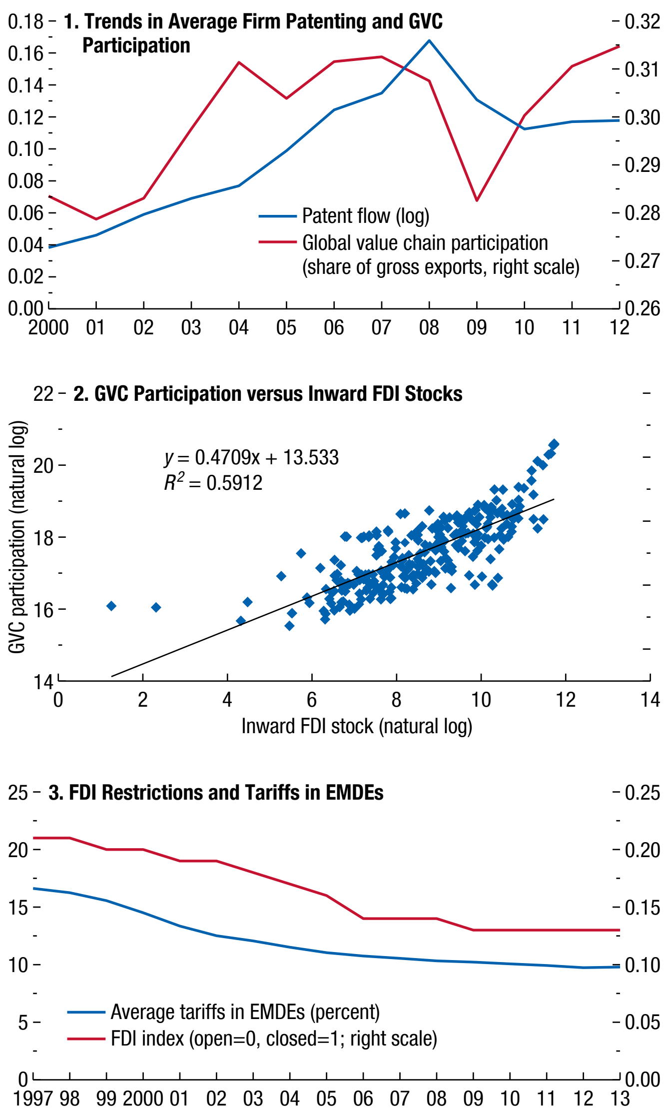
What role do GVCs play in this context? At first glance, trends in GVC participation and patenting suggest that the two appear to be related across emerging market economies (Figure 4.10, panel 1), which would suggest a positive impact. To determine whether these countries have indeed been able to capitalize on their participation in GVCs by increasing innovation, the analysis follows the firm-level framework used by Bloom, Draca, and Van Reenen (2016) (see Annex 4.5).[21] Working at the firm level makes it possible to distinguish two types of technological diffusion as a result of GVC participation: (1) a buildup of innovation capacity in the average firm—so-called within-firm effects, and (2) differentiation of this effect between firms with different rates of patenting—"between-firm" effects.[22] This between-firm

[20]Strokova (2010) documents that intellectual property regimes in emerging market economies, while improving, remain relatively weak.

[21]Firms can also benefit from participation in GVCs through technology adoption without necessarily innovating themselves (see, for instance, Lopez-Garcia and Taglioni 2018, for evidence on Europe). Testing for these effects would require firm-level productivity measures, which are not broadly available for emerging market economies in this chapter's sample. The test in this section is more demanding, since it examines whether participation in GVCs has boosted emerging market firms' innovation capacity and not just their adoption of foreign technology.

[22]Due to lack of data on absorption capacity in firms or sectors, the analysis follows a direct approach by controlling for firms' initial level of innovation (as in Bloom, Draca, and Van Reenen 2016) and

Figure 4.10. Patenting and Global Value Chain Participation



Sources: EORA Multi-Region Input-Output database; External Wealth of Nations; European Patent Office, PATSTAT; Foreign Direct Investment statistics; IMF, October 2016 *World Economic Outlook*; Orbis; United Nations Conference on Trade and Development; and IMF staff calculations.
Note: EMDEs = emerging market and developing economies; FDI = foreign direct investment; GVC = global value chain.

analysis is also used to examine how GVC participation alters sectoral composition of employment across firms according to their technological intensity (measured by past patenting activity). Another advantage to working at the firm level is improved identification of the effect of GVC participation, by controlling for firm-level characteristics that may also determine innovation capacity.[23]

To ensure that the impact of GVC participation on innovation is correctly identified, the empirical strategy attempts to tackle potential reverse causality from patenting to GVC participation. While technology improvements may occur because of GVC participation, firms may be pulled into GVCs because of their high productivity, their capacity to innovate, or even through self-selection that comes from being set up with attributes that lend themselves to GVC participation. The analysis exploits the relationship between GVC participation and FDI to establish causality: it is well known that GVC participation is strongly correlated with FDI, given how both relate to the international allocation of production (see Figure 4.10, panel 2). Changes in GVC participation are therefore identified using policy instruments that affect FDI and trade—namely, an industry-level policy indicator of restrictions to FDI and changes in tariffs. These have fallen as GVC participation has increased (see Figure 4.10, panel 3), and they are found to be negatively associated with changes in GVC participation in the econometric analysis (see Annex 4.5). These instruments help correct for the potential endogeneity of GVC measures to patenting.[24]

The results show that an increase in GVC participation leads to a reallocation of innovation activity but, overall, has a positive effect on firm patenting. The effect of a change in GVC participation on firm patenting flows is significantly positive (a "within effect"), but declines with the initial level of patenting activity of the firms ("between effect") (Table 4.2, column [1]).

Once the potential endogeneity between GVC participation and patenting is controlled for, the impact of GVC participation on patenting is even stronger (Table 4.2, column [2]). This happens both within and between firms. The estimated effects imply that firms that were already patenting before the increase in GVC participation tend to see some reduction in

an indirect approach correlating the country-time fixed effects of the main regression with country-level measures of absorption capacity, such as education, quality of infrastructure, and the rule of law.

[23]The primary patent data are drawn from PATSTAT, and global input-output tables are used to construct industry-level GVC participation measures (see Annex 4.5). GVC participation is measured by the sum of (1) the domestic content in exports reused in trading partners' exports (forward linkages), and (2) the foreign value added embedded in exports (backward linkages) expressed as a share of gross exports.

[24]Standard tests confirm that the instruments satisfy the exclusion restriction.

Table 4.2. Impact of Global Value Chain Participation on Average Firm Patenting and Employment

Dependent Variable	Patent Flow (Log, five-year difference)		Employment (Log, five-year difference)
	(1)	(2)	(3)
Sample Period (2002–12)	OLS (PATSTAT Firms)	IV (PATSTAT Firms)[1]	OLS (Matched ORBIS - PATSTAT Firms)
Initial Patent Stock (2000)	–0.07***	–0.09***	–0.02*
	[–5.703]	[–30.002]	[–1.873]
Within-Firm Effects			
GVC Participation (Five-year change)	0.28***	0.98***	1.82***
	[3.133]	[7.420]	[8.002]
Between-Firm Effects			
Initial Patent Stock (2000) × GVC Participation (Five-year change)	–1.31***	–1.67***	0.91*
	[–4.160]	[–4.963]	[1.943]
Observations	4,044,066	2,928,882	87,929
R^2	0.026	0.030	0.182
Country × Year Fixed Effects	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes

Source: IMF staff estimates.
Note: IV = instrumental variable estimation; GVC = global value chain; OLS = ordinary least squares. Robust *t*-statistics in brackets.
***p < 0.01, **p < 0.05, *p < 0.1.
[1] Instruments include foreign personnel restrictions (percent-year difference and level), screening and approval procedures (level), and tariffs (five-year difference). (See Annex 4.5 for details.)

their patenting flow, possibly reflecting reallocation of some innovation activity to other parts of the GVC.[25] But more extensive GVC participation significantly increases the average patenting of firms that did not previously patent. These firms represent 75 percent of the sample—90 percent excluding China. The overall effect on patenting of the average firm is positive, with the observed 1 percent increase in GVC participation every five years explaining one-tenth of the increase in patenting in the average firm over the same period (Figure 4.11, top panel).

Turning to the broader impact on the economy, increased GVC participation leads to higher employment growth for the average firm and faster employment growth for patenting firms than experienced by nonpatenting firms (Table 4.2, column [3]).[26,27] The larger share of workers flowing from firms that do not innovate to high-tech firms is another way GVC participation boosts economies' technological intensity.

To gauge the role of policies in building innovation capacity in emerging market firms, Figure 4.11 (bottom panel) shows the correlation between the country-year fixed effects from the estimated patenting relationships and a number of policy factors. Policies aimed at improving the quality of education and connectivity to the world through better infrastructure are key, contributing jointly to increase growth in patenting by 2 percent over five years. Box 4.3 discusses how foreign aid can play a role in technology diffusion to low-income countries by helping build key infrastructure technologies and investing in education. Finally, the evidence presented in Figure 4.11 (panel 2) also suggests that greater adherence to the rule of law boosts firm patenting, possibly mitigating the need for multinational companies to rely on internal mechanisms, such as relocation of innovation activities from affiliates to the parent, to overcome market failures caused by poor institutions.

The Role of Greater International Competition

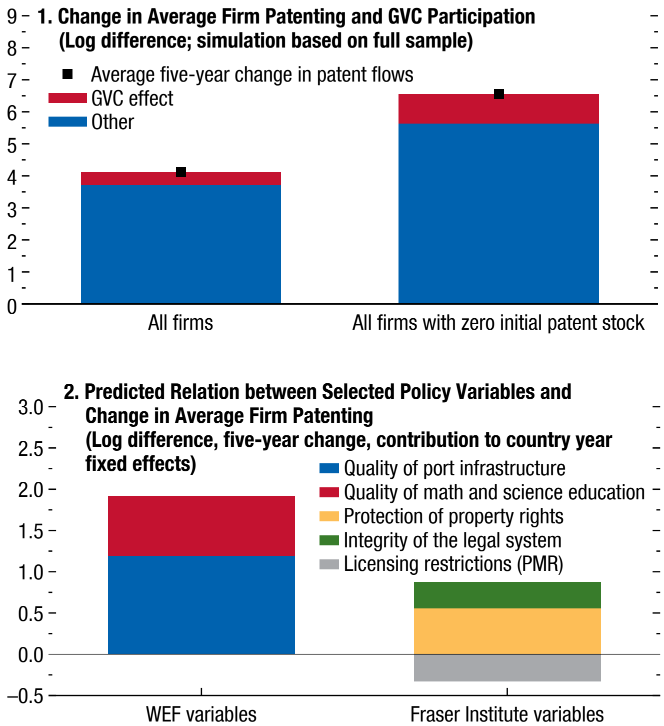
International technology diffusion is a key channel through which globalization impacts innovation, but it may not be the only one. For example, globalization could also make a difference by affecting global competition. Indeed, the evolution of global competition and global market concentration, and their impact on innovation is a much-debated issue (see Box 4.4).

[25] The latter effect is substantially weaker once patenting activity in China is excluded (see Annex 4.5). An alternative explanation could be the relocation of some innovation activity by an emerging market firm to source technology from an advanced economy (see Box 4.2).

[26] Orbis and PATSTAT data are matched to produce a data set of both patenting and nonpatenting firms.

[27] Data limitations prevent testing the effects on firm-level productivity. Performance measures, such as return on assets and return on equity, also have limitations, given that they are affected by the division of value added between labor and capital.

Figure 4.11. The Effects of Global Value Chain Participation and Policy Variables



Sources: EORA Multi-Region Input-Output database; European Patent Office, PATSTAT database; Fraser Institute, Economic Freedom of the World; World Economic Forum Global Competitiveness Report; and IMF staff calculations.
Note: Panel 1 shows result of a simulation based on the full sample. Panel 2 shows the five-year change of contribution to country year fixed effects. GVC = global value chain; PMR = product market regulation; WEF = World Economic Forum Global Competitiveness Report.

While this section does not claim to provide definitive answers, the framework used in the chapter does lend itself to exploring this issue and provides some tentative evidence of the effect of competition on innovation and the diffusion of technology.

At least two opposing forces are at work in the relationship between competition and innovation (Box 4.4). More competition and lower market concentration can depress incentives for firms to innovate because reduced market power means fewer rents from any innovation. However, at the same time, more competition and lower concentration can enhance incentives to innovate to escape competition and secure rents in the first place. And while international trade increases the size of the market over which rents can be captured by winners, it also enhances the "escape competition" effect (Akcigit and others 2017).

By some measures, the evidence suggests that international competition has increased and global concentration has declined—notwithstanding increases in domestic concentration reported in some countries (Gutierrez and Philippon 2017; Grullon, Larkin, and Michaely 2017). Trade with China has risen over the past two decades, not only in the textile industry, but also in innovation-intensive industries such as electrical and optical equipment and transport equipment (Figure 4.12). And the rise of firms from emerging market economies has transformed the international competition landscape more generally (Freund and Sidhu 2017), contributing to a reduction in global market concentration in most industries. Market concentration is usually defined at the industry level and proxied by either a concentration ratio (for example, the share of total industry sales that go to the industry's top four firms) or the Herfindahl-Hirschman Index. Data on the global concentration of patenting show a more mixed picture, though they may underestimate the extent or rise of concentration because the PATSTAT database does not include information on firms' ownership structure.

If global competition indeed has increased, has it led to more or less innovation? An extension of the sectoral framework of analysis (see equation 4.1) can be used to investigate this question (see also Coe, Helpman, and Hoffmaister 2009). In this extension, the knowledge-weighted foreign R&D stock is interacted with relevant structural factors (S), including increased trade with China and measures of global market concentration:

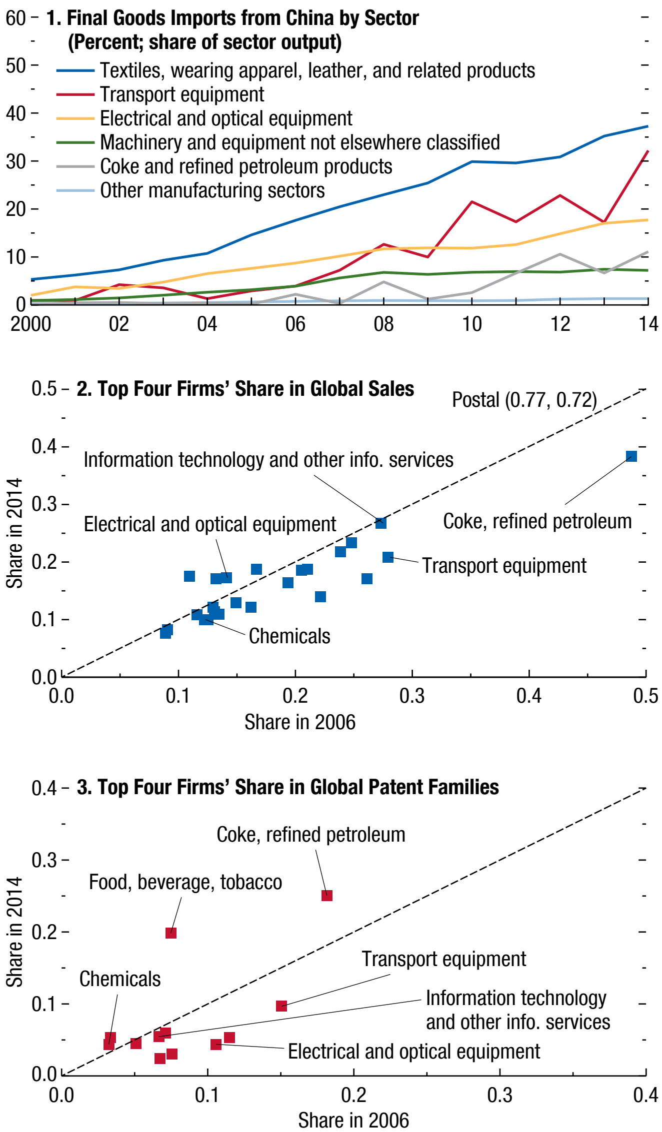
$$\begin{aligned} lnP_{i,c,t} = \; & D_{c,t} + \gamma lnR_{i,c,t} + \mu \ln \textstyle\sum_{l \neq c} \phi_{i,c,l,t} R_{i,l,t} \\ & + \delta \ln \textstyle\sum_{l \neq c} \phi_{i,c,l,t} R_{i,l,t} * S_{i,c,t} \\ & + \theta S_{i,c,t} + \varepsilon_{i,c,t}. \end{aligned} \quad (4.2)$$

In this specification, the coefficient on the "main effect" (θ) captures the direct impact of the structural factor on innovation. The total impact of the weighted foreign knowledge stock on innovation is now given by $\mu + \delta S$, and thus the coefficient on the interaction term (δ) reflects the marginal boost to knowledge diffusion coming from the structural factor (see Annex 4.3 for details).

The results suggest that the observed increase in trade competition and decline in global market concentration may have helped strengthen technology diffusion across countries (Figure 4.13).[28]

[28]While innovation and technology diffusion could affect competition and concentration, raising a risk of reverse causality, it is unlikely for measures of competition used in the present analysis. The China trade shock largely reflected exogenous policy changes, including China's entry into the World Trade Organization. If

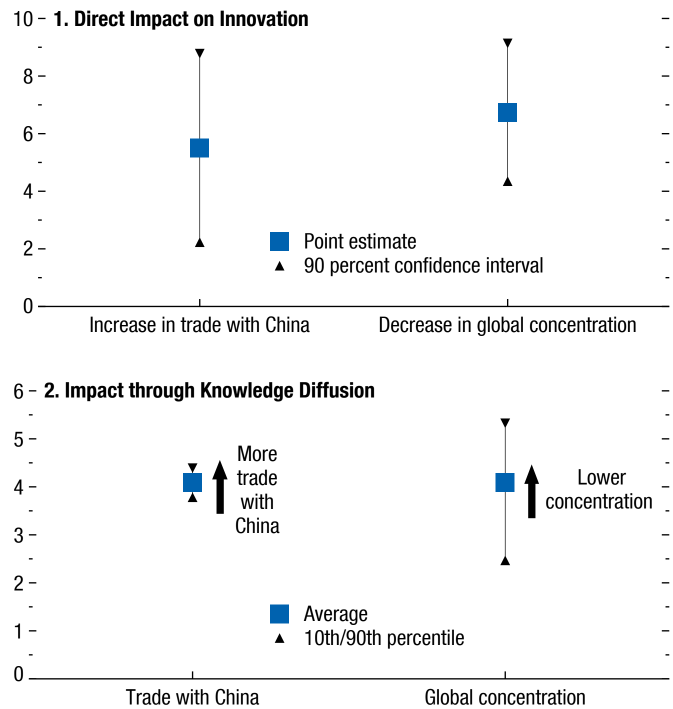
Figure 4.12. International Competition and Global Concentration



Sources: European Patent Office, PATSTAT database; Freund and Sidhu (2017); World Input-Output Database; and IMF staff calculations.

- Increased trade with China boosts domestic innovation and technology diffusion, the latter by increasing the efficiency with which foreign knowledge is used (both the main effect and the interaction effects are positive).

Figure 4.13. The Effect of Competition on Innovation and Technology Diffusion
(Percent)



Source: IMF staff calculations.
Note: Panel 1 shows the estimated change in the recipient's patenting activity in response to the average change in the structural factors over the sample period. Lower and upper bounds denote the 90 percent confidence interval. Panel 2 shows the estimated response of patenting activity in the recipient to a 10 percent increase in the weighted foreign research and development stock, for a range of values of structural factors.

- Similarly, lower global concentration—as measured by the sales share of the top four firms—stimulates both innovation and diffusion. Its impact on diffusion is nontrivial: for example, using the estimates, a 10 percent increase in the foreign R&D stock would boost domestic patenting by about 5.6 percent in a low-concentration sector, whereas the boost to innovation would be less than half of that (2.7 percent) in a high-concentration sector.

The evidence presented within the framework of analysis of this chapter, however tentative, points to a positive relationship between international competition and innovation and technology diffusion. This is broadly in line with findings reported by Bloom, Draca, and Van Reenen (2016) and Coelli, Moxnes, and Ulltveit-Moe (2016), who estimate that increased trade has a positive effect on innovation. However, the results

anything, more innovation in a country sector would reduce import penetration from China in that sector, leading to a downward bias in the coefficient estimate. As for the measure of global market concentration, it is not likely to be influenced by individual countries' innovation, given that the G5 countries (which are treated as the technology frontier) are excluded from the sample.

seem to differ from those presented by Autor and others (2016), who estimate that trade with China had a negative impact on innovation among US firms. Clearly, the discussion is ongoing, and further analysis is needed to achieve a deeper understanding of the opposing forces at work. For example, the relationship among competition, concentration, and innovation or technology diffusion could differ over time, countries, and industries.

Conclusions and Policy Implications

Globalization has a positive impact on the international diffusion of knowledge and technology. While the negative side effects of globalization have been much discussed in public debates, the chapter highlights a key benefit—the contribution of globalization to the sharing of growth potential across countries. Globalization facilitates the diffusion of knowledge and technology through the international use of patents and trade. In addition—while the impact of competition on innovation is a complex issue that necessitates further investigation—there is evidence suggesting that, by enhancing international competition, globalization has increased incentives to innovate and adopt foreign technologies.

The chapter has also found that emerging market economies have made increasing use of existing foreign knowledge and technology over time. This has helped soften the impact of the slowdown in innovation at the frontier on emerging market economies and contributed to cross-country income convergence. Participation in GVCs has been one important factor behind this development, although not all firms have benefited, as multinational companies sometimes relocate innovation activities to the parent company.

Finally, the evidence suggests that knowledge does not flow only in one direction. Technology leaders have benefited from each other's research efforts and knowledge. With the growing contribution of China and Korea to the expansion of the technology frontier, one can expect positive spillovers from these countries to the traditional technology leaders. Alongside more traditional channels of gains from trade, the diffusion of knowledge and technology provides a powerful source of mutual benefits from globalization.

From a policy angle, a main conclusion of the chapter is that global interconnectedness fosters foreign knowledge flows. Policies to enhance these connections—whether through GVCs, FDI, or trade—are well known. They include relaxing excessively stringent regulations on FDI, lowering trade barriers, and building necessary infrastructure. Interconnectedness per se is not enough, though. Economists have long argued that assimilating knowledge requires absorptive capacity (for example, Cohen and Levinthal 1989). Knowledge has an important tacit component, which can be comprehended only through the acquisition of scientific and engineering know-how. Investments in R&D and human capital are essential not only to build innovation capacity but also to maximize the absorption of existing innovations (Griffith and others 2004; Coe and others 2009).

Last but not least, while the chapter has highlighted the positive growth effects from globalization, policymakers must make certain that these benefits are shared broadly across the population. This includes ensuring that innovating firms do not exploit the newly acquired technology to gain excessive control of a market to the detriment of consumers, supporting policies to facilitate adjustment (for example, by investment in education and reskilling), and adjusting the tax-benefit system to reallocate income gains in line with countries' social preferences.

Box 4.1. Patent Data and Concepts

This chapter largely relies on patent data to capture innovation and information flows; this box explains key concepts of the data and offers a quick glance at how the data are aggregated.

The database used is the Worldwide Patent Statistical Database (PATSTAT), which includes information on about 70 million patent applications from 80 countries and the relations between them.

- A patent *application* is the filing to a specific patent office that seeks intellectual property protection in the given jurisdiction. Patent applications are territorial, which implies that a separate patent needs to be filed for each country where protection is desired.
- A patent *family* groups applications that relate to the same technology. Each patent application belongs to one family, but an individual application can be a family by itself.[1]
- Patent *citations* relate patents that build upon each other. Applicants must cite prior knowledge to delimit the novelty and legal boundary of the application. Citations can themselves be an indicator of information flow.

While some parts of the chapter rely on patents at the micro level, for others, the data are aggregated to country and industry level so they can be matched with other variables. For this aggregation, patents are attributed to:

- The country of residence of the *first inventor*: The inventor may be different from the applicant, who owns the patent. Because the former is the creator of the new knowledge, the residence of the inventor seems more important to identify the location of innovation. The ordering of inventors in a patent application generally reflects their degree of importance. Focusing only on the first one (instead of a fractional attribution to all) simplifies the process without significantly altering the picture.
- One of 13 *industrial sectors of applicability*: The technical applicability of a patent is defined by the patent office, which maps the patent into sectors of applicability with respective weights (PATSTAT; Van Looy and Vereyen 2015). The patent is attributed to the aggregate sector with the largest weight.

Coordination on patent procedures is an early example of international collaboration. Progress in harmonizing procedures has continued since the late 19th century. Nevertheless, international comparability remains impaired by cultural and legal differences. Two examples serve as illustration:

- *Japan and the number of claims*: Until 1988, each claim (or idea) needed its own patent (Dernis and Khan 2004), a rule that inflated the number of patent applications at the Japan Patent Office. Although the number of claims per patent has increased significantly since the 1990s, the culture and fee structure have left it significantly below United States Patent and Trademark Office or European Patent Office numbers for most of the sample period (Katznelson 2008).
- *China and the incentives to patent*: Part of the reason for the recent explosion in patenting in China is a set of *Patent Promotion Policies*. Fiscal and other incentives reduce the cost of patenting or increase the payoffs not directly related to the protection of the intellectual property. Some ideas are thus patented that in other countries would not be.

The impact of such cultural and legal differences can be very significant. By the simple application count, China now patents about as much as the rest of the world combined. Using quality-adjusted measures, which weigh the patent count by proxies for their technical or economic value, often dramatically reduces this share.

Various options for quality adjustment exist.[2] As preferred measures, the chapter uses the patent family count and focuses only on international or top three families:

- An *international patent family* needs to have one application in at least two distinct patent offices. The idea is that this filter will capture many of the lower-value patents, as the reduced expected payoff would not warrant the extra cost of application, examination, and maintenance in a foreign country. In addition, the cultural influence of certain patent offices would be reduced.

The author of this box is Johannes Eugster.

[1]Different applications are connected to a "priority filing," which is the first patent filing for a technology. Under the Paris Convention of 1883, applicants have 12 months to file patents in other member countries and claim retroactive protection starting on the priority date (date of initial filing). The family definition used in this chapter (the DOCDB family) generally groups patents with the exact same priorities.

[2]See Squicciarini, Dernis, and Criscuolo (2013) for discussion of the various measures to capture the economic and technological values of patented inventions.

Box 4.1 *(continued)*

- The *top three patent families* would require an application to at least one of the top three patent offices (European Patent Office, Japan Patent Office, United States Patent and Trademark Office). Relative to the previous measure, this implies more consistency, as a very limited number of patent offices are involved. The drawback is that count measures would tend to favor inventors and applicants from Europe, Japan, and the United States.

Different measures have different strengths and weaknesses; none is fully satisfactory. It is therefore crucial to include appropriate fixed effects in the empirical analysis to capture the time-varying differences in patenting and citation culture. This chapter does that wherever possible by including country-time fixed effects.

Box 4.2. International Technology Sourcing and Knowledge Spillovers

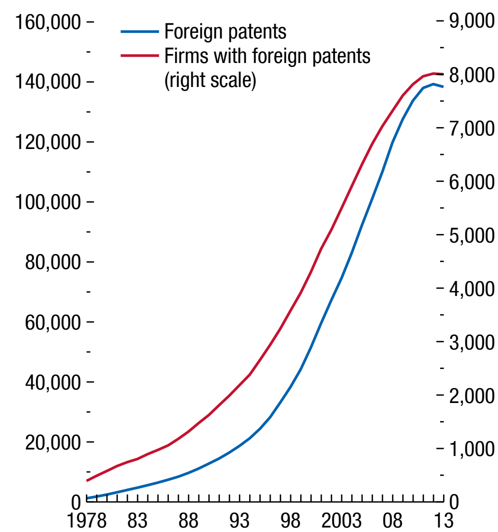
Despite the global reach of information technology, many economists believe that knowledge diffusion is largely localized (Audretsch and Feldman 1996; Jaffe, Trajtenberg, and Henderson 1993; Keller 2002). In their view, being geographically close to other inventors is important to learn from their knowledge. By performing innovation activities abroad—especially in technologically advanced economies—firms can tap into foreign knowledge more effectively and improve productivity. Data on publicly listed firms in Organisation for Economic Co-operation and Development (OECD) countries is used in this box to provide evidence on the evolution of international technology sourcing and test its role as a channel for knowledge spillovers. Data used in the analysis are from the Worldwide Patent Statistical Database (PATSTAT) maintained by the European Patent Office and the Orbis database by Bureau van Dijk.

Evolution of Global Innovation Networks

The innovation linkages are constructed using information on the source and destination countries of patents granted to publicly listed firms in OECD countries. The source is the country of residence of patent inventors, and the destination is the headquarter country of the firm that owns the patent. Three important patterns have emerged as international innovation linkages have steadily strengthened over the past four decades. First, an increasing number of firms' innovations are carried out abroad (Figure 4.2.1). Second, the network has become increasingly multilateral: on average, the number of countries in which firms have an innovation presence has increased. Third, dominant hubs—countries where a dominant share of patents are invented—are apparent in the network. In the sample, 28 percent of all patents invented in 2013 are sourced from the United States, followed by Germany (14 percent), the United Kingdom (13 percent), and Japan (7 percent), as shown in Figure 4.2.2. Perhaps not coincidentally, these countries also have the largest aggregate knowledge among OECD countries measured by research and development (R&D) stock. The United States, Japan, and Germany are the top three, and the United Kingdom ranks sixth. The observation that the majority of foreign patents are invented in knowledge hubs is consistent with technology sourcing as a means of gaining access to foreign knowledge.

The author of this box is Sophia Chen, with support from Hala Moussawi. See Chen and Dauchy (2018) for more details.

Figure 4.2.1. Innovation Intensity
(Number of firms or patents)



Sources: Chen and Dauchy 2018; and European Patent Office, PATSTAT database.

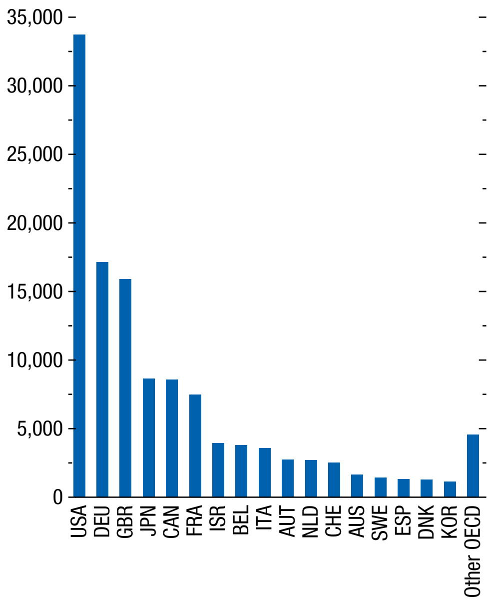
Testing for the Role of Technology Sourcing as a Channel of Knowledge Spillover

Relative to a more aggregate approach, the firm-level approach presents a number of advantages. First, it can control for home country and industry trends in innovation using fixed effects. Second, it can flexibly control for other factors that affect productivity and are correlated with the foreign innovations of firms. For example, firms with more foreign innovations may have higher productivity simply because they also have more knowledge. These firms may also be better at using foreign knowledge in general, because they have a higher "absorptive capacity."

The empirical model uses a firm-level production function augmented with firm-specific knowledge, and industry-specific domestic and foreign knowledge as well as a number of control variables (Griffith, Harrison, and Van Reenen 2006; Chen and Dauchy 2018). Knowledge is measured by R&D stocks. Technology sourcing is measured by the share of a firm's total worldwide patents whose inventor was residing in a foreign country in the pre-sample period between

Box 4.2 *(continued)*

Figure 4.2.2. Foreign Patents by Source Country, 2013
(Number of patents)



Sources: Chen and Dauchy 2018; and European Patent Office, PATSTAT database.
Note: OECD = Organisation for Economic Co-operation and Development. Data labels use International Organization for Standardization (ISO) country codes.

1997 and 2006. It is interacted with the foreign R&D stock to test for its role as a channel of knowledge spillovers. The regression is estimated over a panel of about 12,000 publicly listed firms in OECD countries in 20 manufacturing and services industries between 2009 and 2012.

The approach distinguishes between two groups of OECD countries, based on their aggregate knowledge. This allows for details to be gathered about the overall direction and effect of international technology sourcing from more advanced and less advanced economies. The underlying assumption is that countries with more aggregate knowledge are closer to the technological frontier. The group of technology frontier countries comprises Japan, Germany, and the United States; the other group includes all other OECD countries. The results are consistent with the technology sourcing hypothesis: firms with a stronger innovation presence in technology frontier countries benefit disproportionately more from their aggregate R&D than firms that lack such presence. Besides the overall positive effect, the results show some interesting patterns in direction and size. The interaction terms between technology sourcing and aggregate R&D stocks in less advanced economies are not significant, suggesting that the spillovers from less advanced economies are weak. Moreover, spillovers from technology leader countries' aggregate R&D is strongest when the recipient countries are also technology leaders. These results are robust to alternative explanations for foreign innovation—such as profit shifting—and alternative models controlling for the absorptive capacity of firms.

The results support the idea that technology sourcing can be an effective channel of international knowledge spillovers. Optimal policy design to stimulate innovation should take into account the internationalization of innovations. For example, policies to incentivize the repatriation of foreign-based innovations may end up compromising domestic productivity growth by stifling domestic innovation. Furthermore, when evaluating the effectiveness of R&D tax policy, one should take into account the social returns from global knowledge spillovers.

Box 4.3. The Role of Foreign Aid in Improving Productivity in Low-Income Developing Countries

International technology transfers through such channels as trade, foreign direct investment (FDI), and technology licensing are an effective way to acquire technology and improve productivity (Hoekman, Maskus, and Saggi 2005). But low-income countries are less likely to be recipients of international technology transfers through these channels. This is because they tend to be less integrated into the world economy, they have weaker absorptive capacities, and their technology needs may differ from the technologies used in advanced economies (World Bank 2008). While there is a lot of heterogeneity across low-income countries, with countries in east and south Asia benefiting from their integration into global value chains around China, other regions still lack integration into world trade (Allard and others 2016). The evidence discussed in this box suggests that, where traditional channels of technology transfer—such as FDI and integration into world trade—are weak, foreign aid can play an important and complementary role in bridging the gap (Figure 4.3.1).

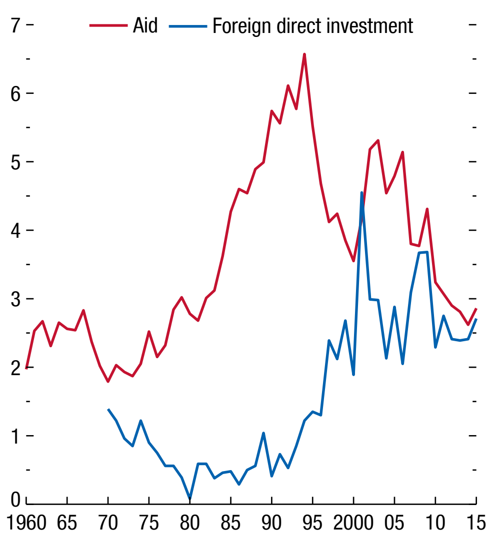
The author of this box is Pankhuri Dutt.

Research has shown that, at the macro level, foreign aid can help technology transfers and boost productivity in low-income countries. For instance, Walley and Cushing (2013) find that as well as trade, foreign aid in the form of technical cooperation and overseas development assistance grants are important channels through which research and development investment in G7 countries had a spillover effect on 11 sub-Saharan African countries from 1980 to 2004. Using a similar approach, Tiruneh, Wamboye, and Sergi (2017) find evidence that foreign aid is a conduit for R&D spillover effects from nine OECD member countries on labor productivity in 28 sub-Saharan African countries from 1992 to 2011.

While broad growth regression-based studies have questioned the effectiveness of aid to emerging market economies (for example, Rajan and Subramanian 2008), the new aid allocation strategies of donors are showing positive results in some cases. Foreign aid can boost technology transfers and productivity in low-income countries through various channels:

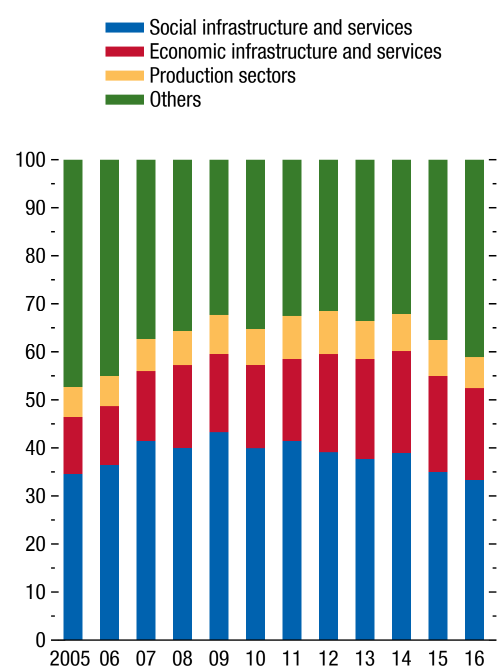
- *Aid for basic infrastructure technologies:* Over the years, official development assistance flows to

Figure 4.3.1. Sub-Saharan Africa: Net Foreign Direct Investment and Aid Inflows[1]
(Percent of GDP)



Sources: World Bank, World Development Indicators; and IMF staff calculations.
[1]Foreign direct investment refers to net inflows; aid refers to net official development assistance and official aid received.

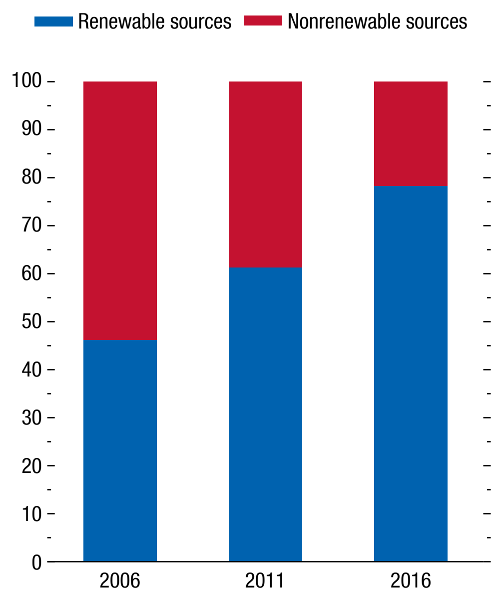
Figure 4.3.2. Official Development Assistance Commitment by Sector
(Percent)



Sources: Organisation for Economic Co-operation and Development, International Development Statistics; and IMF staff calculations.

Box 4.3 *(continued)*

Figure 4.3.3. Aid Commitment to Energy Generation
(Percent)



Sources: Organisation for Economic Co-operation and Development, Creditor Reporting System; and IMF staff calculations.

economic infrastructure sectors have increased as donors recognized the importance of improving trade-related infrastructure and productive capacities of recipients, including as part of the World Trade Organization's Aid for Trade initiative beginning in 2005 (Figure 4.3.2). Many low-income countries need significant investments in basic infrastructure such as roads and electricity. Aid, along with domestic and foreign private investment, is an important source of financing for the development of this sector in these countries. Within the economic infrastructure sector, the transport and communication, energy, and banking sectors cover almost 94 percent of aid. Aid targeted at infrastructure improvements also makes the recipient country more attractive for foreign investment by reducing the cost of selling to recipient-country consumers and improving their participation in global production links. Recent empirical evidence suggests that aid in the infrastructure sector is effective in improving recipient countries' economic infrastructure endowments (see, for example, Vigil and Wagner 2012; and Donabauer, Meyer, and Nunnenkamp 2016).

- *Targeted aid for sustainable development:* Low-income countries can benefit from technological advancements that reduce the cost of technology in advanced economies. For instance, the climate change initiatives and commitments to the United Nations Sustainable Development Goals (SDGs) raised the share of aid to renewable energy projects (Figure 4.3.3), introducing new and more efficient technologies that helped reduce the energy intensity (energy use per GDP) in recipient countries (Kretschmer, Hübler, and Nunnenkamp 2013). Moreover, the evidence suggests that foreign aid combined with technical cooperation has had a substantial and significant long-term effect on the renewable energy capacity of recipients, whereas foreign aid without technical cooperation brought immediate but short-term effects (Kim 2014).
- *Building absorptive capacity:* Aid can also have a positive impact on the absorptive capacity of the recipient country when it is channeled to the health and education sectors. Donabauer, Herzer, and Nunnenkamp (2014) find that aid for education has a statistically significant and a positive effect on FDI flows in Latin American countries with lower education outcomes and labor force skills. Similarly, Selaya and Sunesen (2012) find that aid raises the marginal productivity of private capital when it is allocated to improving the supply of complementary inputs, such as education, health, energy, and transport and communication.
- *Aid as a complement to FDI:* Foreign aid can be a complementary tool to attracting FDI, both by improving conditions for investment, but also as a signaling device. For instance, Garriga and Phillips (2014) find that foreign aid that is not geo-strategically motivated has a statistically significant and positive association with FDI inflows in postconflict recipient developing economies. They suggest that aid allocation in a postconflict country acts as a reliable and public information source that improves the credibility of the recipient government, as aid comes with a set of financial and structural covenants. Empirical evidence suggests that aid is most effective in recipients with stable governments and good institutions (Burnside and

Box 4.3 *(continued)*

Dollar 2000; Collier and Dollar 2002; Dutta, Mukherjee, and Roy 2015).

Foreign aid is not a substitute for other channels of technology transfer, rather—when used effectively—it can help lay conditions that attract foreign direct investment and foster integration into global trade and value chains. The new trend in aid allocation and utilization is blended finance. This is where development finance is used to attract private investments to fund the SDGs as a part of the "Billions to Trillions" agenda, which refers to the large gap in funding for the SDGs. China is already using all three channels of aid, trade, and FDI to invest in Africa and has become the continent's largest trading partner over the past 15 years (Busse, Erdogan, and Mühlen 2016). Africa's demographic potential makes it key to invest in the region and deepen its integration in the global production networks, both for the development of the region and for the world economy more broadly.

Box 4.4. Relationship between Competition, Concentration, and Innovation

The theoretical link between competition and innovation is complex. The early literature on endogenous growth emphasized a *Schumpeterian "rent effect,"* according to which less product market competition increases post-innovation rents for the new incumbent, thus increasing the incentives to innovate. Subsequent literature has highlighted the importance of an additional force, the *"escape competition" effect*: if competitive pressure is too low and profits are already large, a firm's incentive to exert effort on innovation to get ahead of competitors will be low. In the international context, the rent and escape competition effects have a wider interpretation. For instance, lower international barriers to trade allow innovators to extract larger rents, as the market size over which they operate is bigger. At the same time, pressure from the pool of potential competitors increases, as it is also exerted by foreign firms (Akcigit and others 2017).

The empirical literature reflects some of these conflicting forces. For instance, policies that increase product market competition have been found to spur innovation, but only up to a certain point, after which innovation decreases (Aghion and others 2005). Several recent papers have examined how innovation rates in advanced economies have been affected by the increased competitive pressure stemming from globalization and the entry of China into world trade. The effect on innovation is found to be positive in Europe and negative in the United States (Autor and others 2016; Bloom, Draca, and Van Reenen 2016). Product market competition appears to interact in important ways with the degree of intellectual property rights protection—another determinant of innovators' rents. For instance, some evidence suggests that stronger product market competition is associated with more innovation only when intellectual property rights protection is strong (Aghion, Howitt, and Prantl 2015). However, while strong protection motivates multinational companies to transfer technology across countries, it reduces innovation in other contexts (Williams 2013; Bilir 2014).

A related discussion investigates the relationship between market competition and concentration. Most of the literature focuses on product market concentration at the industry level, usually proxied by either the Herfindahl-Hirschman Index or the concentration ratio (the share of an industry's sales that goes to the top four firms in the industry). Theoretically, higher concentration could be consistent with higher competitive pressure—and possibly also greater innovation—for example, if innovative "superstar" firms were more likely to appear in more competitive markets (Autor and others 2017). However, there is empirical evidence that suggests that increased concentration in the United States is at least in part linked to reduced competition (Grullon, Larkin, and Michaely 2017; Gutierrez and Philippon 2017). A final crucial observation is that trends in concentration are sensitive to the definition of the relevant market. For instance, while concentration within some large countries is rising, global concentration appears to be falling, thanks to the increased role in international markets of firms from emerging market economies (Freund and Sidhu 2017).

The author of this box is Roberto Piazza.

Annex 4.1: Data, Sample, and Variable Definition

Annex Table 4.1.1. List of Variables, Variable Definitions, and Sources[1]

Variable	Definition	Source
Patent Flows (international)	Patent families with an application in at least two distinct patent offices	Constructed from PATSTAT
Patent Flows (top three)	Patent families with an application in at least one of top three patent offices (EPO, JPO, USPTO)	Constructed from PATSTAT
Patent Stock	Cumulated patent flows constructed using perpetual inventory method (with discount rate = 10 percent)	Constructed from PATSTAT
R&D Expenditure	Spending on research and development, in constant price PPP US dollar	OECD ANBERD database
R&D Stock	Cumulated R&D expenditure constructed using perpetual inventory method (with discount rate = 10 percent)	Constructed from OECD ANBERD data
Labor Productivity	Real value added per worker, in US dollars	Constructed from KLEMS and UNIDO data
Total Factor Productivity (TFP)	TFP adjusted for varying input utilization (see Annex 2 for details)	Constructed from KLEMS data
Trade with China	Imports of final goods from China as a share of sector gross output	WIOT
Global Concentration	Revenue share of top four firms globally	Freund and Sidhu (2017)
Aggregate R&D Stock	Cumulated gross domestic expenditure on R&D (in constant price PPP US dollar), constructed using perpetual inventory method (with discount rate = 10 percent)	Constructed from OECD data
Aggregate Human Capital	Average years of schooling	Barro-Lee dataset
Product Market Regulation	Indicator of regulation in product markets	OECD
Sector R&D Intensity	R&D spending per worker	Constructed from OECD and KLEMS data
Sector Skill Intensity	Computed as 1–share of production worker	Bureau of Labor Statistics, Occupational Employment Statistics
Sector Turnover	Business churn rate	OECD
Technological Specialization	Uncentered bilateral correlation between two country-sectors' vectors of patent applications in the 23 IPC subsection	Constructed based on PATSTAT
Technological Distance	Absolute ln-difference between two country-sectors in the ratio of R&D (in constant PPP terms) per number of person engaged	Constructed from OECD and KLEMS data
Different Country	Dummy for an international country pair	Mayer and Zignago (2011)
Different Border	Dummy for a country pair sharing no common border	Mayer and Zignago (2011)
Different Language	Dummy for a country pair sharing no common official language	Mayer and Zignago (2011)
International Distance	Distance between the capital cities of two countries, zero for the same country pair	Mayer and Zignago (2011)
Bilateral Citations	Sum of citations between two country-industry pairs	Constructed based on PATSTAT
Global Value Chain (GVC)		Eora multi-region input-output database and World input-output database (2000–12)
Firm Employment Growth	Five-year difference of the logarithm of employee count per firm	Bureau van Dijk Orbis (2000–12)
FDI Regulatory Restrictiveness Index	Index summarizing regulation restrictions on FDI; range from 0 (open) to 1 (closed).	OECD FDI database (2000–12)
Tariffs		UNCTAD TRAINS (2000–12)
IPR, Education, Infrastructure Quality	Index, ranging from 1 (lowest) to 7 (best)	World Economic Forum (2000–12)
PMR, Institutions	Index, ranging from 1 (lowest) to 10 (best)	Fraser (2000–12)

[1]"Notes on CEPII's distances measures: The GeoDist Database," CEPII Working Paper 2011–25.
Note: EPO = European Patent Office; IPC = International Patent Classification; JPO = Japan Patent Office; OECD = Organisation for Economic Co-operation and Development; PMR = product market regulation; PPP = purchasing power parity; R&D = research and development; UNIDO = United Nations Industrial Development Organisation; USPTO = United States Patent and Trademark Office; WIOT = World Input-Output Tables.

Annex Table 4.1.2. List of Sectors in Estimation Samples[1]

ISIC4 Code	Sector Description
10–12	Food products, beverages, and tobacco
13–15	Textiles, wearing apparel, leather, and related products
16–18	Wood and paper products, printing, and reproduction of recorded media
19	Coke and refined petroleum products
20–21	Chemicals and chemical products
22–23	Rubber and plastics products, and other non-metallic mineral products
24–25	Basic metals and fabricated metal products, except machinery and equipment
26–27	Electrical and optical equipment
28	Machinery and equipment, not elsewhere classified
29–30	Transport equipment
31–33	Other manufacturing, repair and installation of machinery and equipment
F	Construction
62–63	Information technology and other information services

[1]The construction and information technology services sectors are only included in the first-stage sample.

Annex Table 4.1.3. List of Countries in Estimation Samples[1]

Regression	Advanced Economies	Emerging Market Economies
Gravity model of knowledge diffusion sample (with technological distance based on research and development)	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States	China, Czech Republic, Estonia, Hungary, Mexico, Poland, Slovenia, Slovakia, Turkey
Alternative gravity model of knowledge diffusion sample (with technological distance based on value added)	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States	Argentina Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, Estonia, Hungary, India, Indonesia, Malaysia, Mexico, Poland, Russia, Slovakia, Slovenia, South Africa, Thailand, Turkey, Uruguay, Vietnam
Patent and labor productivity sample	Australia, Austria, Belgium, Canada, Denmark, Finland, Ireland, Israel, Italy, Korea, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland	China, Czech Republic, Estonia, Hungary, Mexico, Poland, Slovakia, Slovenia, Turkey
Patent and labor productivity sample, expanded emerging market economy sample		Argentina, Bulgaria, Brazil, Chile, China, Colombia, Czech Republic, Estonia, Hungary, India, Malaysia, Mexico, Poland, Russia, Slovakia, Slovenia, South Africa, Turkey, Uruguay
Total factor productivity sample	Austria, Denmark, Finland, Italy, Netherlands, Spain, Sweden	Czech Republic, Slovakia
Patent and global value chain sample, emerging market firm level		Brazil, China, India, Indonesia, Mexico, Philippines, Poland, Russia, South Africa, Thailand, Turkey

[1]The classification of countries into advanced economies and emerging economies is as of the beginning of the sample period, that is, around 1995. Israel, Korea, and Singapore all became advanced economies around 1997 and thus are classified as advanced economies in the sample.

Annex 4.2. Determinants of Knowledge Flows: Additional Results

This annex provides details and robustness tests of the baseline results presented in the chapter's "Determinants of Knowledge Flows" section.

Baseline Results

As discussed in the chapter, a gravity model helps investigate the determinants of knowledge flows. It follows Peri (2005) and models the citations made in the patents of a given country sector to patents from the technology frontier as a function of a set of geographic, linguistic, and technological variables. Dummy variables indicate whether citations involve two distinct sectors (diff_sector) or countries (diff_country) and whether the countries share a common border (diff_border) or an official language (diff_lang). The regression also includes a measure of the distance between countries' capital cities (dist_int) and differences in technological specialization (tech_spec) and technological development (tech_dev). While technological development captures the difference in technological intensity (measured as the log difference either in research and development [R&D] or value added per worker), technological specialization captures compositional differences in the types of technology used.[29] Defining ϕ as the citations, the model can be written as follows:

$$\begin{aligned}\phi_{i,n;j,m} = \exp\Big[& a + \rho_{i,n} + \vartheta_{j,m} + b_1(\mathit{diff\_sector}) \\ & + b_2(\mathit{diff\_country}) + b_3(\mathit{diff\_border}) \\ & + b_4(\mathit{diff\_lang}) + b_5(\mathit{dist\_int}) + b_6(\mathit{tech\_spec}) \\ & + b_7(\mathit{tech\_dev}) + \varepsilon_{i,n;j,m}\Big], \end{aligned} \qquad (4.3)$$

in which *i* and *n* denote the citing country and sector, and *j* and *m* the cited country and sector. It includes country-sector fixed effects for both the citing and cited country sector to control for differences in the amount of innovation, and institutional or cultural factors that might influence the propensity to patent and cite other patents. The model is estimated using the Pseudo-Poisson-Maximum Likelihood estimator, a natural choice for a gravity-type model with significant data heteroscedasticity, many zero entries, and a large number of dummies (Santos Silva and Tenreyro 2006, 2011).

A key summary of the analysis is the predicted relative frequencies of citations for each country sector (denoted $\hat{\phi}$). The predicted values exclude the fixed effects. Given the exponential function and that all variables are zero for the same country sector, the predicted value will be equal to 1 within, and generally a fraction thereof across, different country sectors (see Peri 2005 for more details). These can be interpreted as the share of knowledge that diffuses from the cited to the citing relative to what diffuses within the cited country sector.

The baseline estimation focuses on same-sector pairs and restricts the cited countries to members of the G5 (France, Germany, Japan, United Kingdom, United States). The model is estimated for two samples (see Annex 4.1):

- The first sample uses the log difference of R&D per worker to measure the distance in technological development between citing and cited country sector. In this case, the sample of citing countries includes 23 advanced economies and 9 emerging market economies, reflecting in part the limited availability of sectoral R&D data for emerging market economies.
- To expand coverage of emerging market economies, the chapter follows Peri (2005) in considering an alternative measure of distance in technological development: the log difference of real value added per worker between citing and cited country sector. This expands the sample to 22 emerging market economies.

Annex Table 4.2.1 shows the baseline results presented in the chapter, based on the R&D measure of distance in technological development. Column (1) shows the results for the model estimated as a cross section during 1995–2014; columns (2) to (5) show the results for the model estimated over each five-year subperiod.

In an alternative specification, the difference in technological development is defined based on value added per worker instead of R&D spending. While the effects of geographic variables are generally comparable to those obtained using R&D spending, somewhat more positive (or at least less negative) effects of differences in technological specialization and develop-

[29]The difference in technological specialization is based on compositional differences in patent application. Similar to Peri (2005), for each country sector, a vector is produced for which the cells are the proportions of all patent applications that relate to each of the 23 International Patent Classification subsections. The variable is then defined as 1 minus the uncentered correlation between the two country industries' proportion vectors.

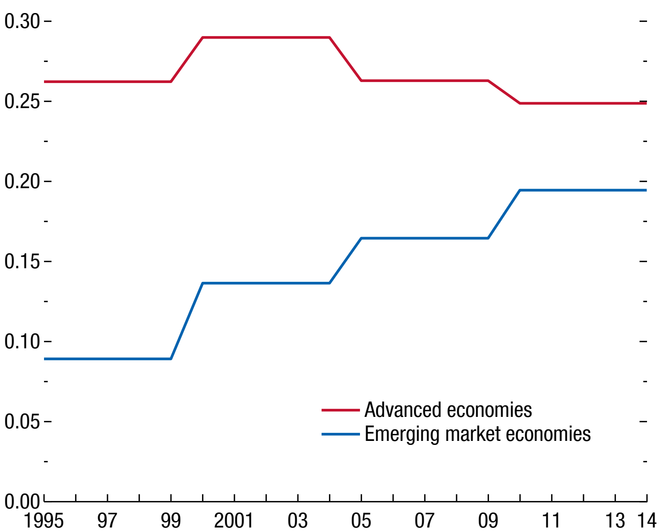
Annex Table 4.2.1. Gravity Model of Knowledge Diffusion: Baseline Results for Different Time Periods

	(1) 1995–2014	(2) 1995–99	(3) 2000–04	(4) 2005–09	(5) 2010–14
diff_country	−0.457***	−0.595***	−0.407***	−0.370***	−0.726***
	[−3.69]	[−7.45]	[−5.18]	[−3.78]	[−4.52]
diff_border	−0.124	−0.333***	0.0117	0.117	−0.435*
	[−0.93]	[−4.89]	[0.12]	[1.09]	[−2.53]
diff_lang	−0.810***	−0.539***	−0.708***	−0.940***	−0.815***
	[−11.96]	[−10.42]	[−11.70]	[−12.61]	[−7.66]
dist_int	−0.02493	0.017*	−0.036**	−0.050***	0.004
	[−1.51]	[1.96]	[−3.02]	[−4.51]	[0.20]
tech_spec	−2.214***	−3.779***	−2.971***	−2.411***	−2.786***
	[−3.30]	[−8.32]	[−5.96]	[−4.52]	[−4.03]
tech_dev_R&D	−0.0655	−0.143***	−0.169***	−0.169***	0.185
	[−0.68]	[−3.89]	[−3.63]	[−3.32]	[1.48]
Citing-Country-Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes
Cited-Country-Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	1,759	1,139	1,263	1,710	1,654

Note: Result from same-sector regression with cited countries limited to the G5 (France, Germany, Japan, United Kingdom, United States) for each sector. Robust *t*-statistics (clustered at citing country-industry level) are in brackets.
***p < 0.001, **p < 0.01, *p < 0.05.

Annex Figure 4.2.1. Diffusion of Knowledge from G5 with Expanded Emerging Market Economy Sample

(Predicted share of knowledge that diffuses, average across recipient country-sectors)



Source: IMF staff calculations.
Note: The figure shows the average share of knowledge from G5 that diffuses, based on a same-sector regression with the difference in technological development based on value added per worker and using interactions to estimate separate coefficients for emerging markets and advanced economies. G5 = France, Germany, Japan, United Kingdom, United States.

ment are found in emerging market economies. The size and evolution of the predicted use of information is, however, very similar to the baseline used (Annex Figure 4.2.1).

Robustness

This section shows that the baseline results are robust to different choices of the estimation sample and other regression specifications. Three main alternatives are considered:

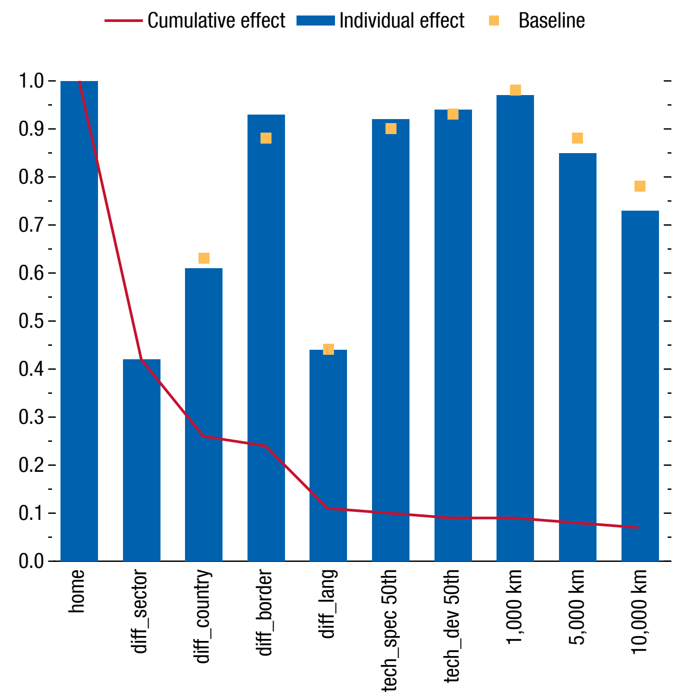
- *Inclusion of cross-sectoral citations:* The sample is expanded to include cross-sectoral patent citations by including, in the gravity equation, a dummy *diff_sector* for the case in which the citing and cited sectors differ. Annex Figure 4.2.2 presents the regression result for the share of knowledge that flows from a given country sector ($\hat{\phi}$). As can be expected, crossing a sectoral barrier entails a significant reduction in knowledge diffusion. Accordingly, the average $\hat{\phi}$ now converges to levels just below 10 percent, roughly half compared with the same-sector setup. The detailed regression results are shown in Annex Table 4.2.2.
- *Inclusion of all countries as source:* In this specification all countries in the sample, and not just the

G5, are included as potential sources of knowledge (for example, all countries are on both the citing and the cited side). The differences with the baseline estimation are small (as shown in Annex Figure 4.2.3), though the effects of most barriers are slightly larger than in the baseline, consistent with the finding that information from nonleaders tends to diffuse less (see Peri 2005).

- *Excluding China from the baseline regression:* This specification is the same as in the baseline, but China is excluded from the estimation sample. As shown in Annex Figure 4.2.4, the importance of the national border is reduced, but this is partly compensated for by the increased importance of technology barriers. Moreover, a shift is observed between sharing a border (getting weaker) and international distance (getting stronger). Overall, point estimates and the average $\hat{\phi}$'s are comparable, suggesting that the inclusion of China, though important, is not a key driver of the results.

Annex Figure 4.2.2. Reduction of Knowledge Flow with Additional Barriers: Including Cross-Sectoral Citations

(Share of information that diffuses across cumulative and individual barriers)



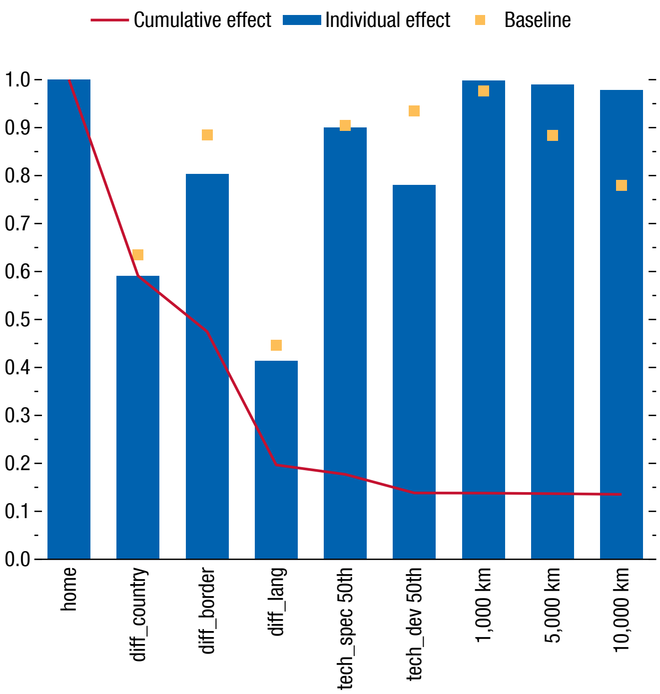
Source: IMF staff calculations.
Note: Square reflects baseline from Figure 4.7 for comparison. km = kilometers.

Annex Table 4.2.2. Gravity Model of Knowledge Diffusion: Including Cross-Sectoral Pairs

	(1) 1995–2014	(2) 1995–99	(3) 2000–04	(4) 2005–09	(5) 2010–14
diff_sector	–0.866***	–0.908***	–0.875***	–0.818***	–0.972***
	[–5.15]	[–4.14]	[–3.87]	[–5.50]	[–5.82]
diff_country	–0.490***	–0.672***	–0.496***	–0.466***	–0.560***
	[–5.50]	[–8.59]	[–6.21]	[–5.21]	[–6.21]
diff_border	–0.0735	–0.309***	–0.00757	0.114	–0.292*
	[–0.67]	[–4.16]	[–0.09]	[1.16]	[–1.97]
diff_lang	–0.810***	–0.542***	–0.687***	–0.899***	–0.956***
	[–12.90]	[–12.20]	[–12.19]	[–12.50]	[–12.20]
dist_int	–31.84*	12.03	–35.65***	–54.48***	–7.275
	[–2.25]	[1.38]	[–3.41]	[–5.34]	[–0.38]
tech_spec	–1.926***	–2.086***	–1.887***	–1.906***	–1.886***
	[–9.70]	[–7.97]	[–6.62]	[–9.87]	[–9.62]
tech_dev_R&D	–0.0610	–0.0997***	–0.0866***	–0.0660*	–0.0291
	[–1.70]	[–5.75]	[–3.38]	[–2.30]	[–0.65]
Citing-Country-Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes
Cited-Country-Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	22,726	14,337	15,930	22,162	21,502

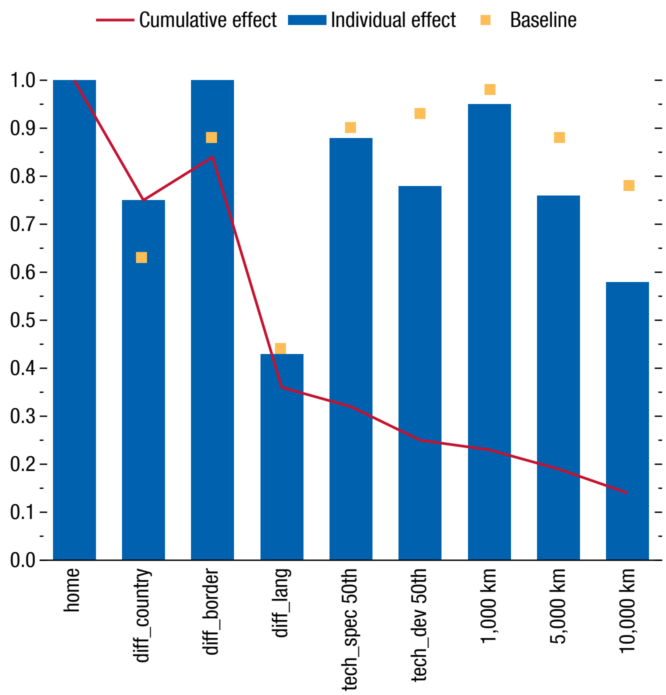
Note: Result from same-sector regression as well as cross-sectoral pairs and cited countries limited to the G5 (France, Germany, Japan, United Kingdom, United States) for each sector. Robust *t*-statistics (clustered at citing-country-industry level) are in brackets.
***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Annex Figure 4.2.3. Reduction of Knowledge Flow with Additional Barriers: Unrestricted Cited Sample
(Share of information that diffuses across cumulative and individual barriers)



Source: IMF staff calculations.
Note: Square reflects baseline from Figure 4.7 for comparison. km = kilometers.

Annex Figure 4.2.4. Reduction of Knowledge Flow with Additional Barriers: Excluding China from Baseline
(Share of information that diffuses across cumulative and individual barriers)



Source: IMF staff calculations.
Note: Square reflects baseline from Figure 4.7 for comparison. km = kilometers.

Annex 4.3. Impact of Foreign Knowledge on Domestic Innovation and Productivity: Additional Results for Panel Estimation of Long-Term Relationships

This annex presents additional discussion and robustness tests of the panel estimation results presented in the sections "Impact on Innovation and Productivity" and "The Role of Greater International Competition."

Impact on Innovation and Productivity: Additional Robustness

The chapter estimated the long-term relationship between the stock of foreign research and development (R&D) and domestic innovation (measured by patent flow) or productivity using a panel data set at the country-sector-year level. Various robustness exercises were conducted for both the impact on innovation (Annex Table 4.3.1) and on productivity (Annex Table 4.3.2). The results are summarized below.

- *Advanced economies versus emerging market economies:* Splitting the estimation sample into advanced economies and emerging market recipients shows that foreign knowledge matters for both groups of countries in boosting innovation—measured by patenting—and productivity (Annex Tables 4.3.1 and 4.3.2, columns [1] and [2]). Foreign R&D seems to play a comparatively more important role for innovation in emerging market economies, while for advanced economies domestic R&D efforts matter more. Compared with advanced economies, emerging market recipients also enjoy a stronger productivity boost for a given change in the foreign stock of knowledge. Focusing on the dynamics of knowledge diffusion, the impact of foreign knowledge flows on domestic innovation appears to have increased more strongly over time in emerging market economies (Annex Tables 4.3.1 and 4.3.2, columns [3] and [4]).
- *Dynamics of knowledge diffusion:* The increase over time in the coefficient on foreign R&D in the innovation equation is robust to restricting the sample to be roughly balanced (that is, keeping only country sectors with a long period) to

Annex Table 4.3.1. Impact of Foreign Knowledge on Domestic Innovation: Robustness

Variables	(1) AE Recipients	(2) EM Recipients	(3) Changing Diffusion-AE	(4) Changing Diffusion-EM	(5) EM Recipients-Broad	(6) Dynamic OLS	(7) Top Three Patent Families	(8) Trade Weight	(9) Sector-Year Fixed Effect
Foreign R&D Stock, Weighted	0.353***	0.342***	0.232***	0.115	0.240***	0.298***	0.359***	0.240***	0.508***
	[0.070]	[0.088]	[0.078]	[0.085]	[0.078]	[0.070]	[0.057]	[0.033]	[0.113]
Foreign R&D Stock*2000–04			0.125***	0.239***					
			[0.034]	[0.064]					
Foreign R&D Stock*2005–09			0.184***	0.280***					
			[0.044]	[0.076]					
Foreign R&D Stock*2010–14			0.249***	0.353***					
			[0.056]	[0.083]					
Own R&D Stock	0.477***	0.361***	0.440***	0.346***		0.410***	0.464***	0.468***	0.724***
	[0.077]	[0.089]	[0.091]	[0.107]		[0.042]	[0.064]	[0.066]	[0.039]
Aggregate R&D Stock* Sector R&D Intensity					0.130***				
					[0.042]				
Human Capital* Sector Skill Intensity					0.139*				
					[0.073]				
Observations	2,345	1,142	2,132	940	2,115	1,605	3,468	3,021	3,487
R^2	0.750	0.707	0.747	0.723	0.646	0.323	0.790	0.794	0.758
Country-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Sector-Year Fixed Effect	No	No	No	No	No	No	No	No	Yes

Source: IMF staff calculations.
Note: AE = advanced economy; EM = emerging market; OLS = ordinary least squares; R&D = research & development.
Robust standard errors (clustered at country-sector level) in brackets.
***p < 0.01, **p < 0.05, *p < 0.1.

Annex Table 4.3.2. Impact of Foreign Knowledge on Domestic Labor Productivity: Robustness

Variables	(1) AE Recipients	(2) EM Recipients	(3) Changing Diffusion-AE	(4) Changing Diffusion-EM	(5) EM Recipients-Broad	(6) Dynamic OLS
Foreign R&D Stock, Weighted (Lagged)	0.039**	0.080**	0.021	0.074	0.073**	0.065**
	[0.017]	[0.040]	[0.020]	[0.046]	[0.031]	[0.032]
Foreign R&D Stock*2000–04			0.027**	0.060***		
			[0.011]	[0.021]		
Foreign R&D Stock*2005–09			0.050***	0.062**		
			[0.018]	[0.029]		
Foreign R&D Stock*2010–14			–0.006	–0.034		
			[0.033]	[0.055]		
Own R&D Stock (Lagged)	0.133***	0.103***	0.123***	0.108***		0.133***
	[0.022]	[0.037]	[0.025]	[0.038]		[0.023]
Aggregate R&D Stock* Sector R&D Intensity					0.039*	
					[0.022]	
Human Capital* Sector Skill Intensity					0.035	
					[0.064]	
Observations	1,968	1,753	1,751	1,511	2,248	1,785
R^2	0.619	0.693	0.633	0.725	0.992	0.067
Country-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes

Source: IMF staff calculations.
Note: AE = advanced economy; EM = emerging market; OLS = ordinary least squares; R&D = research & development.
Robust standard errors (clustered at country-sector level) in brackets.
***p < 0.01, **p < 0.05, *p < 0.1.

avoid sample composition effects. In addition, period-by-period estimation, which allows all coefficients to vary over time, yields similar results. The subperiod coefficients on the foreign R&D stock are all statistically significant.

- *Expanded emerging market sample:* Given that the availability of sector-level R&D data limits the sample to a small number of emerging market economies, an alternative specification is estimated for a larger number of emerging market economies, in which the domestic-sector-level R&D stock is replaced by the domestic aggregate R&D stock interacted with a sector's R&D intensity.[30] The specification also controls for a measure of human capital (that is, aggregate years of schooling interacted with a sector's skill intensity).[31] The results regarding the economic significance of the foreign R&D stock also hold for this larger sample (Annex Tables 4.3.1 and 4.3.2, column [5]).
- *Dynamic ordinary least squares (OLS):* Given that the R&D stock and patent/labor productivity series are possibly nonstationary and cointegrated, the baseline specification is reestimated using dynamic OLS (see Kao and Chiang 2001). The procedure essentially involves adding several lags and leads of the change in the regressors and requires a strongly balanced sample. The number of lags chosen is two, and the number of leads is one. The baseline results hold for both the innovation and labor productivity specifications, with a slightly larger coefficient on the foreign R&D stock (Annex Tables 4.3.1 and 4.3.2, column [6]). For the total factor productivity specification, the balanced-sample requirement significantly reduces the degrees of freedom, and thus the dynamic OLS estimation was not performed.
- *Alternative patent measure:* While the baseline uses international patent families, the results are very similar using patent families with at least one application at one of the top three patent offices, which is another measure of quality-adjusted patent counts (Annex Table 4.3.1, column [7]).
- *Alternative weighting method:* The baseline results are robust to using the (time-varying) bilateral trade links between country sectors in place of the predicted share of knowledge flow ($\hat{\phi}$) based on cross-patent citations. For each receiving country sector, the trade weights are constructed as imports of goods from the originating country sector as a share of gross output (Annex Table 4.3.1, column [8]).
- *Fixed effects:* While the baseline specifications use country-year fixed effects, in line with Peri (2005), the results are robust to using sector-year fixed effects instead, which can capture sector-specific developments that are common across countries.[32] The coefficients on both foreign and domestic R&D become significantly larger under the specification with sector-year fixed effects (Annex Table 4.3.1, column [9]).
- *Calculation of contributions:* To calculate the contribution of foreign knowledge to productivity, the estimated coefficient on foreign R&D is applied to the average annual change in the variable over the relevant period. The contributions by country groups are obtained from separate regression estimates for advanced economies and emerging market recipients, and those by subperiods are obtained from the regression specification in which the coefficient on foreign R&D stock is allowed to vary over time. Only "long panels" (country sectors with ample coverage over time) are included in the calculation of contributions to make sure that changes in sample composition do not affect the results.

The Role of Greater International Competition: Results and Robustness

Within the same framework used to estimate the impact of foreign knowledge on domestic innovation, the impact of competition and market concentration on domestic innovation and the strength of technology diffusion are also estimated. Annex Table 4.3.3 presents these estimates for measures that affect the extent of competition: trade with China, global market concentration, and product market regulation.

- *Trade with China* is measured as imports of final goods from China as a share of the receiving country sector's gross output, calculated from the World Input-Output Tables. This variable increases domestic innovation directly, but also indirectly, by increasing technology diffusion (Annex Table 4.3.3, column [1]). Alternative measures using final goods trade from the Organisation for Economic Co-operation and

[30]The correlation between sector-level R&D stock and this interacted variable is about 0.49 (calculated over country sectors for which both are available). The sector's R&D intensity used in the interaction term to create sectoral variation is based on US data.

[31]The sector's skill intensity is based on US data.

[32]The inclusion of both country-year and sector fixed effects removes most of the variation in the data, and thus the results are not discussed here.

Annex Table 4.3.3. Impact of Competition on Innovation

Variables	(1)	(2)	(3)	(4)
Foreign R&D Stock	0.337***	0.413***	0.335***	0.405***
	[0.054]	[0.046]	[0.045]	[0.075]
Own R&D Stock	0.494***	0.435***	0.447***	0.478***
	[0.063]	[0.055]	[0.061]	[0.059]
China Trade	2.465***			2.086***
	[0.777]			[0.758]
Foreign R&D Stock*China Trade	1.474***			1.236***
	[0.442]			[0.394]
Global Concentration		-4.021***		-4.059***
		[0.923]		[0.879]
Foreign R&D Stock*Global Concentration		-2.121***		-2.27***
		[0.559]		[0.565]
PMR*Firm Turnover			-0.021***	0.02
			[0.007]	[0.019]
Foreign R&D Stock*(PMR*Firm Turnover)			-0.01***	0.004
			[0.003]	[0.008]
Observations	2,281	1,559	2,533	1,175
R^2	0.801	0.819	0.789	0.832
Country-Year Fixed Effect	Yes	Yes	Yes	Yes

Source: IMF staff calculations.
Note: PMR = product market regulation; R&D = research and development.
Robust standard errors (clustered at country-sector level) in brackets.
***p < 0.01, **p < 0.05, *p < 0.1.

Development (OECD) Structural Analysis Database or total goods trade from the COMTRADE Database yield similar estimates. Interestingly, measures of imports of inputs from China do not seem to matter for innovation, suggesting that the effect comes from the competition channel, which is better captured by trade in final goods.

- *Global market concentration* is measured for each sector as the global market share of the four largest firms based on sales. It is calculated from the firm-level Orbis data set made available by Freund and Sidhu (2017), following their methodology, which uses the largest 650 firms globally by revenue in each sector. Only data for 2006 and 2014 are available, and values for the years in between are interpolated for use in the regression. Global concentration has a negative impact on domestic innovation, directly and through lower technology diffusion (Annex Table 4.3.3, column [2]). Alternative measures such as the Herfindahl Index or patent-based concentration measures calculated from PATSTAT data bring similar results.[33] Results are also robust to including an interaction term between foreign R&D and time dummies, which would control for the possible presence of a global trend in technology diffusion. This ensures that changes in global concentration (at the sector level) are not just picking up this global trend.
- *Domestic competition* is proxied by the OECD indicator of product market regulation (interpolated between available years). As the indicator is only available at the country level, a difference-in-difference approach is used, in which product market regulation is interacted with the sectoral turnover rate for the United States (proxied by the average business churn rate collected from the OECD). The assumption underlying this strategy is that sectors with higher turnover are more likely to be affected by regulation that restricts firm entry and exit. The coefficients on both the main and interaction terms are statistically significant in themselves, but become insignificant when all competition variables enter the regression simultaneously (Annex Table 4.3.3, columns [3] and [4]). Alternative measures of domestic concentration based on patent data produce similar results, although their reverse causality risk may be higher.
- *Additional variables:* In addition to the baseline regressors presented in Annex Table 4.3.3, education and intellectual property rights protection were also considered as alternative independent variables. These measures seemed to matter for innovation and technology diffusion when included individually, but their significance was not robust to controlling for other policies and structural factors. The results are thus omitted.

[33]However, the patent-based measures may underestimate the extent of concentration because the PATSTAT database does not have information on firms' ownership structure.

Annex 4.4. Methodology for Local Projection Method Estimation

This annex presents the estimation framework for the local projection method analysis used in the section "Impact on Innovation and Productivity" and explains the identification of productivity shocks used in this framework.

Estimation Framework

To examine the short-term dynamics of technology diffusion, the impulse response of productivity and innovation to a technology shock in leader countries is estimated using the following equation, one for each time horizon h (h = 1, . . . ,5):

$$dlnY_{i,c,t+h} = \alpha_h \omega_{i,c,l,t} dln\,Y_{i,l,t} + \beta_h X_{i,c,t-1} + \theta_{ct} + \varepsilon_{i,c,t}, \quad (4.4)$$

in which i denotes the sector, c the country receiving the spillovers, l the technological leader, and t the time period. $dlnY_{i,c,t+h} = lnY_{i,c,t+h} - lnY_{i,c,t-1}$ is the change in Y in the recipient between period $t-1$ and $t+h$ and $dln\,Y_{i,l,t} = lnY_{i,l,t} - lnY_{i,l,t-1}$ is the shock in the leader, in which the variable under investigation, Y, could be either total factor productivity, labor productivity, or the patent stock of a country sector. Similarly to the long-term approach, the shock is weighted using bilateral country-sector weights ($\omega_{i,c,l,t}$) reflecting the strength of linkages between the receiving and the originating country sectors. $X_{i,c,t-1}$ is a vector of controls, including two lags of the shock in the leaders and two lags of the growth rate of domestic total factor productivity.[34] Finally, θ_{ct} denotes the country-year fixed effects, capturing time-varying factors driving productivity and innovation trends at the country level, such as the business cycle. The impulse response to a technology shock in the leader countries is constructed from a sequence of parameter estimates $\{\alpha_h\}_{h=1}^{5}$ and the associated standard errors (see Jordà 2005).

Identification of Labor Productivity Shocks

Shocks to labor productivity are identified using a structural vector autoregression with long-term restrictions as in Galí (1999). The estimation is performed using the *vars* package in *R*.

[34]Including the leads of the shock, as in Teulings and Zubanov (2014), to correct for possible misspecification does not change the results materially.

The specification considered corresponds to the differencing of both productivity and hours. More precisely, a vector autoregression (VAR) of the following form is first estimated,

$$y_t = A_1 y_{t-1} + \ . \ . \ . + A_p y_{t-p} + u_t, \quad (4.5)$$

in which $y_t = \begin{bmatrix} \Delta x_t \\ \Delta n_t \end{bmatrix}$, with Δx_t the change in log labor productivity (measured as gross value added per hour) and Δn_t the change in log hours. The lag order p is selected according to an Akaike information criterion, which, for annual data, in virtually all cases returns a value $p = 1$.

The identification of structural innovations is achieved by setting restrictions on the impact matrix B defined implicitly by

$$u_t = B\epsilon_t, \quad (4.6)$$

in which $\epsilon_t = \begin{bmatrix} \epsilon_t^z \\ \epsilon_t^m \end{bmatrix}$ is the vector of structural innovations with covariance equal to the identity matrix. The restrictions on B are placed so that a nontechnological innovation, represented by a shock ϵ_t^m , has no long-term effect on x_t. By premultiplying the estimated vector of reduced form shocks $\hat{u}_t$ for B^{-1}, the above equation can be used to calculate the vector of estimated structural innovations $\hat{\epsilon}_t$.

Finally, the series of technological shocks $\hat{e}_t^z$ is retrieved as the sequence of technological impacts on labor productivity:

$$\hat{e}_t^z = B(1,1)\,\hat{\epsilon}_t^z. \quad (4.7)$$

The data for the estimation are obtained by merging the ISIC 3 and ISIC 4 versions of the KLEMS data set for the G5 countries (France, Germany, Japan, United Kingdom, United States). Due to data availability, only the manufacturing and construction sectors are considered. For the various country-sector pairs, the available data are annual and span about 1970–2015 (only shocks for 1995–2015 are used in the local projection estimation).

Identification of Total Factor Productivity Shocks

The measure of total factor productivity (TFP) that enters the local projection estimation (both as shocks in the leaders and as TFP in the recipients) are changes in utilization-adjusted TFP, which is TFP adjusted for varying input utilization, nonconstant returns and imperfect competition following Basu, Fernald, and Kimball (2006) to obtain a measure of "purified" technology shocks. The adjustment involves estimating a production function at the sector level. In particular, for sector i, which belongs to a group k (k = durable manufacturing, nondurable manufacturing, or nonmanufacturing):

$$dy_i = \gamma^k dx_i + \beta^k dh_i + dz_i, \tag{4.8}$$

in which dy_i is the growth rate of real gross output; $dx_i = sk_i dk_i + sl_i dl_i + sm_i dm_i$ is the growth rate of the composite input (consisting of capital, labor, and materials), with sk, sl, and sm denoting the share of each input in gross output; dh_i is the growth rate of hours worked (measured as the first difference in detrended log hours)—a proxy for unobserved input utilization; and dz_i is the residual/adjusted TFP or a measure of industry technology shocks.

The parameters γ and β are assumed to be the same for all sectors within a group.[35] Given the potential correlation between input growth (dx_i and dh_i) and technology shocks in the residual, input growth is instrumented using oil prices, growth in real government defense spending (for the United States), or changes in the cyclically adjusted fiscal balance (for other advanced economies in the sample) and a measure of monetary shocks.[36]

The exercise is conducted for 24 manufacturing and services sectors in 17 advanced economies[37] over 1995–2015 (the sample period for the United States goes back to 1970). Sector-level data on gross output, labor, capital, and intermediate input are taken from the KLEMS database.

Annex 4.5. Impact of Global Value Chains on Firm-Level Patenting: Methodology and Robustness

This annex presents the estimation framework for the firm-level analysis presented in the section "The Impact of Global Value Chains on Patenting: A Firm-Level Analysis." It also discusses robustness of the results, the instrumentation strategy, and the examination of the effect of institutional variables on firm-level innovation.

Estimation Framework

The country-sector-firm-level analysis in the section on global value chains and patenting follows the framework developed by Autor and others (2016) and Bloom, Draca, and Van Reenen (2016). To assess whether changes in global value chain (GVC) participation at the sectoral level are related to firms' technological change—measured by the change in the patent flow—and growth prospects, measured by the change in employment, the following equation is estimated:

$$\begin{aligned}\Delta^5 X_{ijkt} = {} & \delta^X P^s_{ijk,2000} + \alpha^X \Delta^5 GVC_{jkt} \\ & + \gamma^X\left(P^s_{ijk,2000} * \Delta^5 GVC_{jkt}\right) \\ & + f^X_{kt} + s^X_j + \varepsilon^X_{ijkt}\,,\end{aligned} \tag{4.9}$$

in which the subscript i denotes firms, j denotes sectors, k denotes countries, and t periods.

$X = \{P^f, N\}$, in which N is the logarithm of employment, and P^f and P^s denote the logarithm of a *transformed* count of patent flows and stocks, respectively.[38] $P^s_{ijk,2000}$, a firm's patent stock at the beginning of the sample, is a measure of the firm's initial technological intensity. GVC_{jkt} is the standard measure of participation in global value chains in a given country sector and year, computed as the sum of (1) the domestic content in exports reused in trading partners' exports (forward linkages) and (2) the foreign value added embedded in exports (backward linkages) expressed as a share of gross exports. f^X_{kt} is a full set of country dummies interacted with year dummies (country-year fixed effects), which are used to capture country-specific factors that support the capacity to innovate, such as education levels and infrastructure and macroeconomic shocks. s^X_j are sector fixed effects, which control for systematic differences in patenting and employment trends across industries. Δ^5 denotes

[35]This is a more restrictive assumption than in Basu, Fernald, and Kimball (2006), which allows the returns-to-scale parameter (γ) to differ across all sectors. This assumption allows for better performance of the instruments.

[36]For the United States, monetary shocks—identified in a vector autoregression as in Burnside (1996)—are obtained from Basu, Fernald, and Kimball (2006). For other advanced economies in the sample, monetary shocks are estimated as the forecast error of the policy rates, defined as the difference between the actual policy rates and the rate expected by analysts as of October of the same year using forecasts from Consensus Economics. This approach follows Furceri, Loungani, and Zdzienicka 2016.

[37]Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Spain, Sweden, United Kingdom, United States.

[38]To account for the zeros in patent counts when taking logarithms, the estimation follows Bloom, Draca, and Van Reenen (2016) and uses the following transformation: $P^d = ln\left(1 + pat^d\right)$, in which $d = \{f, s\}$ and pat is the untransformed patent count. Furthermore, data limitations prevent the construction of firm-level total factor productivity and labor productivity measures. Other firm performance measures, such as return on assets and return on equity, were considered, but concerns about how these measures are affected by the division of value added between labor and capital ultimately excluded them from the analysis.

five-year differences, and the errors $\left(\varepsilon_{ijkt}^{X}\right)$ are assumed to be heteroscedastic.

The data cover 2000–12 for eight manufacturing sectors across 11 emerging market and developing economies: Brazil, China, India, Indonesia, Mexico, Philippines, Poland, Russia, South Africa, Thailand, and Turkey.[39,40] The primary data are drawn from PATSTAT, which provides comprehensive coverage of all patenting firms. Global input-output tables are used to construct industry-level GVC participation measures. To examine the employment effect, the PATSTAT data set is merged with Orbis to produce a data set of both patenting and nonpatenting firms. This allows employment data to be obtained and the reallocation of employment between nonpatenting and patenting firms to be examined.[41]

This framework allows for analysis of two types of effects:

- A *"within-firm" (intensive margin) effect*, captured by coefficient α^X: It measures how changes in GVC participation relate to firms' average performance in terms of technology upgrading or employment growth. As discussed in the text, the results indicate that $\alpha^X > 0$, suggesting that increasing GVC participation increases firm performance.
- *A "between-firm" (extensive margin) effect*, captured by coefficient γ^X: The latter captures whether, after 2000, the buildup of innovation or job creation associated with increased GVC participation is disproportionately larger for lower-tech firms $(\gamma^X < 0)$ or higher-tech firms $(\gamma^X > 0)$. The results indicate that technological advances have been relatively larger in initially lower-tech firms $(\gamma^P < 0)$, whereas job growth has been relatively higher in higher-tech firms $(\gamma^N > 0)$.

The results are robust to a number of tests (Annex Table 4.5.1), including (1) clustering errors at the country-industry level; (2) using alternative GVC measures—backward linkages, forward linkages, lagged measures, and participation only with regard to advanced economies; (3) using alternative methods of adjusting patent counts for their quality—such as forward citation or family-size weights or focusing only on granted patents; (4) estimating over a different time period—the years after the global financial crisis were excluded to ensure the results were not driven by the shock of the crisis; and (5) excluding from the sample either China or the electrical and machinery equipment sector—each accounting for a large share of the sample.

Instrumentation

In the patenting equation, changes in GVC participation are likely to be correlated with the unobserved shocks $\left(\varepsilon_{ijkt}^{XP}\right)$, due to the possibility of reverse causality (innovative firms may be more likely to be pulled into GVCs because of their high productivity and capacity to innovate) or self-selection (firms may be geared toward GVC participation). Therefore, the use of instrumental variables—the restrictiveness of foreign direct investment (FDI) regulations, as well as changes in FDI restrictions and tariffs—are considered to address potential endogeneity.[42] The first-stage regression of the model can be written as

$$\Delta^5 G_{jkt} = \theta Z_{kt}^{n} + f_{kt}^{G} + s_j^{G} + \varepsilon_{ijkt}^{G}, \qquad (4.10)$$

in which $\Delta^5 G_{jkt} = \left\{\Delta^5 GVC_{jkt}, P_{ijk,2000}^{s} * \Delta^5 GVC_{jkt}\right\}$ and Z_{kt}^{n} is the vector of instruments. As expected, all the coefficients in θ have a negative sign, suggesting that with stricter restrictions on FDI or higher tariffs, integration into GVCs is expected to be lower in the subsequent five years. Standard tests indicate that the set of instruments satisfies the exclusion restriction that the error term be uncorrelated with sectoral-level changes in tariffs and FDI restrictions, and the degree of restrictiveness of the latter.[43]

[39]The Czech Republic and the Slovak Republic were originally included in the sample, but they have been dropped because they do not have any patenting activity in PATSTAT. Although Poland is currently considered an advanced economy, it is still included in the sample because it was not considered a high-income country at the start of the sample period.

[40]Food and beverages, textiles and wearing apparel, wood and paper, petroleum-chemicals and nonmetallic mineral products, metal products, electrical and machinery, transport equipment and other manufacturing.

[41]Initially, the relationship between GVC participation and innovative capacity is tested only for patenting firms in the sample. While the sample of patenting firms is much smaller, the results qualitatively confirm those obtained using the full sample of patenting firms from the original exercise using the PATSTAT data set.

[42]The Durbin-Wu-Hausmann endogeneity test indicates that changes in GVC participation variables—the variable itself and the interaction term—are indeed endogenous. The components of the FDI restrictions used in the estimation correspond to screening and approval procedures and restrictions on foreign personnel. The chosen instruments can only be matched with five of the eight sectors in the primary data set, but rerunning the ordinary least squares regression on the subsample for which the instrumental variables estimation is carried out leaves the results broadly unaffected.

[43]In general, tariffs and FDI restrictions could be correlated with innovation through channels other than GVCs, such as knowledge flows more broadly or changes in the degree of competition. However, the tests confirm the strength and validity of the instruments, likely reflecting the difference in aggregation levels between GVC measures and instruments (sectoral) and patenting (firm level), making the former more exogenous.

Annex Table 4.5.1. Impact of Global Value Chain Participation on Firm-Level Innovation: Robustness

Dependent Variable	Patent Flow (log, five-year difference)							
Sample Period (2002–12)	Baseline (Robust Errors) (1)	Clustered Errors (2)	GVC Forward (3)	GVC Backward (4)	Family-Size Weighted Patents (5)	Granted Patents (6)	Excluding China (7)	Excluding Electrical and Machinery (8)
Initial Patent Stock (2000)	–0.07***	–0.07***	–0.08***	–0.07***	–0.08***	–0.06***	–0.05***	–0.05***
	[–91.317]	[–5.703]	[–111.620]	[–90.896]	[–90.624]	[–82.359]	[–48.643]	[–50.686]
Within-Firm Effects								
GVC Participation (five-year change)	0.28***	0.28***	0.19***	0.44***	0.28***	0.11***	0.14***	0.55***
	[16.494]	[3.133]	[9.273]	[13.756]	[14.356]	[7.269]	[4.656]	[28.131]
Between-Firm Effects								
Initial Patent Stock (2000) × GVC Participation (five-year change)	–1.31***	–1.31***	–1.03***	–1.42***	–1.36***	–0.94***	–0.08*	–1.49***
	[–44.878]	[–4.160]	[–21.249]	[–41.980]	[–42.087]	[–36.306]	[–1.889]	[–37.928]
Observations	4,044,066	4,044,066	4,044,066	4,044,066	4,044,066	4,044,066	792,584	1,684,033
R^2	0.026	0.026	0.025	0.026	0.025	0.022	0.025	0.024
Country × Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

Source: IMF staff calculations.
Note: Robust *t*-statistics in brackets. GVC = global value chain.
***p < 0.01, **p < 0.05, *p < 0.1.

Correlation between Country-Year Fixed Effects and Policy Variables

Finally, the extent to which country-specific factors—estimated using country-year fixed effects in equation (4.9) for the patenting variable $\left(\hat{f}^P_{kt}\right)$—capture absorption capacity factors at the country level is tested by estimating

$$\hat{f}^P_{kt} = \omega_0 + \omega_m I^m_{kt} + \mu_{kt}, \qquad (4.11)$$

in which I^m_{kt} is a vector containing m institutional variables, including a firm's perceptions of the quality of infrastructure and education, the strength of the property rights system, and competition and the rule of law.

Annex Table 4.5.2 shows the correlation between these institutional variables and the country-year fixed

Annex Table 4.5.2. Relationship between Country-Year Fixed Effects and Selected Policy Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interconnectedness								
Quality of Port Infrastructure	0.01080*			0.01189*				
Education	[1.754]			[1.932]				
Quality of Primary Education		0.01308**						
		[2.590]						
Quality of Math and Science Education			0.00668*	0.00733**				
Rule of Law			[1.875]	[2.328]				
Protection of Property Rights					0.00407*			0.00553**
					[1.955]			[2.200]
Integrity of the Legal System						0.00301*		0.00320**
Product Market Regulation						[1.906]		[2.044]
Licensing Restrictions							–0.00346**	–0.00329**
							[–2.391]	[–2.118]
Constant	0.01610	0.01068	0.02919**	–0.01562	0.02631**	0.03068***	0.07200***	0.02333
	[0.701]	[0.698]	[2.428]	[–0.752]	[2.256]	[3.248]	[7.609]	[1.122]
Observations	70	60	70	70	110	110	90	90
R^2	0.042	0.089	0.044	0.095	0.031	0.023	0.060	0.128

Source: IMF staff calculations.
Note: Robust *t*-statistics in brackets.
***p < 0.01, **p < 0.05, *p < 0.1.

effects from the estimated patenting relationships. As illustrated in the chapter, the results suggest that the country-year fixed effects in patenting are positively correlated with firms' perceptions of the quality of infrastructure and education, the strength of the property rights system, competition, and rule of law.

References

Acharya, Ram C., and Wolfgang Keller. 2009. "Technology Transfer through Imports." *Canadian Journal of Economics/Revue canadienne d'économique* 42 (4): 1411–48.

Adler, Gustavo, Romain Duval, Davide Furceri, Sinem Kiliç Çelik, Ksenia Koloskova, and Marcos Poplawski-Ribeiro. 2017. "Gone with the Headwinds: Global Productivity." *IMF Staff Discussion Note 17/04*, International Monetary Fund, Washington, DC.

Aghion, Philippe, Nick Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt. 2005. "Competition and Innovation: An Inverted-U Relationship." *Quarterly Journal of Economics* 120 (2): 701–28.

Aghion, Philippe, Peter Howitt, and Susanne Prantl. 2015. "Patent Rights, Product Market Reforms, and Innovation." *Journal of Economic Growth* 20 (3): 223–62.

Akcigit, Ufuk, Sina Ates, and Giammario Impullitti. 2017. "Innovation and Trade Policy in a Globalized World." Unpublished.

Allard, Céline, Jorge I. Canales Kriljenko, Jesus R. Gonzalez-Garcia, Emmanouil Kitsios, Juan P. Trevino, and Wenjie Chen. 2016. "Trade Integration and Global Value Chains in Sub-Saharan Africa: In Pursuit of the Missing Link." IMF African Departmental Paper 16/02, International Monetary Fund, Washington, DC.

Andrews, Dan, Chiara Criscuolo, and Peter Gal. 2016. "The Global Productivity Slowdown, Technology Divergence, and Public Policy: A Firm-Level Perspective." Background Paper for OECD Global Forum on Productivity.

Audretsch, David B., and Maryann P. Feldman. 1996. "R&D Spillovers and the Geography of Innovation and Production." *The American Economic Review* 86 (3): 630–40.

Autor, David, David Dorn, Gordon H. Hanson, Gary Pisano, and Pian Shu. 2016. "Foreign Competition and Domestic Innovation: Evidence from US Patents." NBER Working Paper 22879, National Bureau of Economic Research, Cambridge, MA.

Autor David, David Dorn, Lawrence F. Katz, Christina Patterson, and John Van Reenen. 2017. "The Fall of the Labor Share and the Rise of Superstar Firms." NBER Working Paper 23396, National Bureau of Economic Research, Cambridge, MA.

Basu, Susanto, John Fernald, and Miles Kimball. 2006. "Are Technology Improvements Contractionary?" *The American Economic Review* 96 (5): 1418–48.

Bilir, L. Kamran B. 2014. "Patent Laws, Product Life-Cycle Lengths, and Multination Activity." *The American Economic Review* 104: 1979–2013.

Bloom, Nicholas, Mirko Draca, and John Van Reenen. 2016. "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity." *Review of Economic Studies* 83(1): 87–117.

Bloom, Nicholas, Charles I. Jones, John Van Reenen, and Michael Webb. 2017. "Are Ideas Getting Harder to Find?" NBER Working Paper 23782, National Bureau of Economic Research, Cambridge, MA.

Branstetter, Lee. 2001. "Are Knowledge Spillovers International or Intranational in Scope? Microeconomic Evidence from the US and Japan." *Journal of International Economics* 53: 53–79.

Brynjolfsson, Erik, Daniel Rock, and Chad Syverson. 2017. "Artificial Intelligence and the Modern Productivity Paradox: A Clash of Expectations and Statistics." In *Economics of Artificial Intelligence*. Chicago: University of Chicago Press.

Burnside, Craig. 1996. "Production Function Regressions, Returns to Scale, and Externalities." *Journal of Monetary Economics* 37 (2): 177–201.

———, and David Dollar. 2000. "Aid, Policies, and Growth." *The American Economic Review* 90 (4): 847–68.

Busse, Erdogan C., and H. Mühlen. 2016. "China's Impact on Africa—The Role of Trade, FDI and Aid." *KYKLOS* 69 (2): 228–62.

Chen, Sophia, and Estelle Dauchy. 2018. "International Technology Sourcing and Knowledge Spillovers: Evidence from OECD Countries." IMF Working Paper 18/51, International Monetary Fund, Washington, DC.

Coe, David T., Elhanan Helpman, and Alexander W. Hoffmaister. 2009. "International R&D Spillovers and Institutions." *European Economic Review* 53 (7): 723–41.

Coelli, Federica, Andreas Moxnes, and Karen Helene Ulltveit-Moe. 2016. "Better, Faster, Stronger: Global Innovation and Trade Liberalization." NBER Working Paper 22647, National Bureau of Economic Research, Cambridge, MA.

Cohen, Wesley M., and Daniel A. Levinthal. 1989. "Innovation and Learning: The Two Faces of R&D." *Economic Journal* 99 (397): 569–96.

Collier, Paul, and David Dollar. 2002. "Aid Allocation and Poverty Reduction." *European Economic Review* 46: 1475–500.

Dernis, Hélène, and Mosahid Khan. 2004. "Triadic Patent Families Methodology." OECD Science, Technology and Industry Working Papers 2004/02, Organisation for Economic Co-operation and Development, Paris.

Donabauer, Julian, Birigt Meyer, and Peter Nunnenkamp. 2016. "Aid, Infrastructure and FDI: Assessing the Transmission Channel with a New Index of Infrastructure." *World Development* 78: 230–45.

Donaubauer, Julian, Dierk Herzer, and Peter Nunnenkamp. 2014. "Does Aid for Education Attract Foreign Investors? An Empirical Analysis." *European Journal of Development Research* 26: 597–613.

Dutta, Nabamita, Deepraj Mukherjee, and Sanjukta Roy. 2015. “Re-Examining the Relationship between Domestic Investment and Foreign Aid: Does Political Stability Matter?” *International Review of Applied Economics* 29 (3): 259–86.

Duval, Romain, Davide Furceri, Sinem Kiliç Çelik, and Marcos Poplawski-Ribeiro. Forthcoming. “Productivity Spillovers in Advanced Economies.”

Eaton, Jonathan, and Samuel Kortum. 2002. “Technology, Geography and Trade”, *Econometrica* (70): 1741–779.

Freund, Caroline, and Dario Sidhu. 2017. “Global Competition and the Rise of China.” PIIE Working Paper 17-3.

Furceri, Davide, Prakash Loungani, and Aleksandra Zdzienicka. 2016. “The Effects of Monetary Policy Shocks on Inequality.” IMF Working Paper 16/245, International Monetary Fund, Washington, DC.

Galí, Jordi. 1999. “Technology, Employment, and the Business Cycle: Do Technology Shocks Explain Aggregate Fluctuations?” *The American Economic Review* 89 (1): 249–71.

Garriga, Ana Carolina, and Brian J. Phillips. 2014. “Foreign Aid as Signal to Investors: Predicting FDI in Postconflict Countries.” *Journal of Conflict Resolution* 58 (2): 280–306.

Gordon, Robert J. 2012. “Is US Economic Growth Over? Faltering Innovation Confronts the Six Headwinds.” NBER Working Paper 18315, National Bureau of Economic Research, Cambridge, MA.

Griffith, Rachel, Rupert Harrison, and John Van Reenen. 2006. “How Special Is the Special Relationship? Using the Impact of US R&D Spillovers on UK Firms as a Test of Technology Sourcing.” *The American Economic Review* 96 (5): 1859–75.

Griffith, Rachel, and Helen Miller. 2011. “Innovation in China: The rise of Chinese Inventors in the Production of Knowledge.” IFS Working Paper W11/15, Institute for Fiscal Studies, London.

Griffith, Rachel, Stephen Redding, and John Van Reenen. 2004. “Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries.” *Review of Economics and Statistics* 86 (4): 883–95.

Grossman, Gene M., and Elhanan Helpman. 1991. *Innovation in the World Economy.* Cambridge, MA: MIT Press.

Grullon, Gustavo, Yelena Larkin, and Roni Michaely. 2017. “Are US Industries Becoming More Concentrated?” Unpublished Working Paper.

Gutiérrez, Germán, and Thomas Philippon. 2017. “Declining Competition and Investment in the US.” NBER Working Paper 23583, National Bureau of Economic Research, Cambridge, MA.

Hoekman, Bernard M., Keith E. Maskus, and Kamal Saggi. 2005. “Transfer of Technology to Developing Countries: Unilateral and Multilateral Policy Options.” *World Development* 33 (10): 1587–602.

Jaffe, Adam B., Manuel Trajtenberg, and Rebecca Henderson. 1993. “Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations.” *Quarterly Journal of Economics* 108 (3): 577–98.

Jordà, Òscar. 2005. “Estimation and Inference of Impulse Responses Local Projections.” *The American Economic Review* 95 (1): 161–82.

Kao, Chihwa, and Min-Hsien Chiang. 2001. “On the Estimation and Inference of a Cointegrated Regression in Panel Data.” In *Nonstationary Panels, Panel Cointegration, and Dynamic Panels (Advances in Econometrics, Volume 15)*, edited by Badi H. Baltagi, Thomas B. Fomby, and R. Carter Hill. Emerald Group Publishing Limited.

Katznelson, Ron D. 2008. “Bad Science in Search of Bad Patents.” *Federal Circuit Bar Journal* 17 (1).

Keller, W. 2004. “International Technology Diffusion.” *Journal of Economic Literature* 42:752–82

Keller, Wolfgang. 2002. “Geographic Localization of International Technology Diffusion.” *The American Economic Review* 92 (1): 120–42.

———. 2010, “International Trade, Foreign Direct Investment, and Technology Spillovers.” In *Handbook of the Economics of Innovation* (2): 793–829. Amsterdam: Elsevier.

Kim, Jung Eun. 2014. “Expanding the Usage of Renewable Energy Through Innovation and Technology Transfer.” Dissertations ALL, Paper 57.

Kretschmer, Betinna, Michael Hübler, and Peter Nunnenkamp. 2013. “Does Foreign Aid Reduce Energy and Carbon Intensities of Developing Economies?” *Journal of International Development* 25: 67–91.

Lopez-Garcia, Paloma, and Daria Taglioni. 2018. “Knowledge Transfers from International Openness in Trade and Investment: The European Case.” In *Critical Connections: Why ECA’s Regional and Global Network of Interconnections Matter for Inclusive Growth and Stability*, edited by David M. Gould. Washington, DC: World Bank.

MacGarvie, Megan. 2006. “Do Firms Learn from International Trade?” *Review of Economics and Statistics* 88 (1): 46–60.

Madsen, Jakob B. 2007. “Evidence for the OECD Countries.” *Journal of International Economics* 72: 464–80.

Organisation for Economic Co-operation and Development (OECD). 2009. OECD Patent Statistics Manual. OECD Publishing, Paris.

——. 2015. *The Future of Productivity*. OECD Publishing, Paris.

Peri, Giovanni. 2005, “Determinants of Knowledge Flows and Their Effect on Innovation.” *Review of Economics and Statistics* 87 (2): 308–22.

Rajan, Raghuram G., and Arvind Subramanian. 2008. “Aid and Growth: What Does the Cross-Country Evidence Really Show?” *Review of Economics and Statistics* 90 (4): 643–65.

Santos Silva, João, and Silvana Tenreyro. 2006. “The Log of Gravity.” *Review of Economics and Statistics* 88 (4): 641–58.

Santos Silva, J.M.C., and Silvana Tenreyro. 2011. “Further Simulation Evidence on the Performance of the Poisson Pseudo-Maximum Likelihood Estimator.” *Economics Letters* 112 (2): 220–22.

Selaya, Pablo, and Eva Rytter Sunesen. 2012. "Does Foreign Aid Increase Foreign Direct Investment?" *World Development* 40 (11): 2155–176.

Squicciarini, M., H. Dernis, and C. Criscuolo. 2013. "Measuring Patent Quality: Indicators of Technological and Economic Value." In *OECD Science, Technology and Industry Working Papers* 2013/03, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k4522wkw1r8-en.

Stiebale, Joel. 2016. "Cross-Border M&As and Innovative Activity of Acquiring and Target Firms." *Journal of International Economics* 99:1–15.

Strokova, Victoria. 2010. "International Property Rights Index: 2010 Report." United Nations Conference on Trade and Development, New York.

Teulings, Coen N., and Nikolay Zubanov. 2014. "Is Economic Recovery a Myth? Robust Estimation of Impulse Responses." *Journal of Applied Econometrics* 29 (3): 497–514.

Tiruneh, Esubalew Alehegn, Evelyn Wamboye, and Bruno S. Sergi. 2017. "Does Productivity in Africa Benefit from Advanced Countries' R&D?" *Technology Analysis & Strategic Management* 29 (7): 804–16.

Van Looy, Bart, Caro Vereyen, and Ulrich Schmoch 2015. "Patent Statistics: Concordance IPC V8—NACE Rev. 2 (version 2.0)." Eurostat Working Paper, Luxembourg.

Vigil, Mariana, and Laurent Wagner. 2012. "Does Aid for Trade Enhance Export Performance? Investigating the Infrastructure Channel." *World Economy* 35 (7): 838–68.

Walley, Bernard, and Matthew Cushing. 2013. "Development Aid and Foreign R&D Spillovers in Sub-Saharan Africa." *International Journal of Applied Economics* 10 (2): 10–31.

Williams, Heidi L. 2013. "Intellectual Property Rights and Innovation: Evidence from the Human Genome." *Journal of Political Economy* 121 (1): 1–27.

World Bank (WB). 2008. "Global Economic Prospects: Technology Diffusion in the Developing World." Washington, DC.

United Nations Conference on Trade and Development (UNCTAD). 2005. "World Investment Report 2005: Transnational Corporations and the Internationalization of R&D." New York.

Zhao, Minyuan. 2006. "Conducting R&D in Countries with Weak Intellectual Property Rights Protection." *Management Science* 52: 1185–199.

STATISTICAL APPENDIX

The Statistical Appendix presents historical data as well as projections. It comprises seven sections: Assumptions, What's New, Data and Conventions, Country Notes, Classification of Countries, Key Data Documentation, and Statistical Tables.

The assumptions underlying the estimates and projections for 2018–19 and the medium-term scenario for 2020–23 are summarized in the first section. The second section presents a brief description of the changes to the database and statistical tables since the October 2017 *World Economic Outlook* (WEO). The third section provides a general description of the data and the conventions used for calculating country group composites. The fourth section summarizes selected key information for each country. The fifth section summarizes the classification of countries in the various groups presented in the WEO. The sixth section provides information on methods and reporting standards for the member countries' national account and government finance indicators included in the report.

The last, and main, section comprises the statistical tables. (Statistical Appendix A is included here; Statistical Appendix B is available online.) Data in these tables have been compiled on the basis of information available through April 2, 2018. The figures for 2018 and beyond are shown with the same degree of precision as the historical figures solely for convenience; because they are projections, the same degree of accuracy is not to be inferred.

Assumptions

Real effective *exchange rates* for the advanced economies are assumed to remain constant at their average levels measured during the period January 26 to February 23, 2018. For 2018 and 2019, these assumptions imply average US dollar–special drawing right (SDR) conversion rates of 1.454 and 1.464, US dollar–euro conversion rates of 1.240 and 1.254, and yen–US dollar conversion rates of 107.5 and 105.7, respectively.

It is assumed that the *price of oil* will average $62.31 a barrel in 2018 and $58.24 a barrel in 2019.

Established *policies* of national authorities are assumed to be maintained. The more specific policy assumptions underlying the projections for selected economies are described in Box A1.

With regard to *interest rates*, it is assumed that the London interbank offered rate (LIBOR) on six-month US dollar deposits will average 2.4 percent in 2018 and 3.4 percent in 2019, that three-month euro deposits will average –0.3 percent in 2018 and 0.0 percent in 2019, and that six-month yen deposits will average 0.0 percent in 2018 and 0.1 percent in 2019.

As a reminder, with respect to the *introduction of the euro*, on December 31, 1998, the Council of the European Union decided that, effective January 1, 1999, the irrevocably fixed conversion rates between the euro and currencies of the member countries adopting the euro are as follows:

1 euro	=	13.7603	Austrian schillings
	=	40.3399	Belgian francs
	=	0.585274	Cyprus pound[1]
	=	1.95583	Deutsche marks
	=	15.6466	Estonian krooni[2]
	=	5.94573	Finnish markkaa
	=	6.55957	French francs
	=	340.750	Greek drachmas[3]
	=	0.787564	Irish pound
	=	1,936.27	Italian lire
	=	0.702804	Latvian lat[4]
	=	3.45280	Lithuanian litas[5]
	=	40.3399	Luxembourg francs
	=	0.42930	Maltese lira[1]
	=	2.20371	Netherlands guilders
	=	200.482	Portuguese escudos
	=	30.1260	Slovak koruna[6]
	=	239.640	Slovenian tolars[7]
	=	166.386	Spanish pesetas

[1]Established on January 1, 2008.
[2]Established on January 1, 2011.
[3]Established on January 1, 2001.
[4]Established on January 1, 2014.
[5]Established on January 1, 2015.
[6]Established on January 1, 2009.
[7]Established on January 1, 2007.

See Box 5.4 of the October 1998 WEO for details on how the conversion rates were established.

What's New

No changes have been introduced for the April 2018 WEO database.

Data and Conventions

Data and projections for 193 economies form the statistical basis of the WEO database. The data are maintained jointly by the IMF's Research Department and regional departments, with the latter regularly updating country projections based on consistent global assumptions.

Although national statistical agencies are the ultimate providers of historical data and definitions, international organizations are also involved in statistical issues, with the objective of harmonizing methodologies for the compilation of national statistics, including analytical frameworks, concepts, definitions, classifications, and valuation procedures used in the production of economic statistics. The WEO database reflects information from both national source agencies and international organizations.

Most countries' macroeconomic data presented in the WEO conform broadly to the 1993 version of the *System of National Accounts* (SNA). The IMF's sector statistical standards—the sixth edition of the *Balance of Payments and International Investment Position Manual* (BPM6), the *Monetary and Financial Statistics Manual and Compilation Guide* (MFSMCG), and the *Government Finance Statistics Manual 2014* (GFSM 2014)—have been or are being aligned with the SNA 2008. These standards reflect the IMF's special interest in countries' external positions, financial sector stability, and public sector fiscal positions. The process of adapting country data to the new standards begins in earnest when the manuals are released. However, full concordance with the manuals is ultimately dependent on the provision by national statistical compilers of revised country data; hence, the WEO estimates are only partially adapted to these manuals. Nonetheless, for many countries, the impact on major balances and aggregates of conversion to the updated standards will be small. Many other countries have partially adopted the latest standards and will continue implementation over a period of years.[1]

The fiscal gross and net debt data reported in the WEO are drawn from official data sources and IMF staff estimates. While attempts are made to align gross and net debt data with the definitions in the GFSM, as a result of data limitations or specific country circumstances, these data can sometimes deviate from the formal definitions. Although every effort is made to ensure the WEO data are relevant and internationally comparable, differences in both sectoral and instrument coverage mean that the data are not universally comparable. As more information becomes available, changes in either data sources or instrument coverage can give rise to data revisions that can sometimes be substantial. For clarification on the deviations in sectoral or instrument coverage, please refer to the metadata for the online WEO database.

Composite data for country groups in the WEO are either sums or weighted averages of data for individual countries. Unless noted otherwise, multiyear averages of growth rates are expressed as compound annual rates of change.[2] Arithmetically weighted averages are used for all data for the emerging market and developing economies group—except data on inflation and money growth, for which geometric averages are used. The following conventions apply:

- Country group composites for exchange rates, interest rates, and growth rates of monetary aggregates are weighted by GDP converted to US dollars at market exchange rates (averaged over the preceding three years) as a share of group GDP.
- Composites for other data relating to the domestic economy, whether growth rates or ratios, are weighted by GDP valued at purchasing power parity as a share of total world or group GDP.[3] Annual inflation rates are simple percentage changes from the previous years, except in the case of emerging market and developing economies, for which the rates are based on logarithmic differences.
- Composites for real GDP per capita in *purchasing power parity* terms are sums of individual country data after conversion to the international dollar in the years indicated.
- Unless noted otherwise, composites for all sectors for the euro area are corrected for reporting discrepancies in intra-area transactions. Unadjusted annual GDP data are used for the euro area and for the majority of individual countries, with the exception of Cyprus, Germany, Ireland, and Portugal, which

[1] Many countries are implementing the SNA 2008 or European System of National and Regional Accounts (ESA) 2010, and a few countries use versions of the SNA older than that from 1993. A similar adoption pattern is expected for the BPM6 and GFSM 2014. Please refer to Table G, which lists the statistical standards adhered to by each country.

[2] Averages for real GDP and its components, employment, inflation, factor productivity, GDP per capita, trade, and commodity prices are calculated based on the compound annual rate of change, except in the case of the unemployment rate, which is based on the simple arithmetic average.

[3] See "Revised Purchasing Power Parity Weights" in the July 2014 *WEO Update* for a summary of the revised purchasing-power-parity-based weights, as well as Box A2 of the April 2004 WEO and Annex IV of the May 1993 WEO. See also Anne-Marie Gulde and Marianne Schulze-Ghattas, "Purchasing Power Parity Based Weights for the *World Economic Outlook*," in *Staff Studies for the World Economic Outlook* (Washington, DC: International Monetary Fund, December 1993), 106–23.

report calendar adjusted data. For data prior to 1999, data aggregations apply 1995 European currency unit exchange rates.
- Composites for fiscal data are sums of individual country data after conversion to US dollars at the average market exchange rates in the years indicated.
- Composite unemployment rates and employment growth are weighted by labor force as a share of group labor force.
- Composites relating to external sector statistics are sums of individual country data after conversion to US dollars at the average market exchange rates in the years indicated for balance of payments data and at end-of-year market exchange rates for debt denominated in currencies other than US dollars.
- Composites of changes in foreign trade volumes and prices, however, are arithmetic averages of percent changes for individual countries weighted by the US dollar value of exports or imports as a share of total world or group exports or imports (in the preceding year).
- Unless noted otherwise, group composites are computed if 90 percent or more of the share of group weights is represented.

Data refer to calendar years, except in the case of a few countries that use fiscal years; Table F lists the economies with exceptional reporting periods for national accounts and government finance data for each country.

For some countries, the figures for 2017 and earlier are based on estimates rather than actual outturns; Table G lists the latest actual outturns for the indicators in the national accounts, prices, government finance, and balance of payments indicators for each country.

Country Notes

- The consumer price data for *Argentina* before December 2013 reflect the consumer price index (CPI) for the Greater Buenos Aires Area (CPI-GBA), while from December 2013 to October 2015 the data reflect the national CPI (IPCNu). The government that took office in December 2015 discontinued the IPCNu, stating that it was flawed, and released a new CPI for the Greater Buenos Aires Area on June 15, 2016 (a new national CPI has been disseminated starting in June 2017). At its November 9, 2016, meeting, the IMF Executive Board considered the new CPI series to be in line with international standards and lifted the declaration of censure issued in 2013. Given the differences in geographical coverage, weights, sampling, and methodology of these series, the average CPI inflation for 2014, 2015, and 2016, and end-of-period inflation for 2015 and 2016 are not reported in the April 2018 WEO.
- *Argentina*'s authorities discontinued the publication of labor market data in December 2015 and released new series starting in the second quarter of 2016.
- *Argentina*'s and *Venezuela*'s consumer prices are excluded from all WEO group aggregates.
- *Greece*'s primary balance estimates for 2016 are based on preliminary excessive deficit procedure (EDP) data on an accrual basis (ESA 2010) provided by the National Statistical Service (ELSTAT) as of October 23, 2017. Fiscal data since 2010 are adjusted in line with program definitions.
- *India*'s real GDP growth rates are calculated as per national accounts: for 1998 to 2011, with base year 2004/05; thereafter, with base year 2011/12.
- Against the background of a civil war and weak capacities, the reliability of *Libya*'s data, especially medium-term projections, is low.
- Data for *Syria* are excluded from 2011 onward because of the uncertain political situation.
- Projecting the economic outlook in *Venezuela*, including assessing past and current economic developments as the basis for the projections, is complicated by the lack of discussions with the authorities (the last Article IV consultation took place in 2004), long intervals in receiving data (with information gaps), incomplete provision of information, and difficulties in interpreting certain reported economic indicators given economic developments. The fiscal accounts include the budgetary central government and Petróleos de Venezuela, S.A. (PDVSA), and data for 2016–23 are IMF staff estimates. Revenue includes the IMF staff's estimate of foreign exchange profits transferred from the central bank to the government (buying US dollars at the most appreciated rate and selling at more depreciated rates in a multitier exchange rate system) and excludes IMF staff's estimate of revenue from PDVSA's sale of PetroCaribe assets to the central bank. The effects of hyperinflation and the noted data gaps mean that IMF staff's projected macroeconomic indicators need to be interpreted with caution. For example, nominal GDP is estimated assuming the GDP deflator rises in line with IMF staff's projection of average inflation. Public external debt in relation to GDP is projected using IMF staff's estimate of the average exchange rate for the year. Fiscal accounts for 2010–23 correspond to the budgetary central government and PDVSA. Fiscal accounts before 2010 correspond to the budgetary central government, public enterprises (including PDVSA), Instituto Venezolano de los Seguros Sociales (IVSS - social security), and Fondo de Garantía de Depósitos y Protección Bancaria (FOGADE - deposit insurance).

Classification of Countries

Summary of the Country Classification

The country classification in the WEO divides the world into two major groups: advanced economies and emerging market and developing economies.[4] This classification is not based on strict criteria, economic or otherwise, and it has evolved over time. The objective is to facilitate analysis by providing a reasonably meaningful method of organizing data. Table A provides an overview of the country classification, showing the number of countries in each group by region and summarizing some key indicators of their relative size (GDP valued at purchasing power parity, total exports of goods and services, and population).

Some countries remain outside the country classification and therefore are not included in the analysis. Cuba and the Democratic People's Republic of Korea are examples of countries that are not IMF members, and their economies therefore are not monitored by the IMF.

General Features and Composition of Groups in the *World Economic Outlook* Classification

Advanced Economies

The 39 advanced economies are listed in Table B. The seven largest in terms of GDP based on market exchange rates—the United States, Japan, Germany, France, Italy, the United Kingdom, and Canada—constitute the subgroup of *major advanced economies;* often referred to as the Group of Seven (G7). The members of the euro area are also distinguished as a subgroup. Composite data shown in the tables for the euro area cover the current members for all years, even though the membership has increased over time.

Table C lists the member countries of the European Union, not all of which are classified as advanced economies in the WEO.

Emerging Market and Developing Economies

The group of emerging market and developing economies (154) includes all those that are not classified as advanced economies.

The *regional breakdowns* of emerging market and developing economies are *Commonwealth of Independent States* (CIS)*; emerging and developing Asia; emerging and developing Europe* (sometimes also referred to as "central and eastern Europe"); *Latin America and the Caribbean* (LAC); the *Middle East, North Africa, Afghanistan,* and *Pakistan* (MENAP); and *sub-Saharan Africa* (SSA).

Emerging market and developing economies are also classified according to *analytical criteria*. The analytical criteria reflect the composition of export earnings and a distinction between net creditor and net debtor economies. The detailed composition of emerging market and developing economies in the regional and analytical groups is shown in Tables D and E.

The analytical criterion *source of export earnings* distinguishes between the categories *fuel* (Standard International Trade Classification [SITC] 3) and *nonfuel* and then focuses on *nonfuel primary products* (SITCs 0, 1, 2, 4, and 68). Economies are categorized into one of these groups when their main source of export earnings exceeded 50 percent of total exports on average between 2012 and 2016.

The financial criteria focus on *net creditor economies, net debtor economies, heavily indebted poor countries* (HIPCs), and *low-income developing countries* (LIDCs). Economies are categorized as net debtors when their latest net international investment position, where available, was less than zero or their current account balance accumulations from 1972 (or earliest available data) to 2016 were negative. Net debtor economies are further differentiated on the basis of *experience with debt servicing.*[5]

The HIPC group comprises the countries that are or have been considered by the IMF and the World Bank for participation in their debt initiative known as the HIPC Initiative, which aims to reduce the external debt burdens of all the eligible HIPCs to a "sustainable" level in a reasonably short period of time.[6] Many of these countries have already benefited from debt relief and have graduated from the initiative.

The LIDCs are countries that have per capita income levels below a certain threshold (set at $2,700 in 2016 as measured by the World Bank's Atlas method), structural features consistent with limited development and structural transformation, and insufficiently close external financial linkages to be widely seen as emerging market economies.

[4] As used here, the terms "country" and "economy" do not always refer to a territorial entity that is a state as understood by international law and practice. Some territorial entities included here are not states, although their statistical data are maintained on a separate and independent basis.

[5] During 2012–16, 25 economies incurred external payments arrears or entered into official or commercial bank debt-rescheduling agreements. This group is referred to as *economies with arrears and/or rescheduling during 2012–16.*

[6] See David Andrews, Anthony R. Boote, Syed S. Rizavi, and Sukwinder Singh, *Debt Relief for Low-Income Countries: The Enhanced HIPC Initiative,* IMF Pamphlet Series 51 (Washington, DC: International Monetary Fund, November 1999).

Table A. Classification by World Economic Outlook Groups and Their Shares in Aggregate GDP, Exports of Goods and Services, and Population, 2017[1]

(Percent of total for group or world)

		GDP		Exports of Goods and Services		Population	
	Number of Economies	Advanced Economies	World	Advanced Economies	World	Advanced Economies	World
Advanced Economies	**39**	**100.0**	**41.3**	**100.0**	**63.6**	**100.0**	**14.4**
United States		36.9	15.3	16.2	10.3	30.6	4.4
Euro Area	19	28.1	11.6	41.4	26.3	31.8	4.6
Germany		7.9	3.3	12.1	7.7	7.8	1.1
France		5.4	2.2	5.4	3.4	6.1	0.9
Italy		4.4	1.8	4.2	2.7	5.7	0.8
Spain		3.4	1.4	3.1	2.0	4.4	0.6
Japan		10.3	4.3	6.1	3.9	11.9	1.7
United Kingdom		5.6	2.3	5.6	3.5	6.2	0.9
Canada		3.4	1.4	3.5	2.3	3.4	0.5
Other Advanced Economies	16	15.7	6.5	27.3	17.3	16.0	2.3
Memorandum							
Major Advanced Economies	7	74.0	30.6	53.1	33.8	71.7	10.4
		Emerging Market and Developing Economies	World	Emerging Market and Developing Economies	World	Emerging Market and Developing Economies	World
Emerging Market and Developing Economies	**154**	**100.0**	**58.7**	**100.0**	**36.4**	**100.0**	**85.6**
Regional Groups							
Commonwealth of Independent States[2]	12	7.6	4.5	7.5	2.7	4.5	3.9
Russia		5.4	3.2	5.0	1.8	2.3	2.0
Emerging and Developing Asia	30	55.2	32.4	49.5	18.0	56.6	48.5
China		31.1	18.2	29.4	10.7	22.0	18.8
India		12.7	7.4	6.0	2.2	20.9	17.9
Excluding China and India	28	11.5	6.7	14.1	5.2	13.8	11.8
Emerging and Developing Europe	12	6.1	3.6	9.9	3.6	2.8	2.4
Latin America and the Caribbean	32	13.1	7.7	14.1	5.1	9.8	8.4
Brazil		4.3	2.6	3.1	1.1	3.3	2.8
Mexico		3.3	1.9	5.3	1.9	2.0	1.7
Middle East, North Africa, Afghanistan, and Pakistan	23	12.8	7.5	14.6	5.3	10.9	9.3
Middle East and North Africa	21	11.3	6.6	14.2	5.2	7.2	6.1
Sub-Saharan Africa	45	5.1	3.0	4.4	1.6	15.3	13.1
Excluding Nigeria and South Africa	43	2.6	1.5	2.6	0.9	11.4	9.8
Analytical Groups[3]							
By Source of Export Earnings							
Fuel	28	17.9	10.5	20.8	7.6	11.8	10.1
Nonfuel	125	82.1	48.2	79.2	28.9	88.2	75.5
Of Which, Primary Products	31	4.8	2.8	5.1	1.9	8.4	7.2
By External Financing Source							
Net Debtor Economies	121	49.8	29.2	46.5	16.9	67.1	57.4
Net Debtor Economies by Debt-Servicing Experience							
Economies with Arrears and/or Rescheduling during 2012–16	25	3.3	1.9	2.3	0.8	5.7	4.8
Other Groups							
Heavily Indebted Poor Countries	39	2.5	1.4	1.9	0.7	11.5	9.8
Low-Income Developing Countries	59	7.1	4.2	6.7	2.4	22.7	19.4

[1]The GDP shares are based on the purchasing-power-parity valuation of economies' GDP. The number of economies comprising each group reflects those for which data are included in the group aggregates.

[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.

[3]Syria is omitted from the source of export earnings and South Sudan and Syria are omitted from the net external position group composites because of insufficient data.

Table B. Advanced Economies by Subgroup

Major Currency Areas		
United States		
Euro Area		
Japan		
Euro Area		
Austria	Greece	Netherlands
Belgium	Ireland	Portugal
Cyprus	Italy	Slovak Republic
Estonia	Latvia	Slovenia
Finland	Lithuania	Spain
France	Luxembourg	
Germany	Malta	
Major Advanced Economies		
Canada	Italy	United States
France	Japan	
Germany	United Kingdom	
Other Advanced Economies		
Australia	Korea	Singapore
Czech Republic	Macao SAR[2]	Sweden
Denmark	New Zealand	Switzerland
Hong Kong SAR[1]	Norway	Taiwan Province of China
Iceland	Puerto Rico	
Israel	San Marino	

[1]On July 1, 1997, Hong Kong was returned to the People's Republic of China and became a Special Administrative Region of China.
[2]On December 20, 1999, Macao was returned to the People's Republic of China and became a Special Administrative Region of China.

Table C. European Union

Austria	Germany	Poland
Belgium	Greece	Portugal
Bulgaria	Hungary	Romania
Croatia	Ireland	Slovak Republic
Cyprus	Italy	Slovenia
Czech Republic	Latvia	Spain
Denmark	Lithuania	Sweden
Estonia	Luxembourg	United Kingdom
Finland	Malta	
France	Netherlands	

Table D. Emerging Market and Developing Economies by Region and Main Source of Export Earnings

	Fuel	Nonfuel Primary Products
Commonwealth of Independent States		
	Azerbaijan	Uzbekistan
	Kazakhstan	
	Russia	
	Turkmenistan[1]	
Emerging and Developing Asia		
	Brunei Darussalam	Lao P.D.R.
	Timor-Leste	Marshall Islands
		Mongolia
		Papua New Guinea
		Solomon Islands
		Tuvalu
Latin America and the Caribbean		
	Bolivia	Argentina
	Ecuador	Chile
	Trinidad and Tobago	Guyana
	Venezuela	Paraguay
		Suriname
		Uruguay
Middle East, North Africa, Afghanistan, and Pakistan		
	Algeria	Afghanistan
	Bahrain	Mauritania
	Iran	Morocco
	Iraq	Sudan
	Kuwait	
	Libya	
	Oman	
	Qatar	
	Saudi Arabia	
	United Arab Emirates	
	Yemen	
Sub-Saharan Africa		
	Angola	Burkina Faso
	Chad	Burundi
	Republic of Congo	Central African Republic
	Equatorial Guinea	Democratic Republic of the Congo
	Gabon	Côte d'Ivoire
	Nigeria	Eritrea
	South Sudan	Guinea
		Guinea-Bissau
		Liberia
		Malawi
		Mali
		Sierra Leone
		South Africa
		Zambia

[1]Turkmenistan, which is not a member of the Commonwealth of Independent States, is included in this group for reasons of geography and similarity in economic structure.

Table E. Emerging Market and Developing Economies by Region, Net External Position, and Status as Heavily Indebted Poor Countries and Low-Income Developing Countries

	Net External Position[1]	Heavily Indebted Poor Countries[2]	Low-Income Developing Countries
Commonwealth of Independent States			
Armenia	*		
Azerbaijan	•		
Belarus	*		
Georgia[3]	*		
Kazakhstan	*		
Kyrgyz Republic	*		*
Moldova	*		*
Russia	•		
Tajikistan	*		*
Turkmenistan[3]	*		
Ukraine[3]	*		
Uzbekistan	•		*
Emerging and Developing Asia			
Bangladesh	*		*
Bhutan	*		*
Brunei Darussalam	•		
Cambodia	*		*
China	•		
Fiji	*		
India	*		
Indonesia	*		
Kiribati	•		*
Lao P.D.R.	*		*
Malaysia	•		
Maldives	*		
Marshall Islands	*		
Micronesia	•		
Mongolia	*		
Myanmar	*		*
Nauru	*		
Nepal	•		*
Palau	•		
Papua New Guinea	*		*
Philippines	*		
Samoa	*		
Solomon Islands	*		*
Sri Lanka	*		
Thailand	*		
Timor-Leste	•		*
Tonga	*		
Tuvalu	*		
Vanuatu	*		
Vietnam	*		*

	Net External Position[1]	Heavily Indebted Poor Countries[2]	Low-Income Developing Countries
Emerging and Developing Europe			
Albania	*		
Bosnia and Herzegovina	*		
Bulgaria	*		
Croatia	*		
Hungary	*		
Kosovo	*		
FYR Macedonia	*		
Montenegro	*		
Poland	*		
Romania	*		
Serbia	*		
Turkey	*		
Latin America and the Caribbean			
Antigua and Barbuda	*		
Argentina	•		
The Bahamas	*		
Barbados	*		
Belize	*		
Bolivia	*	•	
Brazil	*		
Chile	*		
Colombia	*		
Costa Rica	*		
Dominica	*		
Dominican Republic	*		
Ecuador	*		
El Salvador	*		
Grenada	*		
Guatemala	*		
Guyana	*	•	
Haiti	*	•	*
Honduras	*	•	*
Jamaica	*		
Mexico	*		
Nicaragua	*	•	*
Panama	*		
Paraguay	*		
Peru	*		
St. Kitts and Nevis	*		
St. Lucia	*		
St. Vincent and the Grenadines	*		
Suriname	*		
Trinidad and Tobago	•		
Uruguay	*		
Venezuela	•		

Table E. Emerging Market and Developing Economies by Region, Net External Position, and Status as Heavily Indebted Poor Countries and Low-Income Developing Countries *(continued)*

	Net External Position[1]	Heavily Indebted Poor Countries[2]	Low-Income Developing Countries
Middle East, North Africa, Afghanistan, and Pakistan			
Afghanistan	•	•	*
Algeria	•		
Bahrain	•		
Djibouti	*		*
Egypt	*		
Iran	•		
Iraq	•		
Jordan	*		
Kuwait	•		
Lebanon	*		
Libya	•		
Mauritania	*	•	*
Morocco	*		
Oman	•		
Pakistan	*		
Qatar	•		
Saudi Arabia	•		
Somalia	*	*	*
Sudan	*	*	*
Syria[4]	. . .		
Tunisia	*		
United Arab Emirates	•		
Yemen	*		*
Sub-Saharan Africa			
Angola	•		
Benin	*	•	*
Botswana	•		
Burkina Faso	*	•	*
Burundi	*	•	*
Cabo Verde	*		
Cameroon	*	•	*
Central African Republic	*	•	*
Chad	*	•	*
Comoros	*	•	*

	Net External Position[1]	Heavily Indebted Poor Countries[2]	Low-Income Developing Countries
Democratic Republic of the Congo	*	•	*
Republic of Congo	*	•	*
Côte d'Ivoire	*	•	*
Equatorial Guinea	*		
Eritrea	*	*	*
Ethiopia	*	•	*
Gabon	•		
The Gambia	*	•	*
Ghana	*	•	*
Guinea	*	•	*
Guinea-Bissau	*	•	*
Kenya	*		*
Lesotho	*		*
Liberia	*	•	*
Madagascar	*	•	*
Malawi	*	•	*
Mali	*	•	*
Mauritius	•		
Mozambique	*	•	*
Namibia	*		
Niger	*	•	*
Nigeria	*		*
Rwanda	*	•	*
São Tomé and Príncipe	*	•	*
Senegal	*	•	*
Seychelles	*		
Sierra Leone	*	•	*
South Africa	•		
South Sudan[4]	. . .		*
Swaziland	•		
Tanzania	*	•	*
Togo	*	•	*
Uganda	*	•	*
Zambia	*	•	*
Zimbabwe	*		*

[1]Dot (star) indicates that the country is a net creditor (net debtor).
[2]Dot instead of star indicates that the country has reached the completion point, which allows it to receive the full debt relief committed to at the decision point.
[3]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[4]South Sudan and Syria are omitted from the net external position group composite for lack of a fully developed database.

Table F. Economies with Exceptional Reporting Periods[1]

	National Accounts	Government Finance
The Bahamas		Jul/Jun
Bangladesh		Jul/Jun
Barbados		Apr/Mar
Belize		Apr/Mar
Bhutan	Jul/Jun	Jul/Jun
Botswana		Apr/Mar
Dominica		Jul/Jun
Egypt	Jul/Jun	Jul/Jun
Ethiopia	Jul/Jun	Jul/Jun
Haiti	Oct/Sep	Oct/Sep
Hong Kong SAR		Apr/Mar
India	Apr/Mar	Apr/Mar
Iran	Apr/Mar	Apr/Mar
Jamaica		Apr/Mar
Lesotho	Apr/Mar	Apr/Mar
Malawi		Jul/Jun
Marshall Islands	Oct/Sep	Oct/Sep
Mauritius		Jul/Jun
Micronesia	Oct/Sep	Oct/Sep
Myanmar	Oct/Sep	Oct/Sep
Nauru	Jul/Jun	Jul/Jun
Nepal	Aug/Jul	Aug/Jul
Pakistan	Jul/Jun	Jul/Jun
Palau	Oct/Sep	Oct/Sep
Puerto Rico	Jul/Jun	Jul/Jun
St. Lucia		Apr/Mar
Samoa	Jul/Jun	Jul/Jun
Singapore		Apr/Mar
Swaziland		Apr/Mar
Thailand		Oct/Sep
Trinidad and Tobago		Oct/Sep

[1]Unless noted otherwise, all data refer to calendar years.

Table G. Key Data Documentation

		National Accounts					Prices (CPI)	
Country	Currency	Historical Data Source[1]	Latest Actual Annual Data	Base Year[2]	System of National Accounts	Use of Chain-Weighted Methodology[3]	Historical Data Source[1]	Latest Actual Annual Data
Afghanistan	Afghan afghani	NSO	2016	2002/03	SNA 1993		NSO	2017
Albania	Albanian lek	IMF staff	2016	1996	SNA 1993	From 1996	NSO	2017
Algeria	Algerian dinar	NSO	2016	2001	SNA 1993	From 2005	NSO	2017
Angola	Angolan kwanza	MEP	2015	2002	ESA 1995		NSO	2015
Antigua and Barbuda	Eastern Caribbean dollar	CB	2016	2006[6]	SNA 1993		NSO	2016
Argentina	Argentine peso	NSO	2017	2004	SNA 2008		NSO	2017
Armenia	Armenian dram	NSO	2016	2005	SNA 2008		NSO	2016
Australia	Australian dollar	NSO	2017	2015/16	SNA 2008	From 1980	NSO	2017
Austria	Euro	NSO	2016	2010	ESA 2010	From 1995	NSO	2017
Azerbaijan	Azerbaijan manat	NSO	2016	2005	SNA 1993	From 1994	NSO	2017
The Bahamas	Bahamian dollar	NSO	2016	2012	SNA 1993		NSO	2017
Bahrain	Bahrain dinar	NSO	2016	2010	SNA 2008		NSO	2017
Bangladesh	Bangladesh taka	NSO	2016	2005	SNA 1993		NSO	2016
Barbados	Barbados dollar	NSO and CB	2014	1974[6]	SNA 1993		NSO	2017
Belarus	Belarusian ruble	NSO	2016	2014	SNA 2008	From 2005	NSO	2017
Belgium	Euro	CB	2016	2015	ESA 2010	From 1995	CB	2016
Belize	Belize dollar	NSO	2016	2000	SNA 1993		NSO	2016
Benin	CFA franc	NSO	2014	2007	SNA 1993		NSO	2017
Bhutan	Bhutanese ngultrum	NSO	2015/16	2000/01[6]	SNA 1993		CB	2015/16
Bolivia	Bolivian boliviano	NSO	2016	1990	Other		NSO	2017
Bosnia and Herzegovina	Bosnia convertible marka	NSO	2016	2010	ESA 2010	From 2000	NSO	2016
Botswana	Botswana pula	NSO	2015	2006	SNA 1993		NSO	2016
Brazil	Brazilian real	NSO	2017	1995	SNA 2008		NSO	2017
Brunei Darussalam	Brunei dollar	NSO and GAD	2016	2010	SNA 1993		NSO and GAD	2017
Bulgaria	Bulgarian lev	NSO	2016	2010	ESA 2010	From 1996	NSO	2017
Burkina Faso	CFA franc	NSO and MEP	2016	1999	SNA 1993		NSO	2016
Burundi	Burundi franc	NSO	2015	2005	SNA 1993		NSO	2017
Cabo Verde	Cabo Verdean escudo	NSO	2016	2007	SNA 2008	From 2011	NSO	2017
Cambodia	Cambodian riel	NSO	2016	2000	SNA 1993		NSO	2017
Cameroon	CFA franc	NSO	2016	2005	SNA 1993		NSO	2017
Canada	Canadian dollar	NSO	2016	2007	SNA 2008	From 1980	NSO	2017
Central African Republic	CFA franc	NSO	2012	2005	SNA 1993		NSO	2015
Chad	CFA franc	CB	2017	2005	Other		NSO	2017
Chile	Chilean peso	CB	2017	2013[6]	SNA 2008	From 2003	NSO	2017
China	Chinese yuan	NSO	2017	2015	SNA 2008		NSO	2017
Colombia	Colombian peso	NSO	2017	2005	Other	From 2000	NSO	2017
Comoros	Comorian franc	MEP	2015	2000	Other		NSO	2015
Democratic Republic of the Congo	Congolese franc	NSO	2016	2005	SNA 1993		CB	2016
Republic of Congo	CFA franc	NSO	2016	1990	SNA 1993		NSO	2017
Costa Rica	Costa Rican colón	CB	2016	2012	SNA 2008		CB	2016

Table G. Key Data Documentation *(continued)*

	Government Finance					Balance of Payments		
Country	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source	Subsectors Coverage[4]	Accounting Practice[5]	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source
Afghanistan	MoF	2017	2001	CG	C	NSO, MoF, and CB	2017	BPM 5
Albania	IMF staff	2016	1986	CG,LG,SS,MPC, NFPC	Other	CB	2016	BPM 6
Algeria	MoF	2016	1986	CG	C	CB	2016	BPM 6
Angola	MoF	2016	2001	CG,LG	Other	CB	2016	BPM 6
Antigua and Barbuda	MoF	2016	2001	CG	C	CB	2016	BPM 6
Argentina	MEP	2017	1986	CG,SG,SS	C	NSO	2017	BPM 6
Armenia	MoF	2016	2001	CG	C	CB	2016	BPM 6
Australia	MoF	2016	2014	CG,SG,LG,TG	A	NSO	2017	BPM 6
Austria	NSO	2016	2001	CG,SG,LG,SS	A	CB	2016	BPM 6
Azerbaijan	MoF	2015	Other	CG	C	CB	2016	BPM 6
The Bahamas	MoF	2016/17	2001	CG	C	CB	2017	BPM 5
Bahrain	MoF	2016	2001	CG	C	CB	2017	BPM 6
Bangladesh	MoF	2015/16	Other	CG	C	CB	2016	BPM 6
Barbados	MoF	2016/17	1986	CG	C	CB	2016	BPM 5
Belarus	MoF	2016	2001	CG,LG,SS	C	CB	2016	BPM 6
Belgium	CB	2016	ESA 2010	CG,SG,LG,SS	A	CB	2016	BPM 6
Belize	MoF	2016/17	1986	CG,MPC	Mixed	CB	2016	BPM 6
Benin	MoF	2016	1986	CG	C	CB	2016	BPM 6
Bhutan	MoF	2015/16	1986	CG	C	CB	2014/15	BPM 6
Bolivia	MoF	2016	2001	CG,LG,SS,NMPC, NFPC	C	CB	2016	BPM 6
Bosnia and Herzegovina	MoF	2015	2001	CG,SG,LG,SS	Mixed	CB	2016	BPM 6
Botswana	MoF	2015/16	1986	CG	C	CB	2015	BPM 5
Brazil	MoF	2017	2001	CG,SG,LG,SS, MPC,NFPC	C	CB	2017	BPM 6
Brunei Darussalam	MoF	2016	Other	CG, BCG	C	NSO, MEP, and GAD	2015	BPM 6
Bulgaria	MoF	2016	2001	CG,LG,SS	C	CB	2016	BPM 6
Burkina Faso	MoF	2016	2001	CG	CB	CB	2016	BPM 6
Burundi	MoF	2015	2001	CG	A	CB	2016	BPM 6
Cabo Verde	MoF	2016	2001	CG	A	NSO	2016	BPM 6
Cambodia	MoF	2016	1986	CG,LG	A	CB	2016	BPM 5
Cameroon	MoF	2016	2001	CG,NFPC	C	MoF	2016	BPM 5
Canada	MoF	2016	2001	CG,SG,LG,SS	A	NSO	2016	BPM 6
Central African Republic	MoF	2016	2001	CG	C	CB	2015	BPM 5
Chad	MoF	2017	1986	CG,NFPC	C	CB	2015	BPM 6
Chile	MoF	2016	2001	CG,LG	A	CB	2017	BPM 6
China	MoF	2017	Other	CG,LG	C	GAD	2017	BPM 6
Colombia	MoF	2017	2001	CG,SG,LG,SS	Other	CB and NSO	2017	BPM 6
Comoros	MoF	2016	1986	CG	Mixed	CB and IMF staff	2016	BPM 5
Democratic Republic of the Congo	MoF	2016	2001	CG,LG	A	CB	2016	BPM 5
Republic of Congo	MoF	2017	2001	CG	A	CB	2015	BPM 6
Costa Rica	MoF and CB	2016	1986	CG	C	CB	2016	BPM 6

Table G. Key Data Documentation *(continued)*

		National Accounts					Prices (CPI)	
Country	Currency	Historical Data Source[1]	Latest Actual Annual Data	Base Year[2]	System of National Accounts	Use of Chain-Weighted Methodology[3]	Historical Data Source[1]	Latest Actual Annual Data
Côte d'Ivoire	CFA franc	NSO	2015	2009	SNA 1993		NSO	2017
Croatia	Croatian kuna	NSO	2016	2010	ESA 2010		NSO	2017
Cyprus	Euro	NSO	2016	2005	ESA 2010	From 1995	NSO	2016
Czech Republic	Czech koruna	NSO	2017	2010	ESA 2010	From 1995	NSO	2017
Denmark	Danish krone	NSO	2017	2010	ESA 2010	From 1980	NSO	2017
Djibouti	Djibouti franc	NSO	2013	1990	Other		NSO	2017
Dominica	Eastern Caribbean dollar	NSO	2015	2006	SNA 1993		NSO	2015
Dominican Republic	Dominican peso	CB	2016	2007	SNA 2008	From 2007	CB	2017
Ecuador	US dollar	CB	2016	2007	SNA 1993		NSO and CB	2017
Egypt	Egyptian pound	MEP	2016/17	2011/12	SNA 1993		NSO	2016/17
El Salvador	US dollar	CB	2016	1990	Other		NSO	2017
Equatorial Guinea	CFA franc	MEP and CB	2016	2006	SNA 1993		MEP	2017
Eritrea	Eritrean nakfa	IMF staff	2006	2005	SNA 1993		NSO	2009
Estonia	Euro	NSO	2017	2010	ESA 2010	From 2010	NSO	2017
Ethiopia	Ethiopian birr	NSO	2016/17	2015/16	SNA 1993		NSO	2016
Fiji	Fijian dollar	NSO	2017	2011[6]	SNA 1993		NSO	2017
Finland	Euro	NSO	2017	2010	ESA 2010	From 1980	NSO	2017
France	Euro	NSO	2017	2010	ESA 2010	From 1980	NSO	2017
Gabon	CFA franc	MoF	2016	2001	SNA 1993		NSO	2017
The Gambia	Gambian dalasi	NSO	2016	2004	SNA 1993		NSO	2016
Georgia	Georgian lari	NSO	2016	2000	SNA 1993	From 1996	NSO	2017
Germany	Euro	NSO	2017	2010	ESA 2010	From 1991	NSO	2017
Ghana	Ghanaian cedi	NSO	2016	2006	SNA 1993		NSO	2017
Greece	Euro	NSO	2017	2010	ESA 2010	From 1995	NSO	2017
Grenada	Eastern Caribbean dollar	NSO	2016	2006	SNA 1993		NSO	2017
Guatemala	Guatemalan quetzal	CB	2016	2001	SNA 1993	From 2001	NSO	2016
Guinea	Guinean franc	NSO	2016	2010	SNA 1993		NSO	2017
Guinea-Bissau	CFA franc	NSO	2015	2005	SNA 1993		NSO	2017
Guyana	Guyanese dollar	NSO	2016	2006[6]	SNA 1993		NSO	2016
Haiti	Haitian gourde	NSO	2016/17	1986/87	SNA 2008		NSO	2016/17
Honduras	Honduran lempira	CB	2016	2000	SNA 1993		CB	2016
Hong Kong SAR	Hong Kong dollar	NSO	2017	2014	SNA 2008	From 1980	NSO	2017
Hungary	Hungarian forint	NSO	2017	2005	ESA 2010	From 2005	IEO	2017
Iceland	Icelandic króna	NSO	2017	2005	ESA 2010	From 1990	NSO	2017
India	Indian rupee	NSO	2016/17	2011/12	SNA 2008		NSO	2016/17
Indonesia	Indonesian rupiah	NSO	2017	2010	SNA 2008		NSO	2017
Iran	Iranian rial	CB	2016/17	2011/12	SNA 1993		CB	2016/17
Iraq	Iraqi dinar	NSO	2016	2007	SNA 1968/93		NSO	2016
Ireland	Euro	NSO	2017	2015	ESA 2010	From 1995	NSO	2017
Israel	New Israeli shekel	NSO	2017	2015	SNA 2008	From 1995	NSO	2017
Italy	Euro	NSO	2016	2010	ESA 2010	From 1980	NSO	2017
Jamaica	Jamaican dollar	NSO	2016	2007	SNA 1993		NSO	2016

Table G. Key Data Documentation *(continued)*

	Government Finance					Balance of Payments		
Country	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source	Subsectors Coverage[4]	Accounting Practice[5]	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source
Côte d'Ivoire	MoF	2016	1986	CG	A	CB	2015	BPM 6
Croatia	MoF	2016	2001	CG,LG	A	CB	2016	BPM 6
Cyprus	NSO	2017	ESA 2010	CG,LG,SS	A	CB	2016	BPM 6
Czech Republic	MoF	2016	2001	CG,LG,SS	A	NSO	2017	BPM 6
Denmark	NSO	2016	2001	CG,LG,SS	A	NSO	2017	BPM 6
Djibouti	MoF	2016	2001	CG	A	CB	2016	BPM 5
Dominica	MoF	2015/16	1986	CG	C	CB	2015	BPM 6
Dominican Republic	MoF	2016	2001	CG,SG,LG,SS, NMPC	Mixed	CB	2016	BPM 6
Ecuador	CB and MoF	2016	1986	CG,SG,LG,SS, NFPC	C	CB	2016	BPM 6
Egypt	MoF	2016/17	2001	CG,LG,SS,MPC	C	CB	2016/17	BPM 5
El Salvador	MoF and CB	2017	1986	CG,LG,SS	C	CB	2016	BPM 6
Equatorial Guinea	MoF	2016	1986	CG	C	CB	2016	BPM 5
Eritrea	MoF	2008	2001	CG	C	CB	2008	BPM 5
Estonia	MoF	2017	1986/2001	CG,LG,SS	C	CB	2016	BPM 6
Ethiopia	MoF	2015/16	1986	CG,SG,LG,NFPC	C	CB	2015/16	BPM 5
Fiji	MoF	2016	1986	CG	C	CB	2016	BPM 6
Finland	MoF	2016	2001	CG,LG,SS	A	NSO	2017	BPM 6
France	NSO	2016	2001	CG,LG,SS	A	CB	2017	BPM 6
Gabon	IMF staff	2017	2001	CG	A	CB	2016	BPM 5
The Gambia	MoF	2016	1986	CG	C	CB and IMF staff	2016	BPM 5
Georgia	MoF	2017	2001	CG,LG	C	NSO and CB	2016	BPM 5
Germany	NSO	2017	2001	CG,SG,LG,SS	A	CB	2017	BPM 6
Ghana	MoF	2016	2001	CG	C	CB	2016	BPM 5
Greece	NSO	2016	2014	CG,LG,SS	A	CB	2017	BPM 6
Grenada	MoF	2017	2001	CG	CB	CB	2016	BPM 6
Guatemala	MoF	2016	2001	CG	C	CB	2016	BPM 6
Guinea	MoF	2016	2001	CG	Other	CB and MEP	2016	BPM 6
Guinea-Bissau	MoF	2014	2001	CG	A	CB	2015	BPM 6
Guyana	MoF	2016	1986	CG,SS,NFPC	C	CB	2016	BPM 5
Haiti	MoF	2016/17	2001	CG	C	CB	2016/17	BPM 5
Honduras	MoF	2016	2014	CG,LG,SS,NFPC	A	CB	2015	BPM 5
Hong Kong SAR	NSO	2016/17	2001	CG	C	NSO	2016	BPM 6
Hungary	MEP and NSO	2016	ESA 2010	CG,LG,SS,NMPC	A	CB	2017	BPM 6
Iceland	NSO	2016	2001	CG,SG,SS	A	CB	2017	BPM 6
India	MoF and IMF staff	2016/17	1986	CG,SG	C	CB	2016/17	BPM 6
Indonesia	MoF	2016	2001	CG,LG	C	CB	2017	BPM 6
Iran	MoF	2016/17	2001	CG	C	CB	2016/17	BPM 5
Iraq	MoF	2016	2001	CG	C	CB	2016	BPM 5
Ireland	MoF and NSO	2016	2001	CG,LG,SS	A	NSO	2017	BPM 6
Israel	MoF and NSO	2017	2001	CG,LG,SS	Other	NSO	2017	BPM 6
Italy	NSO	2016	2001	CG,LG,SS	A	NSO	2016	BPM 6
Jamaica	MoF	2016/17	1986	CG	C	CB	2016	BPM 5

Table G. Key Data Documentation *(continued)*

		National Accounts					Prices (CPI)	
Country	Currency	Historical Data Source[1]	Latest Actual Annual Data	Base Year[2]	System of National Accounts	Use of Chain-Weighted Methodology[3]	Historical Data Source[1]	Latest Actual Annual Data
Japan	Japanese yen	GAD	2017	2011	SNA 2008	From 1980	GAD	2017
Jordan	Jordanian dinar	NSO	2016	1994	SNA 1993		NSO	2016
Kazakhstan	Kazakhstani tenge	NSO	2016	2007	SNA 1993	From 1994	CB	2016
Kenya	Kenya shilling	NSO	2016	2009	SNA 2008		NSO	2017
Kiribati	Australian dollar	NSO	2016	2006	SNA 2008		NSO	2016
Korea	South Korean won	CB	2017	2010	SNA 2008	From 1980	NSO	2017
Kosovo	Euro	NSO	2016	2015	ESA 2010		NSO	2016
Kuwait	Kuwaiti dinar	MEP and NSO	2016	2010	SNA 1993		NSO and MEP	2016
Kyrgyz Republic	Kyrgyz som	NSO	2016	2005	SNA 1993		NSO	2017
Lao P.D.R.	Lao kip	NSO	2016	2012	SNA 1993		NSO	2016
Latvia	Euro	NSO	2017	2010	ESA 2010	From 1995	NSO	2017
Lebanon	Lebanese pound	NSO	2013	2010	SNA 2008	From 2010	NSO	2015/16
Lesotho	Lesotho loti	NSO	2015/16	2012/13	Other		NSO	2017
Liberia	US dollar	CB	2016	1992	SNA 1993		CB	2016
Libya	Libyan dinar	MEP	2016	2003	SNA 1993		NSO	2017
Lithuania	Euro	NSO	2017	2010	ESA 2010	From 2005	NSO	2017
Luxembourg	Euro	NSO	2016	2010	ESA 2010	From 1995	NSO	2016
Macao SAR	Macanese pataca	NSO	2016	2015	SNA 2008	From 2001	NSO	2017
FYR Macedonia	Macedonian denar	NSO	2017	2005	ESA 2010		NSO	2017
Madagascar	Malagasy ariary	NSO	2015	2000	SNA 1968		NSO	2016
Malawi	Malawian kwacha	NSO	2011	2010	SNA 2008		NSO	2017
Malaysia	Malaysian ringgit	NSO	2017	2010	SNA 2008		NSO	2017
Maldives	Maldivian rufiyaa	MoF and NSO	2016	2014	SNA 1993		CB	2017
Mali	CFA franc	NSO	2016	1999	SNA 1993		NSO	2016
Malta	Euro	NSO	2017	2010	ESA 2010	From 2000	NSO	2017
Marshall Islands	US dollar	NSO	2016/17	2003/04	SNA 1993		NSO	2016/17
Mauritania	Mauritanian ouguiya	NSO	2014	2004	SNA 1993		NSO	2017
Mauritius	Mauritian rupee	NSO	2016	2006	SNA 1993	From 1999	NSO	2017
Mexico	Mexican peso	NSO	2016	2013	SNA 2008		NSO	2017
Micronesia	US dollar	NSO	2014/15	2004	SNA 1993		NSO	2014/15
Moldova	Moldovan leu	NSO	2016	1995	SNA 1993		NSO	2017
Mongolia	Mongolian tögrög	NSO	2016	2010	SNA 1993		NSO	2016
Montenegro	Euro	NSO	2016	2006	ESA 1995		NSO	2016
Morocco	Moroccan dirham	NSO	2016	2007	SNA 1993	From 1998	NSO	2017
Mozambique	Mozambican metical	NSO	2016	2009	SNA 1993/2008		NSO	2017
Myanmar	Myanmar kyat	MEP	2016/17	2010/11	Other		NSO	2016/17
Namibia	Namibia dollar	NSO	2016	2000	SNA 1993		NSO	2016
Nauru	Australian dollar	Other	2015/16	2006/07	SNA 1993		NSO	2016/17
Nepal	Nepalese rupee	NSO	2015/16	2000/01	SNA 1993		CB	2016/17
Netherlands	Euro	NSO	2017	2010	ESA 2010	From 1980	NSO	2017
New Zealand	New Zealand dollar	NSO	2017	2009/10	Other	From 1987	NSO	2017
Nicaragua	Nicaraguan córdoba	CB	2016	2006	SNA 1993	From 1994	CB	2017
Niger	CFA franc	NSO	2016	2000	SNA 1993		NSO	2017
Nigeria	Nigerian naira	NSO	2017	2010	SNA 2008		NSO	2017
Norway	Norwegian krone	NSO	2017	2015	ESA 2010	From 1980	NSO	2017

Table G. Key Data Documentation *(continued)*

	Government Finance					Balance of Payments		
Country	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source	Subsectors Coverage[4]	Accounting Practice[5]	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source
Japan	GAD	2016	2014	CG,LG,SS	A	MoF	2017	BPM 6
Jordan	MoF	2016	2001	CG,NFPC	C	CB	2016	BPM 5
Kazakhstan	NSO	2016	2001	CG,LG	A	CB	2016	BPM 6
Kenya	MoF	2017	2001	CG	A	CB	2017	BPM 6
Kiribati	MoF	2016	1986	CG,LG	C	NSO	2016	BPM 6
Korea	MoF	2017	2001	CG	C	CB	2017	BPM 6
Kosovo	MoF	2016	Other	CG,LG	C	CB	2016	BPM 5
Kuwait	MoF	2016	1986	CG	Mixed	CB	2016	BPM 6
Kyrgyz Republic	MoF	2016	Other	CG,LG,SS	C	CB	2016	BPM 5
Lao P.D.R.	MoF	2016	2001	CG	C	CB	2016	BPM 5
Latvia	MoF	2017	1986	CG,LG,SS	C	CB	2017	BPM 6
Lebanon	MoF	2015	2001	CG	Mixed	CB and IMF staff	2015	BPM 5
Lesotho	MoF	2016/17	2001	CG,LG	C	CB	2016/17	BPM 5
Liberia	MoF	2016	2001	CG	A	CB	2016	BPM 5
Libya	MoF	2017	1986	CG,SG,LG	C	CB	2017	BPM 5
Lithuania	MoF	2016	2014	CG,LG,SS	A	CB	2016	BPM 6
Luxembourg	MoF	2016	2001	CG,LG,SS	A	NSO	2016	BPM 6
Macao SAR	MoF	2016	2014	CG,SS	C	NSO	2016	BPM 6
FYR Macedonia	MoF	2017	1986	CG,SG,SS	C	CB	2017	BPM 6
Madagascar	MoF	2016	1986	CG,LG	C	CB	2016	BPM 5
Malawi	MoF	2016/17	1986	CG	C	NSO and GAD	2016	BPM 6
Malaysia	MoF	2016	2001	CG,SG,LG	C	NSO	2017	BPM 6
Maldives	MoF	2017	1986	CG	C	CB	2016	BPM 5
Mali	MoF	2016	2001	CG	Mixed	CB	2016	BPM 6
Malta	NSO	2016	2001	CG,SS	A	NSO	2016	BPM 6
Marshall Islands	MoF	2016/17	2001	CG,LG,SS	A	NSO	2016/17	BPM 6
Mauritania	MoF	2017	1986	CG	C	CB	2016	BPM 5
Mauritius	MoF	2016/17	2001	CG,LG,NFPC	C	CB	2017	BPM 6
Mexico	MoF	2017	2014	CG,SS,NMPC,NFPC	C	CB	2016	BPM 6
Micronesia	MoF	2014/15	2001	CG,SG,LG,SS	Other	NSO	2014/15	Other
Moldova	MoF	2016	1986	CG,LG,SS	C	CB	2016	BPM 5
Mongolia	MoF	2016	2001	CG,SG,LG,SS	C	CB	2016	BPM 6
Montenegro	MoF	2016	1986	CG,LG,SS	C	CB	2016	BPM 6
Morocco	MEP	2017	2001	CG	A	GAD	2017	BPM 6
Mozambique	MoF	2016	2001	CG,SG	Mixed	CB	2017	BPM 6
Myanmar	MoF	2016/17	Other	CG,NFPC	C	IMF staff	2016/17	BPM 5
Namibia	MoF	2016	2001	CG	C	CB	2015	BPM 6
Nauru	MoF	2016/17	2001	CG	Mixed	IMF staff	2014/15	BPM 6
Nepal	MoF	2015/16	2001	CG	C	CB	2015/16	BPM 5
Netherlands	MoF	2016	2001	CG,LG,SS	A	CB	2016	BPM 6
New Zealand	MoF	2016/17	2001	CG	A	NSO	2017	BPM 6
Nicaragua	MoF	2016	1986	CG,LG,SS	C	IMF staff	2016	BPM 6
Niger	MoF	2017	1986	CG	A	CB	2017	BPM 6
Nigeria	MoF	2017	2001	CG,SG,LG	C	CB	2016	BPM 6
Norway	NSO and MoF	2016	2014	CG,LG,SS	A	NSO	2017	BPM 6

Table G. Key Data Documentation *(continued)*

		National Accounts					Prices (CPI)	
Country	Currency	Historical Data Source[1]	Latest Actual Annual Data	Base Year[2]	System of National Accounts	Use of Chain-Weighted Methodology[3]	Historical Data Source[1]	Latest Actual Annual Data
Oman	Omani rial	NSO	2015	2010	SNA 1993		NSO	2016
Pakistan	Pakistan rupee	NSO	2015/16	2005/06[6]	SNA 1968/ 1993		NSO	2016/17
Palau	US dollar	MoF	2015/16	2004/05	SNA 1993		MoF	2015/16
Panama	US dollar	NSO	2017	2007	SNA 1993	From 2007	NSO	2017
Papua New Guinea	Papua New Guinea kina	NSO and MoF	2015	2013	SNA 1993		NSO	2015
Paraguay	Paraguayan guaraní	CB	2016	1994	SNA 1993		CB	2017
Peru	Peruvian nuevo sol	CB	2017	2007	SNA 1993		CB	2017
Philippines	Philippine peso	NSO	2017	2000	SNA 2008		NSO	2017
Poland	Polish zloty	NSO	2017	2010	ESA 2010	From 1995	NSO	2017
Portugal	Euro	NSO	2017	2011	ESA 2010	From 1980	NSO	2017
Puerto Rico	US dollar	NSO	2014/15	1954	SNA 1968		MEP	2016
Qatar	Qatari riyal	NSO and MEP	2016	2013	SNA 1993		NSO and MEP	2017
Romania	Romanian leu	NSO	2016	2010	ESA 2010	From 2000	NSO	2016
Russia	Russian ruble	NSO	2017	2016	SNA 2008	From 1995	NSO	2017
Rwanda	Rwandan franc	NSO	2016	2014	SNA 2008		NSO	2017
Samoa	Samoa tala	NSO	2016/17	2009/10	SNA 1993		NSO	2016/17
San Marino	Euro	NSO	2016	2007	Other		NSO	2017
São Tomé and Príncipe	São Tomé and Príncipe dobra	NSO	2016	2000	SNA 1993		NSO	2016
Saudi Arabia	Saudi riyal	NSO and MEP	2016	2010	SNA 1993		NSO and MEP	2016
Senegal	CFA franc	NSO	2016	2000	SNA 1993		NSO	2017
Serbia	Serbian dinar	NSO	2016	2010	ESA 2010	From 2010	NSO	2016
Seychelles	Seychellois rupee	NSO	2015	2006	SNA 1993		NSO	2016
Sierra Leone	Sierra Leonean leone	NSO	2016	2006	SNA 1993	From 2010	NSO	2016
Singapore	Singapore dollar	NSO	2017	2010	SNA 2008		NSO	2017
Slovak Republic	Euro	NSO	2017	2010	ESA 2010	From 1997	NSO	2017
Slovenia	Euro	NSO	2017	2010	ESA 2010	From 2000	NSO	2017
Solomon Islands	Solomon Islands dollar	CB	2016	2004	SNA 1993		NSO	2016
Somalia	US dollar	CB	2016	2012	SNA 1993		CB	2014
South Africa	South African rand	NSO	2017	2010	SNA 1993		NSO	2017
South Sudan	South Sudanese pound	NSO	2016	2010	SNA 1993		NSO	2016
Spain	Euro	NSO	2017	2010	ESA 2010	From 1995	NSO	2017
Sri Lanka	Sri Lankan rupee	NSO	2017	2010	SNA 1993		NSO	2017
St. Kitts and Nevis	Eastern Caribbean dollar	NSO	2016	2006[6]	SNA 1993		NSO	2016
St. Lucia	Eastern Caribbean dollar	NSO	2016	2006	SNA 1993		NSO	2016
St. Vincent and the Grenadines	Eastern Caribbean dollar	NSO	2016	2006[6]	SNA 1993		NSO	2016
Sudan	Sudanese pound	NSO	2015	1996	Other		NSO	2015
Suriname	Surinamese dollar	NSO	2016	2007	SNA 1993		NSO	2017

Table G. Key Data Documentation *(continued)*

	Government Finance					Balance of Payments		
Country	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source	Subsectors Coverage[4]	Accounting Practice[5]	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source
Oman	MoF	2016	2001	CG	C	CB	2015	BPM 5
Pakistan	MoF	2016/17	1986	CG,SG,LG	C	CB	2016/17	BPM 5
Palau	MoF	2015/16	2001	CG	Other	MoF	2015/16	BPM 6
Panama	MoF	2016	1986	CG,SG,LG,SS, NFPC	C	NSO	2016	BPM 6
Papua New Guinea	MoF	2015	1986	CG	C	CB	2015	BPM 5
Paraguay	MoF	2016	2001	CG,SG,LG,SS,MPC, NFPC	C	CB	2016	BPM 5
Peru	MoF	2017	1986	CG,SG,LG,SS	C	CB	2017	BPM 5
Philippines	MoF	2017	2001	CG,LG,SS	C	CB	2016	BPM 6
Poland	MoF and NSO	2016	ESA 2010	CG,LG,SS	A	CB	2016	BPM 6
Portugal	NSO	2016	2001	CG,LG,SS	A	CB	2017	BPM 6
Puerto Rico	MEP	2015/16	2001	Other	A	. . .	. . .	. . .
Qatar	MoF	2015	1986	CG	C	CB and IMF staff	2017	BPM 5
Romania	MoF	2016	2001	CG,LG,SS	C	CB	2016	BPM 6
Russia	MoF	2017	2001	CG,SG,SS	Mixed	CB	2017	BPM 6
Rwanda	MoF	2016	1986	CG,LG	Mixed	CB	2016	BPM 6
Samoa	MoF	2016/17	2001	CG	A	CB	2016/17	BPM 6
San Marino	MoF	2016	Other	CG	Other	. . .	. . .	. . .
São Tomé and Príncipe	MoF and Customs	2016	2001	CG	C	CB	2016	BPM 6
Saudi Arabia	MoF	2016	2014	CG	C	CB	2016	BPM 6
Senegal	MoF	2016	2001	CG	C	CB and IMF staff	2017	BPM 6
Serbia	MoF	2016	1986/2001	CG,SG,LG,SS	C	CB	2016	BPM 6
Seychelles	MoF	2016	1986	CG,SS	C	CB	2016	BPM 6
Sierra Leone	MoF	2017	1986	CG	C	CB	2016	BPM 5
Singapore	MoF	2016/17	2001	CG	C	NSO	2017	BPM 6
Slovak Republic	NSO	2017	2001	CG,LG,SS	A	CB	2017	BPM 6
Slovenia	MoF	2017	1986	CG,SG,LG,SS	C	NSO	2017	BPM 6
Solomon Islands	MoF	2016	1986	CG	C	CB	2016	BPM 6
Somalia	MoF	2016	2001	CG	C	CB	2016	BPM 5
South Africa	MoF	2016	2001	CG,SG,SS	C	CB	2016	BPM 6
South Sudan	MoF and MEP	2016	Other	CG	C	MoF, NSO, and MEP	2016	BPM 5
Spain	MoF and NSO	2016	ESA 2010	CG,SG,LG,SS	A	CB	2016	BPM 6
Sri Lanka	MoF	2017	2001	CG	C	CB	2016	BPM 5
St. Kitts and Nevis	MoF	2016	1986	CG, SG	C	CB	2016	BPM 6
St. Lucia	MoF	2015/16	1986	CG	C	CB	2016	BPM 6
St. Vincent and the Grenadines	MoF	2016	1986	CG	C	CB	2016	BPM 6
Sudan	MoF	2017	2001	CG	Mixed	CB	2016	BPM 5
Suriname	MoF	2016	1986	CG	Mixed	CB	2016	BPM 5

Table G. Key Data Documentation *(continued)*

		National Accounts					Prices (CPI)	
Country	Currency	Historical Data Source[1]	Latest Actual Annual Data	Base Year[2]	System of National Accounts	Use of Chain-Weighted Methodology[3]	Historical Data Source[1]	Latest Actual Annual Data
Swaziland	Swazi lilangeni	NSO	2015	2011	SNA 1993		NSO	2017
Sweden	Swedish krona	NSO	2017	2016	ESA 2010	From 1993	NSO	2017
Switzerland	Swiss franc	NSO	2017	2010	ESA 2010	From 1980	NSO	2017
Syria	Syrian pound	NSO	2010	2000	SNA 1993		NSO	2011
Taiwan Province of China	New Taiwan dollar	NSO	2016	2011	SNA 2008		NSO	2017
Tajikistan	Tajik somoni	NSO	2017	1995	SNA 1993		NSO	2017
Tanzania	Tanzania shilling	NSO	2016	2007	SNA 1993		NSO	2017
Thailand	Thai baht	MEP	2017	2002	SNA 1993	From 1993	MEP	2017
Timor-Leste	US dollar	MoF	2016	2015[6]	SNA 2008		NSO	2017
Togo	CFA franc	NSO	2015	2007	SNA 1993		NSO	2016
Tonga	Tongan pa'anga	CB	2016	2010	SNA 1993		CB	2016
Trinidad and Tobago	Trinidad and Tobago dollar	NSO	2016	2012	SNA 1993		NSO	2016
Tunisia	Tunisian dinar	NSO	2017	2004	SNA 1993	From 2009	NSO	2016
Turkey	Turkish lira	NSO	2016	2009	ESA 2010	From 2009	NSO	2017
Turkmenistan	New Turkmen manat	NSO	2017	2008	SNA 1993	From 2000	NSO	2017
Tuvalu	Australian dollar	PFTAC advisors	2015	2005	SNA 1993		NSO	2016
Uganda	Ugandan shilling	NSO	2016	2010	SNA 1993		CB	2016/17
Ukraine	Ukrainian hryvnia	NSO	2017	2010	SNA 2008	From 2005	NSO	2017
United Arab Emirates	U.A.E. dirham	NSO	2016	2010	SNA 1993		NSO	2016
United Kingdom	Pound sterling	NSO	2017	2015	ESA 2010	From 1980	NSO	2017
United States	US dollar	NSO	2017	2009	Other	From 1980	NSO	2017
Uruguay	Uruguayan peso	CB	2016	2005	SNA 1993		NSO	2017
Uzbekistan	Uzbek sum	NSO	2016	1995	SNA 1993		NSO	2016
Vanuatu	Vanuatu vatu	NSO	2016	2006	SNA 1993		NSO	2016
Venezuela	Venezuelan bolívar fuerte	CB	2016	1997	SNA 2008		CB	2016
Vietnam	Vietnamese dong	NSO	2017	2010	SNA 1993		NSO	2017
Yemen	Yemeni rial	IMF staff	2008	1990	SNA 1993		NSO,CB, and IMF staff	2009
Zambia	Zambian kwacha	NSO	2016	2010	SNA 1993		NSO	2017
Zimbabwe	US dollar	NSO	2013	2009	Other		NSO	2016

Table G. Key Data Documentation *(continued)*

	Government Finance					Balance of Payments		
Country	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source	Subsectors Coverage[4]	Accounting Practice[5]	Historical Data Source[1]	Latest Actual Annual Data	Statistics Manual in Use at Source
Swaziland	MoF	2016/17	2001	CG	A	CB	2017	BPM 6
Sweden	MoF	2016	2001	CG,LG,SS	A	NSO	2017	BPM 6
Switzerland	MoF	2016	2001	CG,SG,LG,SS	A	CB	2017	BPM 6
Syria	MoF	2009	1986	CG	C	CB	2009	BPM 5
Taiwan Province of China	MoF	2016	1986	CG,LG,SS	C	CB	2016	BPM 6
Tajikistan	MoF	2017	1986	CG,LG,SS	C	CB	2016	BPM 6
Tanzania	MoF	2016	1986	CG,LG	C	CB	2016	BPM 5
Thailand	MoF	2016/17	2001	CG,BCG,LG,SS	A	CB	2017	BPM 6
Timor-Leste	MoF	2017	2001	CG	C	CB	2017	BPM 6
Togo	MoF	2016	2001	CG	C	CB	2016	BPM 6
Tonga	MoF	2016	2014	CG	C	CB and NSO	2016	BPM 6
Trinidad and Tobago	MoF	2016/17	1986	CG	C	CB and NSO	2016	BPM 6
Tunisia	MoF	2016	1986	CG	C	CB	2016	BPM 5
Turkey	MoF	2016	2001	CG,LG,SS	A	CB	2017	BPM 6
Turkmenistan	MoF	2015	1986	CG,LG	C	NSO and IMF staff	2015	BPM 6
Tuvalu	MoF	2016	Other	CG	Mixed	IMF staff	2012	BPM 6
Uganda	MoF	2016	2001	CG	C	CB	2016	BPM 6
Ukraine	MoF	2016	2001	CG,SG,LG,SS	C	CB	2016	BPM 6
United Arab Emirates	MoF	2016	2001	CG,BCG,SG,SS	C	CB	2016	BPM 5
United Kingdom	NSO	2017	2001	CG,LG	A	NSO	2017	BPM 6
United States	MEP	2017	2014	CG,SG,LG	A	NSO	2016	BPM 6
Uruguay	MoF	2017	1986	CG,LG,SS,MPC, NFPC	A	CB	2016	BPM 6
Uzbekistan	MoF	2016	Other	CG,SG,LG,SS	C	MEP	2016	BPM 6
Vanuatu	MoF	2016	2001	CG	C	CB	2016	BPM 5
Venezuela	MoF	2013	2001	BCG,NFPC	C	CB	2016	BPM 5
Vietnam	MoF	2015	2001	CG,SG,LG	C	CB	2016	BPM 5
Yemen	MoF	2013	2001	CG,LG	C	IMF staff	2009	BPM 5
Zambia	MoF	2016	1986	CG	C	CB	2016	BPM 6
Zimbabwe	MoF	2014	1986	CG	C	CB and MoF	2016	BPM 6

Note: BPM = *Balance of Payments Manual*; CPI = consumer price index; ESA = European System of National Accounts; SNA = System of National Accounts.
[1]CB = central bank; Customs = Customs Authority; GAD = General Administration Department; IEO = international economic organization; MEP = Ministry of Economy, Planning, Commerce, and/or Development; MoF = Ministry of Finance and/or Treasury; NSO = National Statistics Office; PFTAC = Pacific Financial Technical Assistance Centre.
[2]National accounts base year is the period with which other periods are compared and the period for which prices appear in the denominators of the price relationships used to calculate the index.
[3]Use of chain-weighted methodology allows countries to measure GDP growth more accurately by reducing or eliminating the downward biases in volume series built on index numbers that average volume components using weights from a year in the moderately distant past.
[4]For some countries, the structures of government consist of a broader coverage than specified for the general government. Coverage: BCG = budgetary central government; CG = central government; EUA = extrabudgetary units/accounts; LG = local government; MPC = monetary public corporation, including central bank; NFPC = nonfinancial public corporation; NMPC = nonmonetary financial public corporation; SG = state government; SS = social security fund; TG = territorial governments.
[5]Accounting standard: A = accrual accounting; C = cash accounting; CB = commitments basis accounting; Mixed = combination of accrual and cash accounting.
[6]Base year is not equal to 100 because the nominal GDP is not measured in the same way as real GDP or the data are seasonally adjusted.

Box A1. Economic Policy Assumptions Underlying the Projections for Selected Economies

Fiscal Policy Assumptions

The short-term fiscal policy assumptions used in the *World Economic Outlook* (WEO) are normally based on officially announced budgets, adjusted for differences between the national authorities and the IMF staff regarding macroeconomic assumptions and projected fiscal outturns. When no official budget has been announced, projections incorporate policy measures that are judged likely to be implemented. The medium-term fiscal projections are similarly based on a judgment about the most likely path of policies. For cases in which the IMF staff has insufficient information to assess the authorities' budget intentions and prospects for policy implementation, an unchanged structural primary balance is assumed unless indicated otherwise. Specific assumptions used in regard to some of the advanced economies follow. (See also Tables B5 to B9 in the online section of the Statistical Appendix for data on fiscal net lending/borrowing and structural balances.)[1]

Argentina: Fiscal projections are based on the available information regarding budget outturn and budget plans for the federal and provincial governments, fiscal measures announced by the authorities, and the IMF staff's macroeconomic projections.

Australia: Fiscal projections are based on Australian Bureau of Statistics data; the fiscal year 2017/18 budgets of the Commonwealth and States and Territories; the Commonwealth's 2017 Mid-Year Economic and Fiscal Outlook and Updates by States and Territories; and the IMF staff's estimates.

Austria: Fiscal projections are based on data from Statistics Austria, the authorities' projections, and the IMF staff's estimates and projections.

Belgium: Projections are based on the 2017–20 Stability Programme and other available information on the authorities' fiscal plans, with adjustments for the IMF staff's assumptions.

Brazil: Fiscal projections for the end of 2018 take into account budget performance through January 2018, and the deficit target approved in the budget law.

Canada: Projections use the baseline forecasts in the 2018 federal budget and the latest provincial budget updates as available. The IMF staff makes some adjustments to these forecasts, including for differences in macroeconomic projections. The IMF staff's forecast also incorporates the most recent data releases from Statistics Canada's Canadian System of National Economic Accounts, including federal, provincial, and territorial budgetary outturns through the fourth quarter of 2017.

Chile: Projections are based on the authorities' budget projections, adjusted to reflect the IMF staff's projections for GDP and copper prices.

China: Projections assume that the pace of fiscal consolidation is likely to be more gradual, reflecting reforms to strengthen social safety nets and the social security system announced as part of the Third Plenum reform agenda.

Denmark: Estimates for 2016 are aligned with the latest official budget numbers, adjusted where appropriate for the IMF staff's macroeconomic assumptions. For 2017–18, the projections incorporate key features of the medium-term fiscal plan as embodied in the authorities' Convergence Programme 2017 submitted to the European Union.

France: Projections for 2017 reflect the budget law and cancellation of spending taken in July 2017. For 2018–22, they are based on the multiyear budget and the 2018 budget, adjusted for differences in assumptions on macro and financial variables, and revenue projections. Historical fiscal data reflect the May and September 2017 revisions and update of the fiscal accounts, debt data, and national accounts for 2014 and 2015.

Germany: The IMF staff's projections for 2018 and beyond are based on the 2018 Draft Budgetary Plan and data updates from the national statistical agency, adjusted for the differences in the IMF staff's macroeconomic framework and assumptions concerning revenue elasticities. The projections do not include policy measures in the new government's coalition agreement published in February 2018. The estimate of gross debt includes portfolios of impaired assets and noncore business transferred to institutions that are winding up, as well as other financial sector and EU support operations.

[1] The output gap is actual minus potential output, as a percentage of potential output. Structural balances are expressed as a percentage of potential output. The structural balance is the actual net lending/borrowing minus the effects of cyclical output from potential output, corrected for one-time and other factors, such as asset and commodity prices and output composition effects. Changes in the structural balance consequently include effects of temporary fiscal measures, the impact of fluctuations in interest rates and debt-service costs, and other noncyclical fluctuations in net lending/borrowing. The computations of structural balances are based on the IMF staff's estimates of potential GDP and revenue and expenditure elasticities. (See Annex I of the October 1993 WEO.) Net debt is calculated as gross debt minus financial assets corresponding to debt instruments. Estimates of the output gap and of the structural balance are subject to significant margins of uncertainty.

Box A1 *(continued)*

Greece: Greece's primary balance estimates for 2016 are based on preliminary excessive deficit procedure (EDP) data on an accrual basis (European System of National and Regional Accounts [ESA 2010]) provided by the National Statistical Service (ELSTAT) as of October 23, 2017. Fiscal data since 2010 are adjusted in line with program definition.

Hong Kong Special Administrative Region: Projections are based on the authorities' medium-term fiscal projections on expenditures.

Hungary: Fiscal projections include the IMF staff's projections of the macroeconomic framework and of the impact of recent legislative measures, as well as fiscal policy plans announced in the 2018 budget.

India: Historical data are based on budgetary execution data. Projections are based on available information on the authorities' fiscal plans, with adjustments for the IMF staff's assumptions. Subnational data are incorporated with a lag of up to two years; general government data are thus finalized well after central government data. IMF and Indian presentations differ, particularly regarding divestment and license auction proceeds, net versus gross recording of revenues in certain minor categories, and some public sector lending.

Indonesia: IMF projections are based on moderate tax policy and administration reforms, fuel subsidy pricing reforms introduced since January 2015, and a gradual increase in social and capital spending over the medium term in line with fiscal space.

Ireland: Fiscal projections are based on the country's Budget 2018.

Israel: Historical data are based on Government Finance Statistics data prepared by the Central Bureau of Statistics. The central government deficit is assumed to remain at the current ceiling level of 2.9 percent of GDP throughout the projection period, rather than declining in line with medium-term fiscal targets, consistent with long experience of revisions to those targets.

Italy: The IMF staff's estimates and projections are based on the fiscal plans included in the government's 2018 draft budget plan and September 2017 Update to the Economic and Financial Document.

Japan: The projections include fiscal measures already announced by the government, including the consumption tax hike in October 2019.

Korea: The medium-term forecast incorporates the medium-term path for public spending announced by the government.

Mexico: Fiscal projections for 2018 are broadly in line with the approved budget; projections for 2019 onward assume compliance with rules established in the Fiscal Responsibility Law.

Netherlands: Fiscal projections for 2017–23 are based on the authorities' Bureau for Economic Policy Analysis budget projections, after differences in macroeconomic assumptions are adjusted for. Historical data were revised following the June 2014 Central Bureau of Statistics release of revised macro data because of the adoption of ESA 2010 and the revisions of data sources.

New Zealand: Fiscal projections are based on the fiscal year 2017/18 budget and 2017 Half-Year Economic and Fiscal Update, and the IMF staff's estimates.

Portugal: The projections for the current year are based on the authorities' approved budget, adjusted to reflect the IMF staff's macroeconomic forecast. Projections thereafter are based on the assumption of unchanged policies.

Puerto Rico: Fiscal projections are based on the Puerto Rico Fiscal and Economic Growth Plan (FEGP), which was finalized on February 12, 2018, and is pending certification by the Oversight Board. In line with assumptions of this plan, IMF projections assume federal aid for rebuilding after Hurricane Maria devastated the island in September 2017. The projections also assume revenue losses from the following: elimination of federal funding for Puerto Rico for the Affordable Care Act starting in 2018; elimination of federal tax incentives (starting in 2018) that had neutralized the effects of Puerto Rico's Act 154 on foreign companies; and the effects of the Tax Cuts and Job Act, which reduces tax advantages for US companies producing in Puerto Rico. Given sizable policy uncertainty, some FEGP and IMF assumptions may differ, in particular those relating to the effects of the corporate tax reform, tax compliance, and tax adjustments (fees and rates); reduction of subsidies and expenses, freezing of payroll operational costs, and improvement of mobility; and increasing health care efficiency. On the expenditure side, measures include extension of Act 66, which freezes much government spending, through 2020; reduction of operating costs; decreases in government subsidies; and spending cuts in education. Although IMF policy assumptions are similar to those in the FEGP scenario with full measures, the IMF's projections of fiscal revenues,

Box A1 *(continued)*

expenditures, and balance are different from FEGP's. This stems from two main differences in methodologies: first and foremost, while IMF projections are on an accrual basis, FEGP's are on a cash basis. Second, the IMF and FEGP make very different macroeconomic assumptions.

Russia: Projections for 2018–20 are the IMF staff's estimates, based on the authorities' budget. Projections for 2021–23 are based on the new oil price rule, with adjustments by the IMF staff.

Saudi Arabia: Staff baseline projections of total government revenues reflect the impact of announced policies in the 2018 Budget. Oil revenues are based on WEO baseline oil prices and the assumption that Saudi Arabia continues to meet its commitments under the OPEC+ agreement. Expenditure projections take the 2018 budget as a starting point and reflect staff estimates of the effects of the latest changes in policies and economic developments. Expenditures in 2018 include allowances and other measures announced in the Royal Decree for one year in January 2018.

Singapore: For fiscal year 2018/19, projections are based on budget numbers. For the remainder of the projection period, the IMF staff assumes unchanged policies.

South Africa: Fiscal projections are based on the 2018 Budget. Nontax revenue excludes transactions in financial assets and liabilities, as they involve primarily revenues associated with realized exchange rate valuation gains from the holding of foreign currency deposits, sale of assets, and conceptually similar items.

Spain: For 2017, fiscal data are the IMF staff's projections, reflecting the cash outturn through November. For 2018 and beyond, fiscal projections are based on the information specified in the government's 2018 Budgetary Plan and on the IMF staff's macroeconomic projections.

Sweden: Fiscal projections take into account the authorities' projections based on the 2018 Spring Budget. The impact of cyclical developments on the fiscal accounts is calculated using the Organisation for Economic Co-operation and Development's 2005 elasticity to take into account output and employment gaps.

Switzerland: The projections assume that fiscal policy is adjusted as necessary to keep fiscal balances in line with the requirements of Switzerland's fiscal rules.

Turkey: The fiscal projections for 2018 are based on the authorities' Medium Term Programme 2018–20, with adjustments for additionally announced fiscal measures and the IMF staff's higher inflation forecast. For the medium term, the fiscal projections assume a more gradual fiscal consolidation than envisaged in the Medium Term Programme.

United Kingdom: Fiscal projections are based on the country's November 2017 Budget and the March 2018 update, with expenditure projections based on the budgeted nominal values and with revenue projections adjusted for differences between the IMF staff's forecasts of macroeconomic variables (such as GDP growth and inflation) and the forecasts of these variables assumed in the authorities' fiscal projections. The IMF staff's data exclude public sector banks and the effect of transferring assets from the Royal Mail Pension Plan to the public sector in April 2012. Real government consumption and investment are part of the real GDP path, which, according to the IMF staff, may or may not be the same as projected by the UK Office for Budget Responsibility.

United States: Fiscal projections are based on the June 2017 Congressional Budget Office baseline, adjusted for the IMF staff's policy and macroeconomic assumptions. Projections incorporate the effects of tax reform (Tax Cuts and Jobs Act, signed into law end of 2017) as well as the Bipartisan Budget Act of 2018 passed in February 2018. Finally, fiscal projections are adjusted to reflect the IMF staff's forecasts for key macroeconomic and financial variables and different accounting treatment of financial sector support and defined-benefit pension plans, and are converted to a general government basis. Data are compiled using SNA 2008, and when translated into government finance statistics, this is in accordance with GFSM 2014. Because of data limitations, most series begin in 2001.

Monetary Policy Assumptions

Monetary policy assumptions are based on the established policy framework in each country. In most cases, this implies a nonaccommodative stance over the business cycle: official interest rates will increase when economic indicators suggest that inflation will rise above its acceptable rate or range; they will decrease when indicators suggest that inflation will not exceed the acceptable rate or range, that output growth is below its potential rate, and that the margin of slack in the economy is significant. On this basis, the London interbank offered rate (LIBOR) on six-month US dollar deposits is assumed to average

Box A1 *(continued)*

2.4 percent in 2018 and 3.4 percent in 2019 (see Table 1.1). The rate on three-month euro deposits is assumed to average –0.3 percent in 2018 and 0.0 percent in 2019. The interest rate on six-month Japanese yen deposits is assumed to average 0.0 percent in 2018 and 0.1 percent in 2019.

Australia: Monetary policy assumptions are in line with market expectations.

Brazil: Monetary policy assumptions are consistent with gradual convergence of inflation toward the middle of the target range.

Canada: Monetary policy assumptions are in line with market expectations.

China: Monetary policy is expected to tighten with a gradual rise in the interest rate.

Denmark: The monetary policy is to maintain the peg to the euro.

Euro area: Monetary policy assumptions for euro area member countries are in line with market expectations.

Hong Kong Special Administrative Region: The IMF staff assumes that the currency board system remains intact.

India: The policy (interest) rate assumption is consistent with an inflation rate within the Reserve Bank of India's targeted band.

Indonesia: Monetary policy assumptions are in line with the maintenance of inflation within the central bank's targeted band.

Japan: Monetary policy assumptions are in line with market expectations.

Korea: Monetary policy assumptions are in line with market expectations.

Mexico: Monetary policy assumptions are consistent with attaining the inflation target.

Russia: Monetary projections assume that policy rates will be falling over the next year or two as inflation fell below the 4 percent target of the Central Bank of Russia in the context of a tight monetary stance, and the output gap is likely to be small.

Saudi Arabia: Monetary policy projections are based on the continuation of the exchange rate peg to the US dollar.

Singapore: Broad money is projected to grow in line with the projected growth in nominal GDP.

South Africa: Monetary policy will remain neutral.

Sweden: Monetary projections are in line with Riksbank projections.

Switzerland: The projections assume no change in the policy rate in 2016–17.

Turkey: The outlook for monetary and financial conditions assumes no changes to the current policy stance.

United Kingdom: The short-term interest rate path is based on market interest rate expectations.

United States: The IMF staff expects continued gradual normalization of the federal funds target rate over the medium term, in line with the broader macroeconomic outlook.

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Table A1. Summary of World Output[1]

(Annual percent change)

	Average 2000–09	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019	2023
World	**3.9**	**5.4**	**4.3**	**3.5**	**3.5**	**3.6**	**3.5**	**3.2**	**3.8**	**3.9**	**3.9**	**3.7**
Advanced Economies	**1.8**	**3.0**	**1.7**	**1.2**	**1.3**	**2.1**	**2.3**	**1.7**	**2.3**	**2.5**	**2.2**	**1.5**
United States	1.8	2.5	1.6	2.2	1.7	2.6	2.9	1.5	2.3	2.9	2.7	1.4
Euro Area	1.4	2.1	1.6	–0.9	–0.2	1.3	2.1	1.8	2.3	2.4	2.0	1.4
Japan	0.5	4.2	–0.1	1.5	2.0	0.4	1.4	0.9	1.7	1.2	0.9	0.5
Other Advanced Economies[2]	2.8	4.6	2.9	2.0	2.4	3.0	2.1	2.1	2.5	2.4	2.3	2.1
Emerging Market and Developing Economies	**6.1**	**7.4**	**6.4**	**5.4**	**5.1**	**4.7**	**4.3**	**4.4**	**4.8**	**4.9**	**5.1**	**5.0**
Regional Groups												
Commonwealth of Independent States[3]	5.9	4.6	5.3	3.7	2.5	1.0	–2.0	0.4	2.1	2.2	2.1	2.3
Emerging and Developing Asia	8.1	9.6	7.9	7.0	6.9	6.8	6.8	6.5	6.5	6.5	6.6	6.2
Emerging and Developing Europe	4.0	4.3	6.6	2.5	4.9	3.9	4.7	3.2	5.8	4.3	3.7	3.2
Latin America and the Caribbean	3.0	6.1	4.6	2.9	2.9	1.3	0.3	–0.6	1.3	2.0	2.8	2.8
Middle East, North Africa, Afghanistan, and Pakistan	5.2	4.7	4.4	5.0	2.6	2.8	2.5	4.9	2.6	3.4	3.7	3.6
Middle East and North Africa	5.2	4.9	4.4	5.1	2.5	2.6	2.4	4.9	2.2	3.2	3.6	3.4
Sub-Saharan Africa	5.7	7.0	5.1	4.4	5.3	5.1	3.4	1.4	2.8	3.4	3.7	4.0
Memorandum												
European Union	1.7	2.0	1.8	–0.3	0.3	1.8	2.4	2.0	2.7	2.5	2.1	1.7
Low-Income Developing Countries	6.2	7.6	5.1	4.9	6.0	6.0	4.5	3.5	4.7	5.0	5.3	5.4
Analytical Groups												
By Source of Export Earnings												
Fuel	5.8	5.1	5.2	5.0	2.7	2.2	0.3	1.8	1.2	2.0	2.4	2.4
Nonfuel	6.2	8.1	6.7	5.5	5.7	5.3	5.2	4.9	5.5	5.6	5.6	5.5
Of Which, Primary Products	3.7	6.6	4.7	2.2	4.0	2.0	3.0	1.4	3.0	3.0	3.4	3.7
By External Financing Source												
Net Debtor Economies	4.9	6.9	5.3	4.3	4.7	4.4	4.2	3.8	4.7	5.0	5.2	5.4
Net Debtor Economies by Debt-Servicing Experience												
Economies with Arrears and/or Rescheduling during 2012–16	4.8	4.3	2.4	1.8	2.9	1.6	0.4	2.4	3.2	4.2	4.7	5.0
Memorandum												
Median Growth Rate												
Advanced Economies	2.3	2.3	2.0	1.0	1.6	2.5	2.0	2.1	3.0	2.9	2.4	1.9
Emerging Market and Developing Economies	4.6	4.7	4.8	4.3	4.3	3.8	3.4	3.1	3.2	3.5	3.8	3.8
Low-Income Developing Countries	5.0	6.3	6.1	5.0	5.3	4.7	4.0	3.8	4.1	4.0	4.7	5.0
Output per Capita[4]												
Advanced Economies	1.8	–4.0	2.5	1.1	0.7	0.9	1.6	1.7	1.1	1.9	2.0	1.1
Emerging Market and Developing Economies	4.5	1.1	6.0	4.8	3.7	3.6	3.2	2.8	2.8	3.3	3.6	3.7
Low-Income Developing Countries	3.5	3.1	5.3	3.5	1.9	3.7	3.7	1.9	0.9	2.3	2.8	3.1
World Growth Rate Based on Market Exchange Rates	**2.5**	**4.1**	**3.1**	**2.5**	**2.6**	**2.8**	**2.8**	**2.5**	**3.2**	**3.4**	**3.3**	**2.9**
Value of World Output (billions of US dollars)												
At Market Exchange Rates	46,643	65,960	73,165	74,535	76,596	78,663	74,429	75,485	79,865	87,505	92,734	114,353
At Purchasing Power Parities	66,645	89,346	94,925	99,726	104,749	110,342	115,252	120,367	127,044	134,981	143,283	178,018

[1]Real GDP.
[2]Excludes the United States, euro area countries, and Japan.
[3]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[4]Output per capita is in international currency at purchasing power parity.

Table A2. Advanced Economies: Real GDP and Total Domestic Demand[1]

(Annual percent change)

	Average									Projections			Fourth Quarter[2]	Projections	
	2000–09	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023	2017:Q4	2018:Q4	2019:Q4
Real GDP															
Advanced Economies	**1.8**	**3.0**	**1.7**	**1.2**	**1.3**	**2.1**	**2.3**	**1.7**	**2.3**	**2.5**	**2.2**	**1.5**	**2.6**	**2.4**	**2.0**
United States	1.8	2.5	1.6	2.2	1.7	2.6	2.9	1.5	2.3	2.9	2.7	1.4	2.6	3.0	2.3
Euro Area	1.4	2.1	1.6	–0.9	–0.2	1.3	2.1	1.8	2.3	2.4	2.0	1.4	2.7	2.2	2.0
Germany	0.8	3.9	3.7	0.7	0.6	1.9	1.5	1.9	2.5	2.5	2.0	1.2	2.9	2.5	1.9
France	1.4	2.0	2.1	0.2	0.6	0.9	1.1	1.2	1.8	2.1	2.0	1.6	2.5	1.8	2.0
Italy	0.5	1.7	0.6	–2.8	–1.7	0.1	1.0	0.9	1.5	1.5	1.1	0.8	1.6	1.3	1.1
Spain	2.7	0.0	–1.0	–2.9	–1.7	1.4	3.4	3.3	3.1	2.8	2.2	1.7	3.1	2.5	2.1
Netherlands	1.6	1.4	1.7	–1.1	–0.2	1.4	2.3	2.2	3.1	3.2	2.4	1.9	3.4	2.9	2.3
Belgium	1.7	2.7	1.8	0.2	0.2	1.4	1.4	1.5	1.7	1.9	1.7	1.5	1.9	2.2	1.3
Austria	1.7	1.8	2.9	0.7	0.0	0.8	1.1	1.5	2.9	2.6	1.9	1.5	3.6	2.1	2.0
Greece	2.7	–5.5	–9.1	–7.3	–3.2	0.7	–0.3	–0.2	1.4	2.0	1.8	1.9	1.9	2.7	1.0
Portugal	0.9	1.9	–1.8	–4.0	–1.1	0.9	1.8	1.6	2.7	2.4	1.8	1.2	2.4	2.0	2.4
Ireland	3.9	1.8	2.9	0.0	1.6	8.3	25.5	5.1	7.8	4.5	4.0	2.8	7.8	2.2	2.0
Finland	2.0	3.0	2.6	–1.4	–0.8	–0.6	0.1	2.1	3.0	2.6	2.0	1.2	2.8	2.7	1.6
Slovak Republic	4.5	5.0	2.8	1.7	1.5	2.8	3.9	3.3	3.4	4.0	4.2	3.4	3.5	3.9	4.2
Lithuania	4.6	1.6	6.0	3.8	3.5	3.5	2.0	2.3	3.8	3.2	3.0	2.5	3.7	2.7	3.3
Slovenia	2.9	1.2	0.6	–2.7	–1.1	3.0	2.3	3.1	5.0	4.0	3.2	2.1	6.2	2.4	3.6
Luxembourg	3.0	4.9	2.5	–0.4	3.7	5.8	2.9	3.1	3.5	4.3	3.7	3.0	5.2	1.4	5.1
Latvia	4.7	–3.9	6.4	4.0	2.4	1.9	3.0	2.2	4.5	4.0	3.5	3.0	4.7	4.9	2.6
Estonia	4.1	2.3	7.6	4.3	1.9	2.9	1.7	2.1	4.9	3.9	3.2	2.9	5.3	4.2	3.2
Cyprus	3.5	1.3	0.3	–3.1	–5.9	–1.4	2.0	3.0	3.9	3.6	3.0	2.4	3.9	3.0	3.0
Malta	1.6	3.5	1.3	2.7	4.7	8.1	9.9	5.5	6.6	5.7	4.6	3.2	4.5	6.5	4.1
Japan	0.5	4.2	–0.1	1.5	2.0	0.4	1.4	0.9	1.7	1.2	0.9	0.5	2.1	0.8	–0.1
United Kingdom	1.7	1.7	1.5	1.5	2.1	3.1	2.3	1.9	1.8	1.6	1.5	1.6	1.4	1.6	1.6
Korea	4.7	6.5	3.7	2.3	2.9	3.3	2.8	2.8	3.1	3.0	2.9	2.6	3.0	3.4	2.9
Canada	2.1	3.1	3.1	1.7	2.5	2.9	1.0	1.4	3.0	2.1	2.0	1.6	2.9	2.1	1.9
Australia	3.1	2.4	2.7	3.9	2.2	2.6	2.5	2.6	2.3	3.0	3.1	2.6	2.4	3.0	3.4
Taiwan Province of China	3.8	10.6	3.8	2.1	2.2	4.0	0.8	1.4	2.8	1.9	2.0	2.0	2.9	1.8	1.8
Switzerland	1.9	2.9	1.8	1.0	1.9	2.5	1.2	1.4	1.1	2.3	2.0	1.7	1.9	2.2	1.9
Sweden	2.0	6.0	2.7	–0.3	1.2	2.6	4.5	3.2	2.4	2.6	2.2	1.9	3.3	1.9	2.6
Singapore	5.2	15.2	6.4	4.1	5.1	3.9	2.2	2.4	3.6	2.9	2.7	2.6	3.6	1.6	3.6
Hong Kong SAR	4.2	6.8	4.8	1.7	3.1	2.8	2.4	2.1	3.8	3.6	3.2	3.0	3.4	3.9	2.7
Norway	1.8	0.7	1.0	2.7	1.0	2.0	2.0	1.1	1.8	2.1	2.1	1.9	1.4	2.7	1.7
Czech Republic	3.4	2.3	1.8	–0.8	–0.5	2.7	5.3	2.6	4.3	3.5	3.0	2.5	5.2	3.1	3.2
Israel	3.5	5.5	5.2	2.2	4.2	3.5	2.6	4.0	3.3	3.3	3.5	3.0	3.0	3.1	3.8
Denmark	1.0	1.9	1.3	0.2	0.9	1.6	1.6	2.0	2.1	2.0	1.9	1.7	1.2	2.7	1.9
New Zealand	2.9	2.0	1.9	2.5	2.2	3.2	4.2	4.2	3.0	2.9	2.9	2.4	3.2	2.5	3.3
Puerto Rico	1.0	–0.4	–0.4	0.0	–0.3	–1.2	–1.1	–2.6	–7.7	–3.6	–1.2	–0.8	. . .	. . .	. . .
Macao SAR	. . .	25.3	21.7	9.2	11.2	–1.2	–21.6	–0.9	9.3	7.0	6.1	4.3	. . .	. . .	. . .
Iceland	3.5	–3.6	2.0	1.3	4.3	2.2	4.3	7.5	3.6	3.2	3.0	2.6	1.2	4.0	3.9
San Marino	. . .	–4.8	–9.3	–7.6	–3.2	–0.9	0.6	2.2	1.5	1.3	1.3	1.3	. . .	. . .	. . .
Memorandum															
Major Advanced Economies	1.4	2.8	1.6	1.4	1.4	2.0	2.1	1.4	2.1	2.4	2.1	1.3	2.4	2.3	1.8
Real Total Domestic Demand															
Advanced Economies	**1.6**	**2.9**	**1.4**	**0.8**	**1.0**	**2.0**	**2.5**	**1.8**	**2.3**	**2.7**	**2.4**	**1.4**	**2.5**	**2.8**	**2.0**
United States	1.7	2.9	1.6	2.1	1.3	2.7	3.5	1.7	2.4	3.5	3.2	1.0	2.6	3.6	2.8
Euro Area	1.3	1.5	0.7	–2.4	–0.6	1.3	2.0	2.4	2.0	2.2	1.9	1.5	1.5	2.8	1.6
Germany	0.3	2.9	3.0	–0.8	1.0	1.3	1.5	2.4	2.4	2.3	2.0	1.5	2.0	2.7	1.8
France	1.7	2.1	2.0	–0.3	0.7	1.4	1.6	1.9	2.3	1.9	1.8	1.6	2.1	2.3	1.6
Italy	0.7	2.0	–0.6	–5.6	–2.6	0.2	1.5	1.1	1.4	1.6	1.1	0.7	1.2	1.7	0.7
Spain	2.9	–0.5	–3.1	–5.1	–3.2	2.0	4.0	2.6	2.9	2.6	2.1	1.5	3.3	2.4	2.0
Japan	0.2	2.4	0.7	2.3	2.4	0.4	1.0	0.4	1.2	1.1	1.0	0.5	1.8	0.8	–0.2
United Kingdom	1.8	2.5	–0.6	1.8	1.9	3.1	2.3	2.2	1.4	1.4	1.3	1.6	1.9	1.0	1.4
Canada	2.8	5.1	3.4	2.0	2.1	1.8	0.1	0.9	3.8	2.5	1.2	1.4	5.1	1.3	1.2
Other Advanced Economies[3]	2.9	6.1	3.1	2.0	1.5	2.7	2.5	2.2	3.4	2.9	2.8	2.6	4.3	2.9	2.7
Memorandum															
Major Advanced Economies	1.3	2.8	1.4	1.1	1.2	1.9	2.4	1.6	2.1	2.6	2.3	1.1	2.4	2.6	1.9

[1]In this and other tables, when countries are not listed alphabetically, they are ordered on the basis of economic size.
[2]From the fourth quarter of the preceding year.
[3]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.

Table A3. Advanced Economies: Components of Real GDP
(Annual percent change)

	Averages										Projections	
	2000–09	2010–19	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Private Consumer Expenditure												
Advanced Economies	**2.0**	**1.8**	**1.9**	**1.3**	**0.9**	**1.2**	**1.8**	**2.5**	**2.2**	**2.2**	**2.2**	**2.0**
United States	2.4	2.5	1.9	2.3	1.5	1.5	2.9	3.6	2.7	2.8	2.9	2.6
Euro Area	1.4	0.9	0.8	–0.1	–1.1	–0.6	0.8	1.8	2.0	1.6	1.8	1.6
Germany	0.7	1.4	0.3	1.3	1.3	0.8	1.0	1.6	1.9	2.1	2.0	1.7
France	2.0	1.1	1.8	0.5	–0.2	0.5	0.8	1.4	2.2	1.3	1.4	1.7
Italy	0.6	0.2	1.2	0.0	–4.0	–2.4	0.2	1.9	1.4	1.3	1.3	1.1
Spain	2.5	0.5	0.3	–2.4	–3.5	–3.1	1.5	3.0	3.0	2.4	2.3	2.0
Japan	0.8	0.8	2.4	–0.4	2.0	2.4	–0.9	0.0	0.1	1.1	0.6	0.8
United Kingdom	2.2	1.5	0.6	–0.7	1.6	1.7	2.1	2.6	2.9	1.7	1.0	1.1
Canada	3.2	2.4	3.6	2.3	1.9	2.6	2.6	2.2	2.3	3.4	2.4	1.0
Other Advanced Economies[1]	3.1	2.7	3.8	3.0	2.2	2.3	2.4	2.7	2.5	2.5	2.8	2.7
Memorandum												
Major Advanced Economies	1.8	1.8	1.7	1.3	1.1	1.3	1.8	2.5	2.1	2.2	2.1	1.9
Public Consumption												
Advanced Economies	**2.3**	**0.9**	**1.0**	**–0.5**	**0.1**	**–0.3**	**0.6**	**1.5**	**1.6**	**0.9**	**2.1**	**1.6**
United States	2.2	0.1	0.1	–2.7	–0.9	–2.4	–0.5	1.3	1.0	0.1	3.1	1.9
Euro Area	2.0	0.8	0.7	–0.1	–0.3	0.3	0.7	1.3	1.8	1.2	1.4	1.1
Germany	1.2	1.8	1.3	0.9	1.1	1.4	1.5	2.9	3.7	1.6	2.0	1.7
France	1.7	1.2	1.3	1.0	1.6	1.5	1.3	1.1	1.3	1.6	1.0	0.5
Italy	1.3	–0.3	0.6	–1.8	–1.4	–0.3	–0.7	–0.6	0.6	0.1	0.3	0.3
Spain	5.1	0.0	1.5	–0.3	–4.7	–2.1	–0.3	2.1	0.8	1.6	1.0	0.7
Japan	1.7	1.1	1.9	1.9	1.7	1.5	0.5	1.5	1.3	0.1	–0.3	1.1
United Kingdom	2.8	0.8	0.5	0.2	1.3	0.2	2.5	0.6	0.8	0.1	1.0	0.9
Canada	2.6	1.2	2.3	1.3	0.7	–0.7	0.5	1.6	2.2	2.2	1.2	0.6
Other Advanced Economies[1]	2.9	2.5	2.7	1.6	1.9	2.3	2.4	2.6	3.3	3.0	2.9	2.7
Memorandum												
Major Advanced Economies	2.0	0.6	0.7	–0.9	0.1	–0.7	0.3	1.4	1.4	0.5	2.0	1.4
Gross Fixed Capital Formation												
Advanced Economies	**0.6**	**2.9**	**1.7**	**2.9**	**2.4**	**1.5**	**3.5**	**2.7**	**1.9**	**3.5**	**4.5**	**4.3**
United States	0.1	3.8	1.1	3.7	6.3	3.1	4.8	3.5	0.6	3.4	5.6	6.5
Euro Area	0.9	1.6	–0.3	1.5	–3.4	–2.5	1.9	3.3	4.6	3.5	4.4	3.5
Germany	–0.4	2.9	5.0	7.4	–0.1	–1.2	3.8	1.1	2.9	4.0	3.5	2.9
France	1.6	1.9	2.1	2.1	0.2	–0.8	0.1	1.0	2.9	3.7	4.0	3.7
Italy	0.8	–0.7	–0.5	–1.9	–9.3	–6.6	–2.3	2.1	3.2	3.7	4.0	2.1
Spain	2.4	0.2	–4.9	–6.9	–8.6	–3.4	4.7	6.5	3.3	5.0	4.5	3.6
Japan	–2.0	2.2	–1.6	1.7	3.5	4.9	3.1	1.7	1.1	2.5	3.4	1.6
United Kingdom	–0.1	3.2	4.5	2.2	2.1	3.4	7.1	2.8	1.8	4.0	2.2	2.5
Canada	3.1	2.4	11.4	4.6	4.9	1.3	2.4	–5.2	–2.9	2.8	3.2	2.2
Other Advanced Economies[1]	2.8	3.3	5.9	4.1	3.0	2.5	2.5	1.9	2.4	4.0	3.5	3.2
Memorandum												
Major Advanced Economies	0.0	3.0	1.8	3.2	3.4	1.9	3.7	2.3	1.2	3.4	4.5	4.5

Table A3. Advanced Economies: Components of Real GDP *(continued)*

(Annual percent change)

	Averages										Projections	
	2000–09	2010–19	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Final Domestic Demand												
Advanced Economies	**1.8**	**1.9**	**1.7**	**1.3**	**1.1**	**1.0**	**2.0**	**2.4**	**2.1**	**2.3**	**2.7**	**2.4**
United States	1.9	2.4	1.5	1.7	1.9	1.2	2.7	3.3	2.1	2.5	3.4	3.2
Euro Area	1.4	1.0	0.5	0.3	–1.5	–0.8	1.0	2.0	2.5	1.9	2.3	1.9
Germany	0.5	1.8	1.4	2.5	1.0	0.5	1.7	1.8	2.5	2.4	2.3	1.9
France	1.8	1.3	1.8	0.9	0.3	0.4	0.7	1.2	2.2	1.9	1.9	1.8
Italy	0.8	–0.1	0.7	–0.8	–4.5	–2.8	–0.4	1.4	1.5	1.5	1.6	1.1
Spain	2.9	0.3	–0.7	–3.0	–4.8	–3.0	1.8	3.5	2.6	2.8	2.5	2.1
Japan	0.3	1.2	1.4	0.5	2.3	2.8	0.2	0.7	0.6	1.2	1.3	1.0
United Kingdom	2.0	1.6	1.2	–0.1	1.6	1.7	3.0	2.2	2.4	1.8	1.2	1.3
Canada	3.0	2.2	5.0	2.6	2.4	1.6	2.1	0.3	1.1	3.0	2.3	1.2
Other Advanced Economies[1]	3.0	2.8	4.1	3.0	2.3	2.4	2.5	2.5	2.5	3.1	3.0	2.8
Memorandum												
Major Advanced Economies	1.5	1.8	1.6	1.3	1.3	1.1	1.9	2.3	1.9	2.2	2.6	2.3
Stock Building[2]												
Advanced Economies	**–0.1**	**0.1**	**1.3**	**0.1**	**–0.2**	**0.0**	**0.1**	**0.1**	**–0.3**	**0.0**	**0.0**	**0.0**
United States	–0.2	0.1	1.5	–0.1	0.1	0.2	–0.1	0.2	–0.4	–0.1	0.0	0.0
Euro Area	–0.1	0.1	0.9	0.5	–0.9	0.2	0.3	0.0	–0.1	0.1	0.0	0.0
Germany	–0.2	0.0	1.4	0.5	–1.6	0.5	–0.4	–0.3	–0.1	0.0	0.0	0.0
France	–0.1	0.2	0.3	1.1	–0.6	0.2	0.7	0.3	–0.1	0.4	0.0	0.0
Italy	–0.1	0.1	1.3	0.2	–1.1	0.2	0.6	0.1	–0.4	–0.1	0.0	0.0
Spain	0.0	0.0	0.2	–0.1	–0.2	–0.3	0.2	0.4	0.0	0.1	0.1	0.0
Japan	0.0	0.1	1.0	0.2	0.0	–0.4	0.1	0.3	–0.2	–0.1	0.0	0.0
United Kingdom	–0.2	0.1	1.4	–0.6	0.2	0.1	0.2	0.1	–0.2	–0.4	0.1	0.0
Canada	0.0	0.0	0.1	0.7	–0.3	0.5	–0.4	–0.2	–0.2	–0.4	0.0	0.0
Other Advanced Economies[1]	–0.1	0.1	1.9	0.2	–0.3	–0.8	0.2	0.0	–0.3	0.3	–0.1	–0.1
Memorandum												
Major Advanced Economies	–0.1	0.1	1.2	0.1	–0.2	0.2	0.0	0.2	–0.3	–0.1	0.0	0.0
Foreign Balance[2]												
Advanced Economies	**0.1**	**0.0**	**0.1**	**0.3**	**0.4**	**0.3**	**0.0**	**–0.2**	**–0.2**	**0.0**	**–0.1**	**–0.2**
United States	0.0	–0.3	–0.5	0.0	0.1	0.3	–0.2	–0.7	–0.2	–0.2	–0.6	–0.6
Euro Area	0.1	0.4	0.6	0.9	1.5	0.4	0.1	0.1	–0.4	0.4	0.3	0.1
Germany	0.5	0.4	1.1	0.9	1.4	–0.3	0.7	0.1	–0.4	0.2	0.4	0.2
France	–0.3	–0.2	–0.1	0.0	0.5	–0.1	–0.5	–0.5	–0.8	–0.4	0.1	0.0
Italy	–0.2	0.4	–0.3	1.2	2.8	0.8	–0.1	–0.5	–0.3	0.1	0.0	0.0
Spain	–0.2	0.7	0.5	2.1	2.2	1.5	–0.5	–0.4	0.7	0.3	0.3	0.2
Japan	0.1	0.1	1.6	–0.9	–0.8	–0.4	0.0	0.3	0.5	0.5	0.1	–0.1
United Kingdom	–0.1	–0.1	–0.7	1.4	–0.7	–0.6	–0.5	–0.1	–0.8	0.6	0.3	0.2
Canada	–0.8	0.0	–2.1	–0.3	–0.4	0.3	1.1	0.9	0.7	–0.9	–0.3	0.8
Other Advanced Economies[1]	0.6	0.1	0.0	0.5	0.5	0.9	0.4	–0.2	–0.1	–0.6	0.0	0.1
Memorandum												
Major Advanced Economies	0.0	–0.1	–0.1	0.1	0.2	0.1	0.0	–0.3	–0.2	0.0	–0.2	–0.3

[1]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.
[2]Changes expressed as percent of GDP in the preceding period.

Table A4. Emerging Market and Developing Economies: Real GDP
(Annual percent change)

	Average									Projections		
	2000–09	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023
Commonwealth of Independent States[1,2]	**5.9**	**4.6**	**5.3**	**3.7**	**2.5**	**1.0**	**–2.0**	**0.4**	**2.1**	**2.2**	**2.1**	**2.3**
Russia	5.4	4.5	5.1	3.7	1.8	0.7	–2.5	–0.2	1.5	1.7	1.5	1.5
Excluding Russia	7.5	5.0	6.0	3.6	4.2	1.9	–0.6	1.9	3.6	3.5	3.6	3.9
Armenia	8.5	2.2	4.7	7.1	3.3	3.6	3.3	0.3	7.5	3.4	3.5	4.0
Azerbaijan	14.6	4.6	–1.6	2.1	5.9	2.7	0.6	–3.1	0.1	2.0	3.9	2.6
Belarus	7.2	7.8	5.5	1.7	1.0	1.7	–3.8	–2.5	2.4	2.8	2.4	2.0
Georgia	5.9	6.2	7.2	6.4	3.4	4.6	2.9	2.8	4.8	4.5	4.8	5.2
Kazakhstan	8.5	7.3	7.5	5.0	6.0	4.3	1.2	1.1	4.0	3.2	2.8	3.4
Kyrgyz Republic	4.6	–0.5	6.0	–0.1	10.9	4.0	3.9	3.8	4.5	3.3	4.9	3.3
Moldova	4.6	7.1	6.8	–0.7	9.4	4.8	–0.4	4.3	4.0	3.5	3.8	3.9
Tajikistan	8.2	6.5	7.4	7.5	7.4	6.7	6.0	6.9	7.1	4.0	4.0	4.0
Turkmenistan	14.2	9.2	14.7	11.1	10.2	10.3	6.5	6.2	6.5	6.2	5.6	5.7
Ukraine[3]	4.5	0.3	5.5	0.2	0.0	–6.6	–9.8	2.4	2.5	3.2	3.3	4.0
Uzbekistan	6.4	8.5	8.3	8.2	8.0	8.0	7.9	7.8	5.3	5.0	5.0	6.0
Emerging and Developing Asia	**8.1**	**9.6**	**7.9**	**7.0**	**6.9**	**6.8**	**6.8**	**6.5**	**6.5**	**6.5**	**6.6**	**6.2**
Bangladesh	5.8	6.0	6.5	6.3	6.0	6.3	6.8	7.2	7.1	7.0	7.0	7.0
Bhutan	8.2	9.3	9.7	6.4	3.6	4.0	6.1	6.3	6.0	7.1	7.6	11.4
Brunei Darussalam	1.4	2.7	3.7	0.9	–2.1	–2.5	–0.4	–2.5	0.5	1.0	8.0	9.1
Cambodia	8.3	6.0	7.2	7.3	7.4	7.1	7.2	7.0	6.9	6.9	6.8	6.0
China	10.3	10.6	9.5	7.9	7.8	7.3	6.9	6.7	6.9	6.6	6.4	5.5
Fiji	0.9	3.0	2.7	1.4	4.7	5.6	3.8	0.4	3.8	3.5	3.4	3.2
India[4]	6.9	10.3	6.6	5.5	6.4	7.4	8.2	7.1	6.7	7.4	7.8	8.2
Indonesia	5.3	6.4	6.2	6.0	5.6	5.0	4.9	5.0	5.1	5.3	5.5	5.6
Kiribati	1.4	–0.9	1.6	4.6	4.3	–0.6	10.3	1.1	3.1	2.3	2.4	1.8
Lao P.D.R.	7.0	8.0	8.0	7.8	8.0	7.6	7.3	7.0	6.8	6.8	7.0	6.8
Malaysia	4.7	7.5	5.3	5.5	4.7	6.0	5.0	4.2	5.9	5.3	5.0	4.9
Maldives	6.3	7.1	8.4	2.3	7.1	7.6	2.2	4.5	4.8	5.0	5.0	5.4
Marshall Islands	1.9	1.2	3.5	2.9	–0.8	–0.4	1.9	2.0	1.9	1.8	1.7	1.5
Micronesia	0.5	3.3	1.0	–1.7	–3.0	–2.5	3.9	2.9	2.0	1.4	0.9	0.6
Mongolia	5.6	7.3	17.3	12.3	11.6	7.9	2.4	1.2	5.1	5.0	6.3	7.0
Myanmar	11.1	5.3	5.6	7.3	8.4	8.0	7.0	5.9	6.7	6.9	7.0	7.5
Nauru	. . .	13.6	11.7	10.1	34.2	36.5	2.8	10.4	4.0	–3.0	0.0	2.0
Nepal	4.1	4.8	3.4	4.8	4.1	6.0	3.3	0.4	7.5	5.0	4.0	3.8
Palau	. . .	3.0	5.1	3.9	–2.1	5.4	11.4	0.5	–1.0	1.0	4.0	2.0
Papua New Guinea	2.8	10.1	1.1	4.6	3.8	12.5	8.0	2.4	2.5	2.9	2.6	3.3
Philippines	4.4	7.6	3.7	6.7	7.1	6.1	6.1	6.9	6.7	6.7	6.8	7.0
Samoa	3.2	–2.0	5.6	0.4	–1.9	1.2	1.6	7.1	2.4	2.5	2.8	2.2
Solomon Islands	1.2	6.8	13.2	4.6	3.0	2.3	2.5	3.5	3.2	3.0	2.9	2.9
Sri Lanka	5.1	8.0	8.4	9.1	3.4	5.0	5.0	4.5	3.1	4.0	4.5	5.0
Thailand	4.3	7.5	0.8	7.2	2.7	1.0	3.0	3.3	3.9	3.9	3.8	3.5
Timor-Leste[5]	. . .	8.5	7.7	5.5	2.5	4.1	4.0	5.3	–0.5	2.8	5.7	5.2
Tonga	1.1	3.2	1.8	–1.1	–0.6	2.9	3.5	3.1	3.1	3.2	2.9	1.4
Tuvalu	. . .	–3.1	7.9	–3.8	4.6	1.3	9.1	3.0	3.2	3.5	3.1	2.0
Vanuatu	3.3	1.6	1.2	1.8	2.0	2.3	0.2	3.5	4.2	3.8	3.5	3.0
Vietnam	6.9	6.4	6.2	5.2	5.4	6.0	6.7	6.2	6.8	6.6	6.5	6.5
Emerging and Developing Europe	**4.0**	**4.3**	**6.6**	**2.5**	**4.9**	**3.9**	**4.7**	**3.2**	**5.8**	**4.3**	**3.7**	**3.2**
Albania	5.9	3.7	2.5	1.4	1.0	1.8	2.2	3.4	3.9	3.7	3.8	4.0
Bosnia and Herzegovina	4.2	0.8	0.9	–0.7	2.4	1.1	3.1	3.2	2.7	3.2	3.5	4.0
Bulgaria	5.0	1.3	1.9	0.0	0.9	1.3	3.6	3.9	3.6	3.8	3.1	2.8
Croatia	3.0	–1.4	–0.3	–2.2	–0.6	–0.1	2.3	3.2	2.8	2.8	2.6	2.2
Hungary	2.4	0.7	1.7	–1.6	2.1	4.2	3.4	2.2	4.0	3.8	3.0	2.2
Kosovo	. . .	3.3	4.4	2.8	3.4	1.2	4.1	4.1	4.1	4.0	4.0	4.0
FYR Macedonia	3.1	3.4	2.3	–0.5	2.9	3.6	3.9	2.9	0.0	2.8	3.0	3.5
Montenegro	. . .	2.7	3.2	–2.7	3.5	1.8	3.4	2.9	4.2	3.1	2.4	3.0
Poland	3.9	3.6	5.0	1.6	1.4	3.3	3.8	2.9	4.6	4.1	3.5	2.8
Romania	4.8	–2.8	2.0	1.2	3.5	3.1	4.0	4.8	7.0	5.1	3.5	3.1
Serbia	5.1	0.6	1.4	–1.0	2.6	–1.8	0.8	2.8	1.8	3.5	3.5	4.0
Turkey	3.8	8.5	11.1	4.8	8.5	5.2	6.1	3.2	7.0	4.4	4.0	3.6

Table A4. Emerging Market and Developing Economies: Real GDP *(continued)*

(Annual percent change)

	Average 2000–09	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019	2023
Latin America and the Caribbean	**3.0**	**6.1**	**4.6**	**2.9**	**2.9**	**1.3**	**0.3**	**–0.6**	**1.3**	**2.0**	**2.8**	**2.8**
Antigua and Barbuda	2.8	–7.2	–2.1	3.5	–0.1	5.1	4.1	5.3	2.8	3.5	3.0	2.0
Argentina	2.3	10.1	6.0	–1.0	2.4	–2.5	2.7	–1.8	2.9	2.0	3.2	3.3
The Bahamas	1.0	1.5	0.6	3.1	–0.6	–1.2	–3.1	0.2	1.3	2.5	2.2	1.5
Barbados	1.4	0.3	0.8	0.3	–0.6	0.1	1.0	1.6	0.9	0.5	0.8	1.0
Belize	4.9	3.3	2.1	3.7	0.7	4.0	3.8	–0.5	0.8	1.8	2.0	1.7
Bolivia	3.7	4.1	5.2	5.1	6.8	5.5	4.9	4.3	4.2	4.0	3.8	3.7
Brazil	3.4	7.5	4.0	1.9	3.0	0.5	–3.5	–3.5	1.0	2.3	2.5	2.2
Chile	4.2	5.8	6.1	5.3	4.1	1.8	2.3	1.3	1.5	3.4	3.3	3.0
Colombia	4.0	4.0	6.6	4.0	4.9	4.4	3.1	2.0	1.8	2.7	3.3	3.5
Costa Rica	4.2	5.0	4.3	4.8	2.3	3.5	3.6	4.5	3.2	3.6	3.6	3.5
Dominica	2.6	0.7	–0.2	–1.1	0.8	4.2	–3.7	2.6	–4.2	–16.3	12.2	1.5
Dominican Republic	4.2	8.3	3.1	2.8	4.7	7.6	7.0	6.6	4.6	5.5	5.0	5.0
Ecuador	3.9	3.5	7.9	5.6	4.9	3.8	0.1	–1.6	2.7	2.5	2.2	1.8
El Salvador	2.0	1.4	2.2	1.9	1.8	1.4	2.3	2.4	2.4	2.3	2.3	2.2
Grenada	2.3	–0.5	0.8	–1.2	2.4	7.3	6.4	3.7	3.5	3.6	3.6	2.7
Guatemala	3.3	2.9	4.2	3.0	3.7	4.2	4.1	3.1	2.8	3.2	3.6	3.6
Guyana	1.8	4.4	5.4	4.8	5.2	3.8	3.1	3.3	2.1	3.5	3.7	27.8
Haiti	0.8	–5.5	5.5	2.9	4.2	2.8	1.2	1.5	1.2	2.0	3.0	2.0
Honduras	4.5	3.7	3.8	4.1	2.8	3.1	3.8	3.8	4.8	3.5	3.6	3.8
Jamaica	0.9	–1.4	1.4	–0.5	0.2	0.6	0.8	1.5	1.0	1.5	1.8	2.4
Mexico	1.4	5.1	3.7	3.6	1.4	2.8	3.3	2.9	2.0	2.3	3.0	2.9
Nicaragua	2.9	4.4	6.3	6.5	4.9	4.8	4.9	4.7	4.9	4.7	4.5	4.5
Panama	5.5	5.8	11.8	9.2	6.6	6.0	5.8	5.0	5.4	5.6	5.8	5.5
Paraguay	1.9	13.1	4.3	–1.2	14.0	4.7	3.0	4.0	4.3	4.5	4.1	4.0
Peru	5.0	8.5	6.5	6.0	5.8	2.4	3.3	4.1	2.5	3.7	4.0	3.8
St. Kitts and Nevis	3.2	–2.9	–0.8	–0.8	6.6	5.1	4.9	3.1	2.6	3.5	3.2	2.7
St. Lucia	2.2	–1.6	0.6	0.2	0.3	3.6	–0.9	3.4	3.0	2.5	2.3	1.6
St. Vincent and the Grenadines	3.1	–2.3	0.2	1.3	2.5	0.3	0.9	0.8	1.0	2.1	2.5	2.8
Suriname	4.5	5.2	5.8	2.7	2.9	0.3	–2.6	–5.1	0.0	1.4	2.0	3.0
Trinidad and Tobago	6.3	3.3	–0.3	1.3	1.0	–0.3	1.5	–6.0	–2.6	0.2	0.2	1.9
Uruguay	2.2	7.8	5.2	3.5	4.6	3.2	0.4	1.5	3.1	3.4	3.1	3.0
Venezuela	3.7	–1.5	4.2	5.6	1.3	–3.9	–6.2	–16.5	–14.0	–15.0	–6.0	–1.5
Middle East, North Africa, Afghanistan, and Pakistan	**5.2**	**4.7**	**4.4**	**5.0**	**2.6**	**2.8**	**2.5**	**4.9**	**2.6**	**3.4**	**3.7**	**3.6**
Afghanistan	. . .	8.4	6.5	14.0	5.7	2.7	1.3	2.4	2.5	2.5	3.0	5.0
Algeria	3.9	3.6	2.8	3.4	2.8	3.8	3.7	3.3	2.0	3.0	2.7	0.5
Bahrain	5.6	4.3	2.0	3.7	5.4	4.4	2.9	3.2	3.2	3.0	2.3	2.3
Djibouti	3.2	4.1	7.3	4.8	5.0	6.0	6.5	6.5	6.7	6.7	6.7	6.0
Egypt	5.0	5.1	1.8	2.2	3.3	2.9	4.4	4.3	4.2	5.2	5.5	6.0
Iran	4.8	5.7	3.1	–7.7	–0.3	3.2	–1.6	12.5	4.3	4.0	4.0	4.1
Iraq	10.9	6.4	7.5	13.9	7.6	0.7	4.8	11.0	–0.8	3.1	4.9	2.4
Jordan	6.5	2.3	2.6	2.7	2.8	3.1	2.4	2.0	2.3	2.5	2.7	3.0
Kuwait	5.3	–2.4	10.9	7.9	0.4	0.6	–1.0	2.2	–2.5	1.3	3.8	2.9
Lebanon	4.9	8.0	0.9	2.8	2.6	2.0	0.8	1.0	1.2	1.5	1.8	2.8
Libya[4]	4.2	3.2	–66.7	124.7	–36.8	–53.0	–13.0	–7.4	70.8	16.4	1.4	1.5
Mauritania	4.3	4.8	4.7	5.8	6.1	5.6	0.8	1.6	3.2	2.7	4.5	5.3
Morocco	4.8	3.8	5.2	3.0	4.5	2.7	4.5	1.2	4.2	3.1	4.0	4.6
Oman	3.5	4.8	–1.1	9.3	4.4	2.8	4.7	1.8	–0.3	2.1	4.2	2.3
Pakistan	4.7	2.6	3.6	3.8	3.7	4.1	4.1	4.5	5.3	5.6	4.7	5.0
Qatar	12.1	18.1	13.4	4.7	4.4	4.0	3.6	2.2	2.1	2.6	2.7	2.7
Saudi Arabia	3.4	4.8	10.3	5.4	2.7	3.7	4.1	1.7	–0.7	1.7	1.9	2.3
Somalia	. . .	. . .	. . .	1.2	1.9	2.4	2.5	2.4	1.8	2.5	2.8	3.5
Sudan[6]	5.5	5.2	–3.7	–10.6	2.2	3.2	3.0	3.5	3.2	3.7	3.5	3.0
Syria[7]	4.4	3.4	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Tunisia	4.6	2.6	–1.9	3.9	2.4	2.3	1.1	1.0	1.9	2.4	2.9	4.2
United Arab Emirates	4.9	1.6	6.4	5.1	5.8	3.3	3.8	3.0	0.5	2.0	3.0	3.1
Yemen	4.1	7.7	–12.7	2.4	4.8	–0.2	–37.1	–34.3	–13.8	–0.5	17.9	6.3

Table A4. Emerging Market and Developing Economies: Real GDP *(continued)*
(Annual percent change)

	Average 2000–09	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019	2023
Sub-Saharan Africa	**5.7**	**7.0**	**5.1**	**4.4**	**5.3**	**5.1**	**3.4**	**1.4**	**2.8**	**3.4**	**3.7**	**4.0**
Angola	11.3	3.5	3.9	5.2	6.8	4.7	3.0	–0.8	0.7	2.2	2.4	4.9
Benin	4.2	2.1	3.0	4.8	7.2	6.4	2.1	4.0	5.6	6.0	6.3	6.1
Botswana	3.4	8.6	6.0	4.5	11.3	4.1	–1.7	4.3	2.2	4.6	4.5	4.2
Burkina Faso	5.3	8.4	6.6	6.5	5.8	4.3	3.9	5.9	6.4	6.0	6.0	5.3
Burundi	3.4	5.1	4.0	4.4	5.9	4.5	–4.0	–1.0	0.0	0.1	0.4	0.5
Cabo Verde	6.0	1.5	4.0	1.1	0.8	0.6	1.0	3.8	4.0	4.3	4.0	4.0
Cameroon	3.9	3.4	4.1	4.5	5.4	5.9	5.7	4.5	3.2	4.0	4.5	5.5
Central African Republic	1.0	3.0	3.3	4.1	–36.7	1.0	4.8	4.5	4.0	4.0	4.0	4.0
Chad	8.3	13.6	0.1	8.8	5.8	6.9	1.8	–6.4	–3.1	3.5	2.8	4.2
Comoros	2.0	2.1	2.2	3.0	3.5	2.0	1.0	2.2	2.5	3.0	3.0	3.0
Democratic Republic of the Congo	3.1	7.1	6.9	7.1	8.5	9.5	6.9	2.4	3.4	3.8	4.0	4.7
Republic of Congo	4.6	8.7	3.4	3.8	3.3	6.8	2.6	–2.8	–4.6	0.7	4.6	0.2
Côte d'Ivoire	0.7	2.0	–4.2	10.1	9.3	8.8	8.8	8.3	7.8	7.4	7.1	6.4
Equatorial Guinea	25.3	–8.9	6.5	8.3	–4.1	–0.7	–9.1	–9.7	–4.4	–8.5	–2.8	1.0
Eritrea	–0.9	2.2	8.7	7.0	4.6	2.9	2.6	1.9	5.0	4.2	3.8	4.3
Ethiopia	8.4	10.6	11.4	8.7	9.9	10.3	10.4	8.0	10.9	8.5	8.3	8.0
Gabon	0.6	6.3	7.1	5.3	5.5	4.4	3.9	2.1	0.8	2.7	3.7	4.7
The Gambia	3.7	6.5	–4.3	5.6	4.8	0.9	4.3	2.2	3.5	5.4	5.2	4.8
Ghana	5.4	7.9	14.0	9.3	7.3	4.0	3.8	3.7	8.4	6.3	7.6	5.1
Guinea	2.9	4.2	5.6	5.9	3.9	3.7	3.5	6.6	6.7	5.8	5.9	5.0
Guinea-Bissau	2.7	4.6	8.1	–1.7	3.3	1.0	6.1	5.8	5.5	5.5	5.5	5.0
Kenya	3.4	8.4	6.1	4.6	5.9	5.4	5.7	5.8	4.8	5.5	6.0	6.0
Lesotho	3.7	6.3	6.7	4.9	2.2	3.0	2.5	3.1	3.1	1.7	2.6	1.8
Liberia	. . .	6.4	7.7	8.4	8.8	0.7	0.0	–1.6	2.5	3.2	4.7	5.3
Madagascar	3.0	0.3	1.5	3.0	2.3	3.3	3.1	4.2	4.1	5.1	5.6	5.1
Malawi	4.2	6.9	4.9	1.9	5.2	5.7	2.9	2.3	4.0	3.5	4.5	6.5
Mali	5.2	5.4	3.2	–0.8	2.3	7.0	6.0	5.8	5.3	5.0	4.7	4.7
Mauritius	4.4	4.1	3.9	3.2	3.2	3.6	3.5	3.9	3.9	3.9	4.0	4.0
Mozambique	7.6	6.7	7.1	7.2	7.1	7.4	6.6	3.8	2.9	3.0	2.5	9.9
Namibia	3.8	6.0	5.1	5.1	5.6	6.4	6.0	1.1	–1.2	1.2	3.3	3.5
Niger	4.3	8.4	2.2	11.8	5.3	7.5	4.0	5.0	5.2	5.1	5.4	5.6
Nigeria	8.3	11.3	4.9	4.3	5.4	6.3	2.7	–1.6	0.8	2.1	1.9	2.0
Rwanda	8.3	7.3	7.8	8.8	4.7	7.6	8.9	6.0	6.1	7.2	7.8	7.5
São Tomé and Príncipe	3.9	4.5	4.8	4.5	4.3	4.1	4.0	4.1	4.0	5.0	5.5	5.5
Senegal	4.0	4.3	1.9	4.5	3.6	4.1	6.5	6.7	7.2	7.0	7.0	6.5
Seychelles	1.9	5.9	5.4	3.7	6.0	4.5	5.0	4.5	4.2	3.3	3.3	3.3
Sierra Leone	8.7	5.3	6.3	15.2	20.7	4.6	–20.5	6.3	3.5	3.5	5.6	7.3
South Africa	3.6	3.0	3.3	2.2	2.5	1.8	1.3	0.6	1.3	1.5	1.7	1.8
South Sudan	. . .	. . .	. . .	–52.4	29.3	2.9	–0.2	–13.8	–11.1	–3.8	–2.6	–0.7
Swaziland	3.8	3.5	2.0	3.5	4.8	3.6	1.1	0.0	0.2	–0.9	0.2	2.2
Tanzania	6.2	6.4	7.9	5.1	7.3	7.0	7.0	7.0	6.0	6.4	6.6	6.5
Togo	1.5	6.1	6.4	6.5	6.1	5.9	5.7	5.1	4.4	4.9	5.2	5.8
Uganda	7.5	7.7	6.8	2.2	4.7	4.6	5.7	2.3	4.5	5.2	5.8	7.3
Zambia	6.8	10.3	5.6	7.6	5.0	4.7	2.9	3.7	3.6	4.0	4.5	4.5
Zimbabwe[8]	–6.1	15.4	16.3	13.6	5.3	2.8	1.4	0.7	3.0	2.4	4.2	5.0

[1]Data for some countries refer to real net material product (NMP) or are estimates based on NMP. The figures should be interpreted only as indicative of broad orders of magnitude because reliable, comparable data are not generally available. In particular, the growth of output of new private enterprises of the informal economy is not fully reflected in the recent figures.
[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[3]Data are based on the 2008 System of National Accounts. The revised national accounts data are available beginning in 2000 and exclude Crimea and Sevastopol from 2010 onward.
[4]See country-specific notes for India and Libya in the "Country Notes" section of the Statistical Appendix.
[5]In this table only, the data for Timor-Leste are based on non-oil GDP.
[6]Data for 2011 exclude South Sudan after July 9. Data for 2012 and onward pertain to the current Sudan.
[7]Data for Syria are excluded for 2011 onward owing to the uncertain political situation.
[8]The Zimbabwe dollar ceased circulating in early 2009. Data are based on IMF staff estimates of price and exchange rate developments in US dollars. IMF staff estimates of US dollar values may differ from authorities' estimates. Real GDP is in constant 2009 prices.

Table A5. Summary of Inflation
(Percent)

	Average 2000–09	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019	2023
GDP Deflators												
Advanced Economies	**1.8**	**0.9**	**1.3**	**1.2**	**1.2**	**1.4**	**1.3**	**1.0**	**1.4**	**1.7**	**1.8**	**1.8**
United States	2.2	1.2	2.1	1.8	1.6	1.8	1.1	1.3	1.8	2.3	2.2	1.7
Euro Area	2.0	0.7	1.0	1.3	1.2	0.9	1.4	0.8	1.1	1.3	1.6	2.0
Japan	–1.1	–1.9	–1.7	–0.8	–0.3	1.7	2.1	0.3	–0.2	0.5	1.1	0.8
Other Advanced Economies[1]	2.1	2.0	2.0	1.2	1.4	1.3	1.0	1.2	2.0	1.9	1.7	2.0
Consumer Prices												
Advanced Economies	**2.0**	**1.5**	**2.7**	**2.0**	**1.4**	**1.4**	**0.3**	**0.8**	**1.7**	**2.0**	**1.9**	**2.0**
United States	2.6	1.6	3.1	2.1	1.5	1.6	0.1	1.3	2.1	2.5	2.4	2.1
Euro Area[2]	2.1	1.6	2.7	2.5	1.3	0.4	0.0	0.2	1.5	1.5	1.6	2.1
Japan	–0.3	–0.7	–0.3	–0.1	0.3	2.8	0.8	–0.1	0.5	1.1	1.1	1.3
Other Advanced Economies[1]	2.1	2.4	3.3	2.1	1.7	1.5	0.5	1.0	1.8	2.0	1.9	2.0
Emerging Market and Developing Economies[3]	**6.8**	**5.6**	**7.1**	**5.8**	**5.5**	**4.7**	**4.7**	**4.3**	**4.0**	**4.6**	**4.3**	**4.1**
Regional Groups												
Commonwealth of Independent States[4]	13.7	7.2	9.8	6.2	6.5	8.1	15.5	8.3	5.5	4.6	4.8	4.2
Emerging and Developing Asia	4.0	5.1	6.5	4.6	4.6	3.4	2.7	2.8	2.4	3.3	3.3	3.5
Emerging and Developing Europe	12.7	5.7	5.5	6.1	4.5	4.1	3.2	3.2	6.2	6.8	6.3	5.2
Latin America and the Caribbean	6.2	4.2	5.2	4.6	4.6	4.9	5.5	5.6	4.1	3.6	3.5	3.4
Middle East, North Africa, Afghanistan, and Pakistan	6.7	6.6	9.3	9.8	9.2	6.7	5.6	4.7	6.3	8.2	6.8	5.7
Middle East and North Africa	6.5	6.2	8.7	9.7	9.4	6.5	5.8	4.9	6.6	8.7	7.1	5.8
Sub-Saharan Africa	10.3	8.1	9.4	9.2	6.6	6.3	7.0	11.3	11.0	9.5	8.9	7.5
Memorandum												
European Union	2.5	2.0	3.1	2.6	1.5	0.5	0.0	0.2	1.7	1.9	1.8	2.2
Low-Income Developing Countries	9.6	9.2	11.8	9.9	8.1	7.2	7.4	8.7	9.5	9.3	8.8	7.1
Analytical Groups												
By Source of Export Earnings												
Fuel	10.2	6.7	8.6	8.0	8.1	6.4	8.8	6.9	5.3	6.1	5.9	5.5
Nonfuel	5.9	5.3	6.7	5.3	4.9	4.2	3.8	3.7	3.7	4.3	4.0	3.8
Of Which, Primary Products[5]	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
By External Financing Source												
Net Debtor Economies	7.7	6.7	7.7	7.0	6.3	5.7	5.5	5.1	5.4	5.6	5.2	4.6
Net Debtor Economies by Debt-Servicing Experience												
Economies with Arrears and/or Rescheduling during 2012–16	8.8	9.7	10.0	7.8	6.7	10.3	15.4	8.7	16.8	15.7	11.5	6.7
Memorandum												
Median Inflation Rate												
Advanced Economies	2.2	1.9	3.2	2.6	1.4	0.7	0.1	0.6	1.6	1.7	1.8	2.0
Emerging Market and Developing Economies[3]	5.1	4.1	5.4	4.5	3.8	3.2	2.7	2.7	3.3	3.6	3.4	3.0

[1]Excludes the United States, euro area countries, and Japan.
[2]Based on Eurostat's harmonized index of consumer prices.
[3]Excludes Argentina and Venezuela. See country-specific notes for Argentina and Venezuela in the "Country Notes" section of the Statistical Appendix.
[4]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[5]Data are missing because of Argentina, which accounts for more than 30 percent of the weights of the group. See country-specific notes for Argentina in the "Country Notes" section of the Statistical Appendix.

Table A6. Advanced Economies: Consumer Prices[1]

(Annual percent change)

	Average									Projections			End of Period[2]	Projections	
	2000–09	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023	2017	2018	2019
Advanced Economies	**2.0**	**1.5**	**2.7**	**2.0**	**1.4**	**1.4**	**0.3**	**0.8**	**1.7**	**2.0**	**1.9**	**2.0**	**1.7**	**2.0**	**2.0**
United States	2.6	1.6	3.1	2.1	1.5	1.6	0.1	1.3	2.1	2.5	2.4	2.1	2.1	2.6	2.3
Euro Area[3]	2.1	1.6	2.7	2.5	1.3	0.4	0.0	0.2	1.5	1.5	1.6	2.1	1.4	1.6	1.8
Germany	1.6	1.2	2.5	2.1	1.6	0.8	0.1	0.4	1.7	1.6	1.7	2.7	1.6	1.6	1.9
France	1.9	1.7	2.3	2.2	1.0	0.6	0.1	0.3	1.2	1.5	1.6	1.9	1.2	1.4	2.0
Italy	2.3	1.6	2.9	3.3	1.2	0.2	0.1	–0.1	1.3	1.1	1.3	1.6	0.7	1.6	1.3
Spain	3.0	1.8	3.2	2.4	1.4	–0.1	–0.5	–0.2	2.0	1.7	1.6	1.8	1.1	1.6	1.6
Netherlands	2.3	0.9	2.5	2.8	2.6	0.3	0.2	0.1	1.3	2.0	2.2	2.4	1.7	2.1	2.2
Belgium	2.1	2.3	3.4	2.6	1.2	0.5	0.6	1.8	2.2	1.6	1.8	2.0	1.6	1.5	2.0
Austria	1.9	1.7	3.5	2.6	2.1	1.5	0.8	1.0	2.2	2.2	2.2	2.1	2.3	2.2	2.2
Greece	3.2	4.7	3.1	1.0	–0.9	–1.4	–1.1	0.0	1.1	0.7	1.1	1.7	1.0	0.9	1.2
Portugal	2.6	1.4	3.6	2.8	0.4	–0.2	0.5	0.6	1.6	1.6	1.6	2.1	1.6	1.8	2.5
Ireland	2.9	–1.6	1.2	1.9	0.6	0.3	0.0	–0.2	0.3	0.9	1.3	1.9	–0.1	1.8	1.4
Finland	1.8	1.7	3.3	3.2	2.2	1.2	–0.2	0.4	0.8	1.2	1.7	2.0	0.5	1.7	1.7
Slovak Republic	5.2	0.7	4.1	3.7	1.5	–0.1	–0.3	–0.5	1.3	1.9	1.9	2.0	2.0	1.9	2.0
Lithuania	3.0	1.2	4.1	3.2	1.2	0.2	–0.7	0.7	3.7	2.2	2.2	2.5	3.8	2.2	2.2
Slovenia	4.9	1.8	1.8	2.6	1.8	0.2	–0.5	–0.1	1.4	1.7	2.0	2.0	1.7	1.7	2.0
Luxembourg	2.7	2.8	3.7	2.9	1.7	0.7	0.1	0.0	2.1	1.4	1.8	2.0	0.9	1.4	3.1
Latvia	5.8	–1.2	4.2	2.3	0.0	0.7	0.2	0.1	2.9	3.0	2.5	2.3	2.2	3.0	2.5
Estonia	4.3	2.7	5.1	4.2	3.2	0.5	0.1	0.9	3.7	3.0	2.5	2.1	3.8	1.8	2.5
Cyprus	2.6	2.6	3.5	3.1	0.4	–0.3	–1.5	–1.2	0.7	0.4	1.6	2.0	–0.5	2.2	2.1
Malta	2.5	2.0	2.5	3.2	1.0	0.8	1.2	0.9	1.3	1.6	1.8	2.0	1.3	1.7	1.8
Japan	–0.3	–0.7	–0.3	–0.1	0.3	2.8	0.8	–0.1	0.5	1.1	1.1	1.3	0.6	0.8	2.1
United Kingdom	1.8	3.3	4.5	2.8	2.6	1.5	0.0	0.7	2.7	2.7	2.2	2.0	3.0	2.7	2.0
Korea	3.1	2.9	4.0	2.2	1.3	1.3	0.7	1.0	1.9	1.7	1.9	2.0	1.5	2.1	2.0
Canada	2.1	1.8	2.9	1.5	0.9	1.9	1.1	1.4	1.6	2.2	2.2	2.0	1.8	2.2	2.1
Australia	3.2	2.9	3.3	1.7	2.5	2.5	1.5	1.3	2.0	2.2	2.4	2.5	2.0	2.3	2.4
Taiwan Province of China	1.0	1.0	1.4	1.9	0.8	1.2	–0.3	1.4	0.6	1.3	1.3	2.0	1.2	1.3	1.3
Switzerland	1.0	0.7	0.2	–0.7	–0.2	0.0	–1.1	–0.4	0.5	0.7	1.0	1.0	0.6	0.9	0.9
Sweden	1.9	1.9	1.4	0.9	0.4	0.2	0.7	1.1	1.9	1.5	1.6	2.0	1.8	1.5	1.8
Singapore	1.5	2.8	5.2	4.6	2.4	1.0	–0.5	–0.5	0.6	1.2	1.0	1.0	0.4	1.8	0.4
Hong Kong SAR	–0.2	2.3	5.3	4.1	4.3	4.4	3.0	2.4	1.5	2.2	2.1	2.6	1.5	2.2	2.1
Norway	2.1	2.4	1.3	0.7	2.1	2.0	2.2	3.6	1.9	1.9	2.0	2.0	1.6	1.8	2.0
Czech Republic	2.8	1.5	1.9	3.3	1.4	0.3	0.3	0.7	2.4	2.3	2.0	2.0	2.4	2.2	2.0
Israel	2.0	2.7	3.5	1.7	1.5	0.5	–0.6	–0.5	0.2	0.7	1.3	2.0	0.4	1.0	1.5
Denmark	2.1	2.3	2.8	2.4	0.8	0.6	0.5	0.3	1.1	1.4	1.7	2.0	1.0	1.6	1.8
New Zealand	2.7	2.3	4.1	1.0	1.1	1.2	0.3	0.6	1.9	1.7	2.1	2.0	1.6	2.2	2.0
Puerto Rico	2.8	2.5	2.9	1.3	1.1	0.6	–0.8	–0.3	1.9	2.2	0.8	1.6	3.1	2.2	0.8
Macao SAR	. . .	2.8	5.8	6.1	5.5	6.0	4.6	2.4	1.2	2.2	2.4	2.8	2.0	2.2	2.4
Iceland	6.2	5.4	4.0	5.2	3.9	2.0	1.6	1.7	1.8	2.4	2.3	2.5	1.9	2.7	2.5
San Marino	. . .	2.6	2.0	2.8	1.6	1.1	0.1	0.6	0.9	1.0	1.1	1.2	0.9	1.0	1.1
Memorandum															
Major Advanced Economies	1.9	1.4	2.6	1.9	1.3	1.5	0.3	0.8	1.8	2.1	2.0	2.0	1.7	2.1	2.1

[1]Movements in consumer prices are shown as annual averages.
[2]Monthly year-over-year changes and, for several countries, on a quarterly basis.
[3]Based on Eurostat's harmonized index of consumer prices.

Table A7. Emerging Market and Developing Economies: Consumer Prices[1]

(Annual percent change)

	Average									Projections			End of Period[2]	Projections	
	2000–09	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023	2017	2018	2019
Commonwealth of Independent States[3,4]	**13.7**	**7.2**	**9.8**	**6.2**	**6.5**	**8.1**	**15.5**	**8.3**	**5.5**	**4.6**	**4.8**	**4.2**	**4.7**	**4.9**	**4.7**
Russia	13.9	6.9	8.4	5.1	6.8	7.8	15.5	7.1	3.7	2.8	3.7	4.0	2.5	3.5	4.0
Excluding Russia	13.3	8.1	13.3	9.2	5.7	8.8	15.5	11.3	9.9	9.2	7.2	4.5	10.1	8.3	6.4
Armenia	3.6	7.3	7.7	2.5	5.8	3.0	3.7	–1.4	0.9	3.5	4.0	4.0	2.6	4.0	4.0
Azerbaijan	7.0	5.7	7.8	1.1	2.5	1.5	4.1	12.6	13.0	7.0	6.0	4.0	10.0	7.0	5.0
Belarus	31.6	7.7	53.2	59.2	18.3	18.1	13.5	11.8	6.0	6.0	6.0	5.0	4.6	6.0	6.0
Georgia	6.3	7.1	8.5	–0.9	–0.5	3.1	4.0	2.1	6.0	3.6	3.0	3.0	6.7	3.0	3.0
Kazakhstan	9.2	7.1	8.3	5.1	5.8	6.7	6.7	14.6	7.4	6.4	5.6	2.1	7.1	6.0	5.2
Kyrgyz Republic	8.5	8.0	16.6	2.8	6.6	7.5	6.5	0.4	3.2	4.5	5.0	5.0	3.7	5.5	5.2
Moldova	11.7	7.4	7.6	4.6	4.6	5.1	9.6	6.4	6.6	4.7	5.1	5.1	7.3	4.0	6.0
Tajikistan	16.0	6.5	12.4	5.8	5.0	6.1	5.8	5.9	7.3	6.3	6.0	6.0	6.7	6.3	6.0
Turkmenistan	7.6	4.4	5.3	5.3	6.8	6.0	7.4	3.6	8.0	9.4	8.2	6.0	10.4	9.4	8.2
Ukraine[5]	12.9	9.4	8.0	0.6	–0.3	12.1	48.7	13.9	14.4	11.0	8.0	5.0	13.7	9.0	6.5
Uzbekistan	15.8	12.3	12.4	11.9	11.7	9.1	8.5	8.0	12.5	19.5	12.9	7.3	18.9	16.9	10.1
Emerging and Developing Asia	**4.0**	**5.1**	**6.5**	**4.6**	**4.6**	**3.4**	**2.7**	**2.8**	**2.4**	**3.3**	**3.3**	**3.5**	**2.8**	**3.5**	**3.3**
Bangladesh	5.6	9.4	11.5	6.2	7.5	7.0	6.2	5.7	5.7	6.0	6.0	5.5	5.9	6.0	6.0
Bhutan	4.8	5.7	7.3	9.3	11.3	9.9	6.3	3.9	3.4	4.1	4.6	4.7	3.5	4.5	4.5
Brunei Darussalam	0.6	0.2	0.1	0.1	0.4	–0.2	–0.4	–0.7	–0.1	0.1	0.3	0.2	0.0	0.3	0.2
Cambodia	4.6	4.0	5.5	2.9	3.0	3.9	1.2	3.0	2.9	3.3	3.2	3.0	2.2	3.3	3.2
China	1.8	3.3	5.4	2.6	2.6	2.0	1.4	2.0	1.6	2.5	2.6	3.0	1.8	2.8	2.6
Fiji	3.4	3.7	7.3	3.4	2.9	0.5	1.4	3.9	3.4	3.3	3.0	3.0	2.8	3.3	3.0
India	5.9	9.5	9.5	10.0	9.4	5.8	4.9	4.5	3.6	5.0	5.0	4.8	4.7	5.2	4.9
Indonesia	8.5	5.1	5.3	4.0	6.4	6.4	6.4	3.5	3.8	3.5	3.4	3.0	3.6	3.5	3.6
Kiribati	3.5	–3.9	1.5	–3.0	–1.5	2.1	0.6	1.9	2.2	2.5	2.5	2.5	2.2	2.5	2.5
Lao P.D.R.	7.8	6.0	7.6	4.3	6.4	4.1	1.3	1.6	0.8	2.3	3.1	3.1	0.1	2.6	2.9
Malaysia	2.2	1.7	3.2	1.7	2.1	3.1	2.1	2.1	3.8	3.2	2.4	2.5	3.5	3.0	2.5
Maldives	3.2	6.2	11.3	10.9	3.8	2.1	1.0	0.5	2.8	1.5	1.7	2.3	0.5	2.3	2.4
Marshall Islands	. . .	1.8	5.4	4.3	1.9	1.1	–2.2	–1.5	0.7	1.1	1.5	2.1	0.7	1.1	1.5
Micronesia	3.1	3.7	4.1	6.3	2.2	0.7	–0.2	0.5	0.5	2.0	2.0	2.0	0.5	2.0	2.0
Mongolia	8.8	10.2	7.7	15.0	8.6	12.9	5.9	0.6	4.6	6.4	6.8	6.3	7.2	7.8	6.9
Myanmar	18.9	8.2	2.8	2.8	5.7	5.1	10.0	6.8	5.1	5.5	5.8	5.7	5.5	5.8	6.1
Nauru	. . .	–2.0	–3.4	0.3	–1.1	0.3	9.8	8.2	5.1	2.0	2.0	2.0	1.6	2.0	2.0
Nepal	5.5	9.6	9.6	8.3	9.9	9.0	7.2	9.9	4.5	6.0	5.8	5.5	2.7	5.7	5.7
Palau	. . .	1.4	4.7	3.6	3.4	4.1	0.9	–1.0	0.9	2.0	2.0	2.0	0.9	2.0	2.0
Papua New Guinea	7.5	5.1	4.4	4.5	5.0	5.2	6.0	6.7	5.2	2.9	2.5	2.4	3.9	2.6	2.5
Philippines	4.9	3.8	4.7	3.2	2.9	4.2	1.4	1.8	3.2	4.2	3.8	3.0	3.3	4.1	3.7
Samoa	5.7	–0.2	2.9	6.2	–0.2	–1.2	1.9	0.1	1.3	2.9	2.5	3.0	1.0	2.6	2.5
Solomon Islands	9.1	1.0	7.4	5.9	5.4	5.2	–0.6	0.5	–0.4	1.3	1.4	4.2	–2.2	1.9	5.0
Sri Lanka	9.7	6.2	6.7	7.5	6.9	2.8	2.2	4.0	6.5	4.8	4.8	4.9	7.1	4.7	4.8
Thailand	2.4	3.3	3.8	3.0	2.2	1.9	–0.9	0.2	0.7	1.4	0.7	2.0	0.8	0.8	1.0
Timor-Leste	. . .	5.2	13.2	10.9	9.5	0.7	0.6	–1.3	0.6	1.8	2.7	4.0	0.8	2.5	2.8
Tonga	8.0	3.5	6.3	1.1	2.1	1.2	–1.1	2.6	8.0	3.0	2.5	2.5	7.5	2.5	2.5
Tuvalu	. . .	–1.9	0.5	1.4	2.0	1.1	3.2	3.5	2.4	2.7	2.5	2.6	2.9	3.4	2.8
Vanuatu	2.9	2.8	0.9	1.3	1.5	0.8	2.5	0.8	3.1	4.8	3.4	3.0	3.8	4.6	3.4
Vietnam	6.5	9.2	18.7	9.1	6.6	4.1	0.6	2.7	3.5	3.8	4.0	4.0	2.6	4.0	4.0
Emerging and Developing Europe	**12.7**	**5.7**	**5.5**	**6.1**	**4.5**	**4.1**	**3.2**	**3.2**	**6.2**	**6.8**	**6.3**	**5.2**	**6.8**	**6.6**	**6.0**
Albania	2.7	3.6	3.4	2.0	1.9	1.6	1.9	1.3	2.0	2.5	2.8	3.0	1.8	2.8	2.9
Bosnia and Herzegovina	2.9	2.1	3.7	2.0	–0.1	–0.9	–1.0	–1.1	1.3	1.5	1.6	2.0	1.6	1.9	1.7
Bulgaria[6]	6.7	3.0	3.4	2.4	0.4	–1.6	–1.1	–1.3	1.2	2.0	2.1	2.1	1.8	2.1	2.1
Croatia	3.2	1.0	2.3	3.4	2.2	–0.2	–0.5	–1.1	1.1	1.5	1.5	1.8	1.2	1.2	1.4
Hungary	6.1	4.9	3.9	5.7	1.7	–0.2	–0.1	0.4	2.4	2.7	3.3	3.0	2.1	3.2	3.2
Kosovo	. . .	3.5	7.3	2.5	1.8	0.4	–0.5	0.3	1.5	1.0	1.9	2.2	0.7	1.8	2.0
FYR Macedonia	2.6	1.5	3.9	3.3	2.8	–0.3	–0.3	–0.2	1.4	1.8	1.9	2.0	2.4	1.8	2.0
Montenegro	10.1	0.4	3.5	4.1	2.2	–0.7	1.5	–0.3	2.4	2.8	1.8	2.0	1.9	2.7	1.8
Poland	3.5	2.6	4.3	3.7	0.9	0.0	–0.9	–0.6	2.0	2.5	2.5	2.5	2.1	2.9	2.2
Romania	15.6	6.1	5.8	3.3	4.0	1.1	–0.6	–1.6	1.3	4.7	3.1	3.1	3.3	3.5	3.2
Serbia	20.2	6.1	11.1	7.3	7.7	2.1	1.4	1.1	3.1	2.7	3.0	3.0	3.0	3.0	3.0
Turkey	21.7	8.6	6.5	8.9	7.5	8.9	7.7	7.8	11.1	11.4	10.5	8.0	11.9	10.9	10.0

Table A7. Emerging Market and Developing Economies: Consumer Prices[1] *(continued)*
(Annual percent change)

													End of Period[2]		
	Average								Projections				Projections		
	2000–09	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023	2017	2018	2019
Latin America and the Caribbean[7]	**6.2**	**4.2**	**5.2**	**4.6**	**4.6**	**4.9**	**5.5**	**5.6**	**4.1**	**3.6**	**3.5**	**3.4**	**4.1**	**3.6**	**3.5**
Antigua and Barbuda	1.8	3.4	3.5	3.4	1.1	1.1	1.0	–0.5	2.5	1.4	2.0	2.0	2.8	2.0	2.0
Argentina[8]	8.4	10.5	9.8	10.0	10.6	. . .	. . .	. . .	25.7	22.7	15.4	8.0	24.8	19.2	13.6
The Bahamas	2.3	1.6	3.1	1.9	0.4	1.2	1.9	–0.3	1.4	2.2	2.5	2.1	2.0	2.4	2.6
Barbados	3.7	5.8	9.4	4.5	1.8	1.8	–1.1	1.5	4.4	5.4	2.9	2.7	6.6	2.2	3.5
Belize	2.5	0.9	1.7	1.2	0.5	1.2	–0.9	0.7	1.1	1.3	1.9	1.7	1.1	1.6	2.1
Bolivia	4.8	2.5	9.9	4.5	5.7	5.8	4.1	3.6	2.8	3.5	4.5	4.5	2.7	4.5	4.5
Brazil	6.9	5.0	6.6	5.4	6.2	6.3	9.0	8.7	3.4	3.5	4.2	4.1	2.9	3.9	4.3
Chile	3.5	1.4	3.3	3.0	1.9	4.4	4.3	3.8	2.2	2.4	3.0	3.0	2.3	2.6	3.0
Colombia	6.3	2.3	3.4	3.2	2.0	2.9	5.0	7.5	4.3	3.5	3.4	3.0	4.1	3.4	3.0
Costa Rica	10.9	5.7	4.9	4.5	5.2	4.5	0.8	0.0	1.6	2.8	3.0	3.0	2.6	3.0	3.0
Dominica	2.0	2.8	1.1	1.4	0.0	0.8	–0.8	0.0	0.6	1.4	1.6	1.6	1.4	1.4	1.8
Dominican Republic	12.2	6.3	8.5	3.7	4.8	3.0	0.8	1.6	3.3	4.4	3.5	4.0	4.2	3.7	3.8
Ecuador	15.3	3.6	4.5	5.1	2.7	3.6	4.0	1.7	0.4	1.0	1.4	1.8	–0.2	2.5	1.4
El Salvador	3.5	1.2	5.1	1.7	0.8	1.1	–0.7	0.6	1.0	1.7	1.9	2.0	2.0	2.1	2.0
Grenada	2.8	3.4	3.0	2.4	0.0	–1.0	–0.6	1.7	2.0	2.0	1.8	1.9	0.5	1.8	1.9
Guatemala	7.0	3.9	6.2	3.8	4.3	3.4	2.4	4.4	4.4	4.2	3.7	3.8	5.7	4.2	3.5
Guyana	6.1	4.3	4.4	2.4	1.9	0.7	–0.9	0.8	2.1	2.6	2.9	3.3	2.3	2.8	3.0
Haiti	14.8	4.1	7.4	6.8	6.8	3.9	7.5	13.4	14.7	11.1	6.0	5.0	15.4	8.0	5.0
Honduras	8.2	4.7	6.8	5.2	5.2	6.1	3.2	2.7	3.9	4.7	4.5	4.5	4.7	5.0	4.5
Jamaica	10.9	12.6	7.5	6.9	9.4	8.3	3.7	2.3	4.4	4.9	5.0	5.0	5.2	5.1	5.0
Mexico	5.2	4.2	3.4	4.1	3.8	4.0	2.7	2.8	6.0	4.4	3.1	3.0	6.8	3.6	3.0
Nicaragua	8.9	5.5	8.1	7.2	7.1	6.0	4.0	3.5	3.9	6.2	7.2	7.2	5.7	6.3	7.4
Panama	2.4	3.5	5.9	5.7	4.0	2.6	0.1	0.7	0.9	2.2	2.5	2.3	0.5	2.2	2.5
Paraguay	8.2	4.6	8.2	3.7	2.7	5.0	3.1	4.1	3.6	4.2	4.0	4.0	4.5	4.0	4.0
Peru	2.6	1.5	3.4	3.7	2.8	3.2	3.5	3.6	2.8	1.6	2.0	2.0	1.4	2.3	2.0
St. Kitts and Nevis	3.4	0.9	5.8	0.8	1.1	0.2	–2.3	–0.7	0.1	1.1	2.0	2.0	0.2	2.0	2.0
St. Lucia	2.8	3.3	2.8	4.2	1.5	3.5	–1.0	–3.1	0.1	1.5	1.6	1.5	2.2	1.4	1.5
St. Vincent and the Grenadines	2.9	0.8	3.2	2.6	0.8	0.2	–1.7	–0.2	2.0	1.5	1.5	1.5	2.2	1.5	1.5
Suriname	15.3	6.9	17.7	5.0	1.9	3.4	6.9	55.5	22.0	8.9	9.6	3.9	9.3	11.2	7.8
Trinidad and Tobago	6.3	10.5	5.1	9.3	5.2	5.7	4.7	3.1	1.9	2.7	2.1	3.2	1.3	2.7	2.1
Uruguay	8.5	6.7	8.1	8.1	8.6	8.9	8.7	9.6	6.2	7.0	6.1	6.1	6.6	6.6	6.5
Venezuela[8]	20.8	28.2	26.1	21.1	43.5	57.3	111.8	254.4	1,087.5	13,864.6	12,874.6	12,874.6	2,818.4	12,874.6	12,874.6
Middle East, North Africa, Afghanistan, and Pakistan	**6.7**	**6.6**	**9.3**	**9.8**	**9.2**	**6.7**	**5.6**	**4.7**	**6.3**	**8.2**	**6.8**	**5.7**	**7.2**	**7.3**	**7.4**
Afghanistan	. . .	2.2	11.8	6.4	7.4	4.7	–0.7	4.4	5.0	5.0	5.0	5.0	3.0	5.0	5.0
Algeria	3.2	3.9	4.5	8.9	3.3	2.9	4.8	6.4	5.6	7.4	7.6	13.9	4.9	10.4	6.9
Bahrain	1.6	2.0	–0.4	2.8	3.3	2.7	1.8	2.8	1.4	2.9	4.9	1.5	1.4	2.7	4.7
Djibouti	3.4	4.0	5.1	3.7	2.4	2.9	2.1	2.7	0.7	1.0	2.0	2.5	–1.0	1.0	2.0
Egypt	7.0	11.7	11.1	8.6	6.9	10.1	11.0	10.2	23.5	20.1	13.0	7.0	29.8	10.4	15.2
Iran	14.7	12.3	21.5	30.6	34.7	15.6	11.9	9.1	9.9	12.1	11.5	10.2	10.2	11.2	13.4
Iraq	. . .	2.4	5.6	6.1	1.9	2.2	1.4	0.4	0.1	2.0	2.0	2.0	0.4	2.0	2.0
Jordan	3.6	4.8	4.2	4.5	4.8	2.9	–0.9	–0.8	3.3	1.5	2.5	2.5	2.5	2.5	2.5
Kuwait	2.9	4.5	4.9	3.2	2.7	3.1	3.7	3.5	1.5	2.5	3.7	2.7	1.5	2.5	3.7
Lebanon	2.4	4.0	5.0	6.6	4.8	1.9	–3.7	–0.8	4.5	4.3	3.0	2.5	5.0	3.5	2.5
Libya[8]	–0.1	2.5	15.9	6.1	2.6	2.4	9.8	25.9	28.0	24.3	14.4	9.0	30.0	20.0	10.0
Mauritania	6.2	6.3	5.7	4.9	4.1	3.8	0.5	1.5	2.3	3.7	5.0	4.4	1.2	4.7	5.0
Morocco	1.9	1.0	0.9	1.3	1.9	0.4	1.5	1.6	0.8	1.4	2.0	2.0	1.9	2.0	2.0
Oman	2.5	3.3	4.0	2.9	1.2	1.0	0.1	1.1	1.6	2.5	3.5	3.0	1.6	2.5	3.5
Pakistan	7.5	10.1	13.7	11.0	7.4	8.6	4.5	2.9	4.1	5.0	5.2	5.0	3.9	5.4	5.0
Qatar	5.5	–2.4	2.0	1.8	3.2	3.4	1.8	2.7	0.4	3.9	3.5	2.2	. . .	. . .	. . .
Saudi Arabia	1.6	3.8	3.8	2.9	3.5	2.2	1.3	2.0	–0.9	3.7	2.0	2.1	–0.9	3.7	2.0
Somalia	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	5.2	2.8	2.6
Sudan[9]	8.6	13.0	18.3	35.4	36.5	36.9	16.9	17.8	32.4	43.5	39.5	22.5	25.2	42.0	37.0
Syria[10]	4.8	4.4	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Tunisia	2.8	3.3	3.5	5.1	5.8	4.9	4.9	3.7	5.3	7.0	6.1	3.9	6.4	6.5	5.9
United Arab Emirates	5.5	0.9	0.9	0.7	1.1	2.3	4.1	1.6	2.0	4.2	2.5	2.0	2.0	4.2	2.5
Yemen	10.9	11.2	19.5	9.9	11.0	8.2	61.4	–20.3	4.9	23.0	20.0	5.0	16.0	30.0	10.0

Table A7. Emerging Market and Developing Economies: Consumer Prices[1] *(continued)*
(Annual percent change)

	Average									Projections			End of Period[2]	Projections	
	2000–09	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023	2017	2018	2019
Sub-Saharan Africa	**10.3**	**8.1**	**9.4**	**9.2**	**6.6**	**6.3**	**7.0**	**11.3**	**11.0**	**9.5**	**8.9**	**7.5**	**10.3**	**9.6**	**9.3**
Angola	62.4	14.5	13.5	10.3	8.8	7.3	10.3	32.4	31.7	27.9	17.0	6.5	26.3	24.6	15.0
Benin	3.2	2.2	2.7	6.7	1.0	–1.1	0.3	–0.8	0.1	2.9	2.9	2.7	3.0	2.8	3.0
Botswana	8.7	6.9	8.5	7.5	5.9	4.4	3.1	2.8	3.3	3.7	3.8	4.0	2.9	3.5	3.7
Burkina Faso	2.8	–0.6	2.8	3.8	0.5	–0.3	0.9	–0.2	0.4	2.0	2.0	2.0	2.1	2.0	2.0
Burundi	10.7	6.5	9.6	18.2	7.9	4.4	5.6	5.5	16.6	12.7	22.1	14.5	10.5	18.9	24.7
Cabo Verde	2.0	2.1	4.5	2.5	1.5	–0.2	0.1	–1.4	0.8	1.0	1.5	2.0	0.3	1.0	1.5
Cameroon	2.6	1.3	2.9	2.4	2.1	1.9	2.7	0.9	0.6	1.1	1.3	2.0	0.8	1.1	1.3
Central African Republic	3.4	1.5	1.2	5.9	6.6	11.6	4.5	4.6	3.8	3.5	3.2	3.0	3.6	3.6	3.4
Chad	3.5	–2.1	1.9	7.7	0.2	1.7	6.8	–1.1	–0.9	2.1	2.6	3.0	7.2	–2.3	5.4
Comoros	4.4	3.9	2.2	5.9	1.6	1.3	2.0	1.8	1.0	2.0	2.0	2.0	2.9	3.5	2.0
Democratic Republic of the Congo	61.5	23.5	14.9	0.9	0.9	1.2	1.0	18.2	41.5	25.8	13.7	3.5	55.0	29.5	15.8
Republic of Congo	2.9	0.4	1.8	5.0	4.6	0.9	3.2	3.2	0.5	1.5	1.6	3.0	1.8	1.8	1.9
Côte d'Ivoire	3.0	1.4	4.9	1.3	2.6	0.4	1.2	0.7	0.8	1.7	2.0	2.0	1.1	2.0	2.0
Equatorial Guinea	5.6	5.3	4.8	3.4	3.2	4.3	1.7	1.4	0.7	0.6	2.8	2.8	–0.2	1.3	4.0
Eritrea	18.7	11.2	3.9	6.0	6.5	10.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Ethiopia	10.3	8.1	33.2	24.1	8.1	7.4	10.1	7.3	9.9	11.2	8.6	8.0	13.6	10.0	8.0
Gabon	1.1	1.4	1.3	2.7	0.5	4.5	–0.1	2.1	3.0	2.8	2.5	2.5	3.0	2.8	2.5
The Gambia	6.6	5.0	4.8	4.6	5.2	6.3	6.8	7.2	8.0	5.8	5.0	4.8	6.9	5.1	4.8
Ghana	17.7	6.7	7.7	7.1	11.7	15.5	17.2	17.5	12.4	8.7	8.0	6.0	11.8	8.0	8.0
Guinea	15.1	15.5	21.4	15.2	11.9	9.7	8.2	8.2	8.9	8.2	8.0	7.8	9.5	8.0	8.0
Guinea-Bissau	3.0	1.1	5.1	2.1	0.8	–1.0	1.5	1.5	1.1	2.0	2.2	3.0	–1.3	2.0	2.3
Kenya	7.3	4.3	14.0	9.4	5.7	6.9	6.6	6.3	8.0	4.8	5.0	5.0	4.5	5.1	5.0
Lesotho	7.3	3.3	6.0	5.5	5.0	4.6	4.3	6.2	5.6	5.5	5.5	5.0	6.0	5.5	5.5
Liberia	9.8	7.3	8.5	6.8	7.6	9.9	7.7	8.8	12.4	11.7	10.5	6.2	13.9	11.0	10.0
Madagascar	10.4	9.2	9.5	5.7	5.8	6.1	7.4	6.7	8.1	7.8	6.8	5.0	8.1	7.9	6.2
Malawi	14.1	7.4	7.6	21.3	28.3	23.8	21.9	21.7	11.5	10.4	7.6	5.0	7.1	9.0	7.5
Mali	2.5	1.3	3.1	5.3	–0.6	0.9	1.4	–1.8	1.8	1.4	1.7	2.2	1.1	1.6	1.7
Mauritius	5.9	2.9	6.5	3.9	3.5	3.2	1.3	1.0	3.7	5.1	4.5	3.7	4.2	5.9	4.7
Mozambique	10.5	12.7	10.4	2.1	4.2	2.3	2.4	19.2	15.3	6.7	5.7	5.5	7.2	6.5	5.5
Namibia	7.6	4.9	5.0	6.7	5.6	5.3	3.4	6.7	6.1	5.8	5.8	5.8	5.2	5.7	5.8
Niger	3.1	–2.8	2.9	0.5	2.3	–0.9	1.0	0.2	2.4	3.9	2.0	2.0	4.8	1.9	2.1
Nigeria	12.3	13.7	10.8	12.2	8.5	8.0	9.0	15.7	16.5	14.0	14.8	14.0	15.4	14.5	16.6
Rwanda	8.1	2.3	5.7	6.3	4.2	1.8	2.5	5.7	4.8	2.8	5.0	5.0	0.7	5.0	5.0
São Tomé and Príncipe	15.9	13.3	14.3	10.6	8.1	7.0	5.3	4.6	5.5	5.4	4.7	3.0	5.8	5.0	4.5
Senegal	2.0	1.2	3.4	1.4	0.7	–1.1	0.1	0.9	1.4	1.5	1.5	1.5	0.3	1.5	1.5
Seychelles	8.6	–2.4	2.6	7.1	4.3	1.4	4.0	–1.0	2.9	3.8	3.0	3.0	3.5	3.8	3.3
Sierra Leone	7.5	17.8	18.5	13.8	9.8	8.3	9.0	11.5	18.0	13.9	11.2	7.2	13.8	13.0	9.9
South Africa	6.0	4.3	5.0	5.6	5.8	6.1	4.6	6.3	5.3	5.3	5.3	5.5	4.7	5.6	5.3
South Sudan	. . .	. . .	. . .	45.1	0.0	1.7	52.8	379.8	187.9	104.1	108.2	39.0	117.7	96.4	125.1
Swaziland	7.5	4.5	6.1	8.9	5.6	5.7	5.0	8.0	6.3	5.4	5.4	5.5	4.7	6.0	4.9
Tanzania	6.5	7.2	12.7	16.0	7.9	6.1	5.6	5.2	5.3	4.8	5.0	5.0	4.0	5.0	5.0
Togo	3.0	1.4	3.6	2.6	1.8	0.2	1.8	0.9	–0.7	0.4	1.2	3.0	–1.6	2.4	0.2
Uganda	6.4	3.7	15.0	12.7	4.9	3.1	5.4	5.5	5.6	3.6	4.3	5.0	3.3	4.0	4.5
Zambia	17.2	8.5	8.7	6.6	7.0	7.8	10.1	17.9	6.6	8.2	8.0	8.0	6.1	8.0	8.0
Zimbabwe[11]	–5.5	3.0	3.5	3.7	1.6	–0.2	–2.4	–1.6	1.3	5.2	6.3	2.3	3.5	7.9	4.9

[1]Movements in consumer prices are shown as annual averages.
[2]Monthly year-over-year changes and, for several countries, on a quarterly basis.
[3]For many countries, inflation for the earlier years is measured on the basis of a retail price index. Consumer price index (CPI) inflation data with broader and more up-to-date coverage are typically used for more recent years.
[4]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in the group for reasons of geography and similarity in economic structure.
[5]Starting in 2014, data exclude Crimea and Sevastopol.
[6]Based on Eurostat's harmonized index of consumer prices.
[7]Excludes Argentina and Venezuela.
[8]See country-specific notes for Argentina, Libya, and Venezuela in the "Country Notes" section of the Statistical Appendix.
[9]Data for 2011 exclude South Sudan after July 9. Data for 2012 and onward pertain to the current Sudan.
[10]Data for Syria are excluded for 2011 onward owing to the uncertain political situation.
[11]The Zimbabwe dollar ceased circulating in early 2009. Data are based on IMF staff estimates of price and exchange rate developments in US dollars. IMF staff estimates of US dollar values may differ from authorities' estimates.

Table A8. Major Advanced Economies: General Government Fiscal Balances and Debt[1]

(Percent of GDP unless noted otherwise)

	Average							Projections		
	2000–09	2012	2013	2014	2015	2016	2017	2018	2019	2023
Major Advanced Economies										
Net Lending/Borrowing	–4.2	–6.4	–4.3	–3.6	–3.0	–3.3	–3.4	–3.5	–3.7	–2.7
Output Gap[2]	0.4	–2.0	–1.9	–1.3	–0.7	–0.7	–0.1	0.6	1.1	0.7
Structural Balance[2]	–4.1	–5.2	–3.8	–3.2	–2.8	–3.2	–3.3	–3.6	–4.2	–3.0
United States										
Net Lending/Borrowing[3]	–4.6	–7.9	–4.4	–4.0	–3.5	–4.2	–4.6	–5.3	–5.9	–5.0
Output Gap[2]	1.0	–2.2	–1.9	–1.1	0.0	–0.2	0.3	1.2	1.8	1.1
Structural Balance[2]	–4.4	–6.4	–4.4	–3.8	–3.6	–4.3	–4.6	–5.6	–6.8	–5.3
Net Debt	45.2	80.5	81.3	80.8	80.5	81.5	82.3	81.4	82.7	90.2
Gross Debt	65.3	103.5	105.4	105.1	105.3	107.2	107.8	108.0	109.4	116.9
Euro Area										
Net Lending/Borrowing	–2.4	–3.6	–3.0	–2.6	–2.1	–1.5	–0.9	–0.6	–0.5	0.1
Output Gap[2]	0.6	–2.0	–2.8	–2.5	–1.9	–1.4	–0.5	0.3	0.6	0.5
Structural Balance[2]	–2.9	–2.1	–1.2	–1.1	–0.9	–0.7	–0.6	–0.7	–0.8	–0.2
Net Debt	55.2	72.2	74.6	75.0	73.9	73.2	71.0	68.9	66.9	58.6
Gross Debt	68.7	89.4	91.3	91.8	89.9	88.9	86.6	84.2	81.7	71.7
Germany										
Net Lending/Borrowing	–2.2	0.0	–0.1	0.3	0.6	0.8	1.1	1.5	1.7	1.4
Output Gap[2]	–0.3	0.5	–0.3	0.1	0.1	0.2	0.9	1.6	1.7	0.8
Structural Balance[2]	–2.2	–0.2	0.1	0.5	0.6	0.8	0.9	0.6	0.7	1.0
Net Debt	52.3	58.4	57.4	54.2	51.2	48.5	45.1	41.5	38.1	27.2
Gross Debt	63.9	79.8	77.4	74.7	71.0	68.2	64.1	59.8	55.7	42.4
France										
Net Lending/Borrowing	–3.2	–4.8	–4.0	–3.9	–3.6	–3.4	–2.6	–2.4	–3.1	–0.3
Output Gap[2]	0.3	–1.9	–2.4	–2.5	–2.5	–2.3	–1.8	–1.1	–0.5	0.1
Structural Balance[2]	–3.4	–3.5	–2.4	–2.3	–1.9	–1.8	–1.4	–1.5	–2.7	–0.4
Net Debt	56.5	80.0	83.1	85.6	86.5	87.5	87.7	87.0	86.9	79.7
Gross Debt	65.4	90.7	93.5	95.0	95.8	96.6	97.0	96.3	96.2	89.0
Italy										
Net Lending/Borrowing	–3.2	–2.9	–2.9	–3.0	–2.6	–2.5	–1.9	–1.6	–0.9	0.0
Output Gap[2]	0.1	–2.8	–4.1	–4.1	–3.2	–2.6	–1.6	–0.7	–0.2	0.2
Structural Balance[2,4]	–3.9	–1.5	–0.6	–1.0	–0.7	–1.3	–1.5	–1.3	–0.7	–0.1
Net Debt	94.9	111.6	116.7	118.8	119.5	120.2	119.9	118.5	116.5	106.5
Gross Debt	103.2	123.4	129.0	131.8	131.5	132.0	131.5	129.7	127.5	116.6
Japan										
Net Lending/Borrowing	–6.3	–8.6	–7.9	–5.6	–3.8	–3.7	–4.2	–3.4	–2.8	–2.0
Output Gap[2]	–1.3	–3.7	–2.3	–2.6	–2.0	–1.8	–0.8	–0.2	0.1	–0.1
Structural Balance[2]	–5.9	–7.4	–7.3	–5.3	–4.2	–4.1	–4.0	–3.4	–2.8	–1.9
Net Debt	93.6	146.7	146.4	148.5	147.6	152.8	153.0	152.6	150.8	146.3
Gross Debt[5]	168.9	229.0	232.5	236.1	231.3	235.6	236.4	236.0	234.2	229.6
United Kingdom										
Net Lending/Borrowing	–3.0	–7.6	–5.4	–5.4	–4.3	–3.0	–2.3	–1.8	–1.5	–0.6
Output Gap[2]	0.9	–2.2	–2.0	–0.8	–0.3	–0.2	0.0	0.0	0.0	0.0
Structural Balance[2]	–3.7	–5.9	–3.8	–4.6	–3.9	–2.8	–2.2	–1.8	–1.5	–0.6
Net Debt	36.8	76.0	77.2	79.1	79.6	79.1	78.2	77.4	77.0	73.6
Gross Debt	41.7	84.5	85.6	87.4	88.2	88.2	87.0	86.3	85.9	82.5
Canada										
Net Lending/Borrowing	0.5	–2.5	–1.5	0.2	–0.1	–1.1	–1.0	–0.8	–0.8	–0.7
Output Gap[2]	0.5	–0.2	0.4	1.2	0.1	–0.5	0.4	0.5	0.6	0.0
Structural Balance[2]	0.2	–2.4	–1.7	–0.7	–0.2	–0.8	–1.2	–1.1	–1.1	–0.7
Net Debt	31.3	28.3	29.3	28.0	27.7	28.5	27.8	27.4	26.6	23.5
Gross Debt	74.6	84.8	85.8	85.0	90.5	91.1	89.7	86.6	83.8	74.3

Note: The methodology and specific assumptions for each country are discussed in Box A1. The country group composites for fiscal data are calculated as the sum of the US dollar values for the relevant individual countries.

[1]Debt data refer to the end of the year and are not always comparable across countries. Gross and net debt levels reported by national statistical agencies for countries that have adopted the System of National Accounts (SNA) 2008 (Australia, Canada, Hong Kong SAR, United States) are adjusted to exclude unfunded pension liabilities of government employees' defined-benefit pension plans. Fiscal data for the aggregated major advanced economies and the United States start in 2001, and the average for the aggregate and the United States is therefore for the period 2001–07.

[2]Percent of potential GDP.

[3]Figures reported by the national statistical agency are adjusted to exclude items related to the accrual-basis accounting of government employees' defined-benefit pension plans.

[4]Excludes one-time measures based on the authorities' data and, if unavailable, on receipts from the sale of assets.

[5]Includes equity shares; nonconsolidated basis.

Table A9. Summary of World Trade Volumes and Prices

(Annual percent change)

	Averages										Projections	
	2000–09	2010–19	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Trade in Goods and Services												
World Trade[1]												
Volume	5.0	4.9	12.5	7.1	3.0	3.5	3.8	2.7	2.3	4.9	5.1	4.7
Price Deflator												
In US Dollars	3.4	0.5	5.5	11.2	–1.7	–0.7	–1.7	–13.2	–4.1	4.4	6.1	1.2
In SDRs	2.2	1.0	6.6	7.4	1.3	0.1	–1.7	–5.8	–3.4	4.6	1.2	0.6
Volume of Trade												
Exports												
Advanced Economies	3.9	4.6	12.1	6.0	2.8	3.1	3.9	3.8	2.0	4.2	4.5	3.9
Emerging Market and Developing Economies	7.9	5.4	13.8	8.7	3.5	4.8	3.2	1.5	2.6	6.4	5.1	5.3
Imports												
Advanced Economies	3.6	4.5	11.5	5.1	1.7	2.3	3.9	4.6	2.7	4.0	5.1	4.5
Emerging Market and Developing Economies	9.0	5.9	14.3	11.5	5.3	5.2	4.2	–0.9	1.8	6.4	6.0	5.6
Terms of Trade												
Advanced Economies	–0.2	0.1	–0.9	–1.6	–0.6	0.9	0.3	2.0	0.9	–0.2	0.6	0.2
Emerging Market and Developing Economies	1.5	0.1	1.9	4.1	0.6	–0.6	–0.6	–4.2	–1.4	0.6	1.1	–0.5
Trade in Goods												
World Trade[1]												
Volume	4.8	5.0	14.5	7.0	2.3	3.3	3.1	2.2	2.2	5.4	5.3	4.8
Price Deflator												
In US Dollars	3.4	0.4	6.4	12.6	–1.4	–1.3	–2.5	–14.3	–5.0	4.8	6.3	1.0
In SDRs	2.1	0.9	7.5	8.8	1.6	–0.5	–2.5	–7.0	–4.3	5.1	1.3	0.4
World Trade Prices in US Dollars[2]												
Manufactures	1.7	0.3	2.3	4.2	2.8	–3.0	–0.5	–2.2	–5.2	1.4	1.9	1.3
Oil	13.1	–0.6	27.9	31.6	1.0	–0.9	–7.5	–47.2	–15.7	23.3	18.0	–6.5
Nonfuel Primary Commodities	5.3	1.6	26.7	18.1	–10.2	–1.5	–3.9	–17.6	–1.5	6.8	5.6	0.5
Food	5.5	1.4	12.3	20.5	–2.9	0.4	–4.1	–17.4	2.7	2.2	2.6	1.8
Beverages	5.2	–0.3	14.1	16.6	–18.6	–11.9	20.7	–3.1	–5.0	–9.3	–3.5	4.9
Agricultural Raw Materials	0.1	2.4	33.2	22.7	–12.7	1.6	2.0	–13.5	–5.7	2.3	3.6	–0.9
Metal	9.4	1.8	48.2	13.5	–16.8	–4.3	–10.1	–23.0	–5.4	22.2	13.0	–1.1
World Trade Prices in SDRs[2]												
Manufactures	0.5	0.8	3.4	0.7	6.0	–2.2	–0.4	6.1	–4.5	1.7	–2.9	0.7
Oil	11.8	–0.1	29.3	27.2	4.1	–0.1	–7.5	–42.7	–15.1	23.6	12.5	–7.1
Nonfuel Primary Commodities	4.1	2.1	28.0	14.2	–7.4	–0.7	–3.9	–10.5	–0.9	7.0	0.6	–0.1
Food	4.2	1.9	13.5	16.5	0.1	1.2	–4.1	–10.3	3.4	2.5	–2.2	1.2
Beverages	4.0	0.3	15.3	12.7	–16.1	–11.2	20.8	5.2	–4.4	–9.0	–8.0	4.2
Agricultural Raw Materials	–1.1	2.9	34.6	18.5	–10.0	2.4	2.0	–6.1	–5.1	2.6	–1.3	–1.6
Metal	8.1	2.4	49.8	9.7	–14.3	–3.5	–10.1	–16.4	–4.8	22.5	7.7	–1.7
World Trade Prices in Euros[2]												
Manufactures	–1.0	1.3	7.4	–0.7	11.3	–6.1	–0.5	17.1	–4.9	–0.6	–7.2	0.2
Oil	10.2	0.5	34.3	25.5	9.3	–4.1	–7.6	–36.8	–15.4	20.8	7.5	–7.6
Nonfuel Primary Commodities	2.6	2.7	32.9	12.7	–2.8	–4.6	–4.0	–1.3	–1.3	4.6	–3.8	–0.6
Food	2.7	2.4	17.9	14.9	5.1	–2.8	–4.2	–1.1	3.0	0.2	–6.6	0.6
Beverages	2.5	0.8	19.8	11.2	–11.9	–14.7	20.7	16.1	–4.8	–11.1	–12.1	3.7
Agricultural Raw Materials	–2.6	3.5	39.8	17.0	–5.5	–1.7	1.9	3.6	–5.5	0.2	–5.7	–2.1
Metal	6.6	2.9	55.5	8.3	–10.0	–7.3	–10.2	–7.8	–5.1	19.8	2.9	–2.2

Table A9. Summary of World Trade Volumes and Prices *(continued)*

(Annual percent change)

	Averages										Projections	
	2000–09	2010–19	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Trade in Goods												
Volume of Trade												
Exports												
Advanced Economies	3.6	4.6	14.9	6.0	1.9	2.7	3.5	3.1	1.8	4.4	4.7	3.8
Emerging Market and Developing Economies	7.7	5.4	15.3	7.6	3.8	4.7	2.6	1.1	2.6	6.4	5.1	5.3
Fuel Exporters	4.9	2.6	6.8	5.7	2.6	2.2	–0.6	2.8	1.3	0.8	1.9	3.0
Nonfuel Exporters	8.8	6.4	18.7	8.3	4.4	5.8	3.9	0.5	3.0	7.8	5.9	5.9
Imports												
Advanced Economies	3.3	4.5	13.2	5.3	0.3	2.1	3.6	3.6	2.3	4.7	5.4	4.8
Emerging Market and Developing Economies	8.8	5.9	15.6	11.1	5.1	4.7	2.5	–0.5	2.3	7.0	6.2	5.8
Fuel Exporters	10.9	3.0	8.2	11.7	8.2	3.9	0.7	–7.3	–5.0	3.1	6.6	1.4
Nonfuel Exporters	8.4	6.5	17.5	10.9	4.4	4.9	2.9	1.0	3.9	7.8	6.1	6.6
Price Deflators in SDRs												
Exports												
Advanced Economies	1.3	0.7	4.3	6.4	0.3	0.2	–2.2	–6.1	–2.4	4.4	2.0	0.9
Emerging Market and Developing Economies	4.7	1.3	12.5	13.3	3.1	–1.3	–3.1	–8.8	–7.2	6.9	1.2	–0.6
Fuel Exporters	9.2	0.7	21.3	25.6	4.6	–2.6	–6.7	–29.6	–13.3	16.1	8.1	–3.7
Nonfuel Exporters	3.0	1.4	9.0	8.4	2.4	–0.7	–1.6	–0.8	–5.4	4.6	–0.6	0.2
Imports												
Advanced Economies	1.7	0.7	6.2	8.7	1.5	–0.6	–2.2	–7.9	–3.5	4.3	1.3	0.8
Emerging Market and Developing Economies	3.0	1.2	10.7	8.5	2.6	–0.7	–2.6	–4.9	–5.8	5.7	0.2	0.0
Fuel Exporters	3.4	1.0	8.0	6.5	3.3	0.2	–2.4	–3.2	–3.8	3.1	–1.5	0.6
Nonfuel Exporters	2.9	1.3	11.3	8.9	2.4	–0.9	–2.7	–5.2	–6.2	6.2	0.6	–0.1
Terms of Trade												
Advanced Economies	–0.4	0.0	–1.8	–2.1	–1.1	0.8	0.1	1.9	1.2	0.1	0.7	0.1
Emerging Market and Developing Economies	1.7	0.1	1.6	4.4	0.5	–0.6	–0.5	–4.1	–1.5	1.1	0.9	–0.6
Regional Groups												
Commonwealth of Independent States[3]	3.8	0.1	12.6	20.6	1.6	–6.8	–1.5	–19.9	–13.3	10.3	7.7	–3.2
Emerging and Developing Asia	–0.7	0.0	–6.0	–2.3	1.3	0.9	2.2	8.6	0.3	–3.4	–1.4	0.7
Emerging and Developing Europe	0.5	–0.3	–3.6	–1.9	–1.1	1.5	1.3	2.4	1.7	–2.1	–1.1	0.3
Latin America and the Caribbean	2.3	0.2	7.1	5.1	–1.7	–1.3	–2.2	–9.1	1.3	4.6	0.1	–1.1
Middle East, North Africa, Afghanistan, and Pakistan	5.0	–0.7	8.5	12.6	–0.1	–0.1	–4.6	–25.7	–6.2	10.2	8.5	–3.6
Middle East and North Africa	5.3	–0.7	8.5	12.8	0.4	0.0	–4.7	–26.4	–6.7	10.7	8.6	–3.7
Sub-Saharan Africa	3.6	0.8	12.3	12.6	–1.4	–1.2	–3.4	–15.5	–1.4	8.1	3.1	–2.3
Analytical Groups												
By Source of Export Earnings												
Fuel	5.6	–0.3	12.3	17.9	1.2	–2.7	–4.4	–27.2	–9.8	12.6	9.7	–4.3
Nonfuel	0.2	0.2	–2.1	–0.5	0.0	0.2	1.2	4.6	0.8	–1.5	–1.2	0.3
Memorandum												
World Exports in Billions of US Dollars												
Goods and Services	12,353	22,699	18,713	22,284	22,596	23,304	23,729	21,070	20,669	22,654	25,273	26,701
Goods	9,792	17,755	14,907	17,931	18,135	18,549	18,635	16,223	15,757	17,422	19,474	20,515
Average Oil Price[4]	13.1	–0.6	27.9	31.6	1.0	–0.9	–7.5	–47.2	–15.7	23.3	18.0	–6.5
In US Dollars a Barrel	49.17	75.54	79.03	104.01	105.01	104.07	96.25	50.79	42.84	52.81	62.31	58.24
Export Unit Value of Manufactures[5]	1.7	0.3	2.3	4.2	2.8	–3.0	–0.5	–2.2	–5.2	1.4	1.9	1.3

[1]Average of annual percent change for world exports and imports.
[2]As represented, respectively, by the export unit value index for manufactures of the advanced economies and accounting for 83 percent of the advanced economies' trade (export of goods) weights; the average of UK Brent, Dubai Fateh, and West Texas Intermediate crude oil prices; and the average of world market prices for nonfuel primary commodities weighted by their 2002–04 shares in world commodity exports.
[3]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[4]Percent change of average of UK Brent, Dubai Fateh, and West Texas Intermediate crude oil prices.
[5]Percent change for manufactures exported by the advanced economies.

Table A10. Summary of Current Account Balances

(Billions of US dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019	2023
Advanced Economies	**–16.1**	**–49.1**	**5.7**	**200.6**	**217.4**	**295.8**	**316.7**	**396.2**	**345.8**	**287.2**	**414.3**
United States	–430.7	–444.6	–426.2	–349.5	–373.8	–434.6	–451.7	–466.2	–614.7	–727.3	–739.7
Euro Area	–7.7	–12.4	174.1	293.1	326.6	371.7	408.2	442.4	460.8	478.1	510.5
Germany	192.3	229.7	248.9	252.5	291.0	301.1	297.5	296.6	346.8	364.1	413.6
France	–22.2	–28.3	–32.8	–24.5	–36.2	–10.7	–21.0	–36.8	–39.1	–26.6	–8.2
Italy	–72.6	–68.3	–7.0	21.1	41.3	28.4	50.4	56.1	56.1	50.8	23.2
Spain	–56.2	–47.4	–3.1	20.7	14.9	13.5	23.8	21.7	23.7	26.2	34.6
Japan	221.0	129.8	59.7	45.9	36.8	134.1	188.1	195.4	194.5	199.0	238.9
United Kingdom	–92.3	–62.3	–113.1	–151.8	–161.4	–150.0	–153.9	–106.7	–110.1	–103.2	–101.0
Canada	–58.2	–49.6	–65.7	–59.4	–43.2	–55.9	–49.3	–49.3	–57.3	–48.6	–42.1
Other Advanced Economies[1]	283.0	266.4	272.2	347.8	360.1	365.5	348.5	346.1	393.5	406.4	450.3
Emerging Market and Developing Economies	**280.1**	**379.1**	**355.7**	**177.5**	**168.8**	**–59.7**	**–90.6**	**–25.2**	**–23.7**	**–76.0**	**–345.5**
Regional Groups											
Commonwealth of Independent States[2]	68.9	107.3	67.5	18.0	57.8	52.4	–0.3	26.6	63.5	54.2	51.7
Russia	67.5	97.3	71.3	33.4	57.5	68.8	25.5	40.2	76.8	67.3	67.6
Excluding Russia	1.4	10.0	–3.8	–15.4	0.2	–16.4	–25.9	–13.6	–13.3	–13.1	–15.8
Emerging and Developing Asia	233.3	98.2	122.1	99.3	231.1	312.0	226.6	151.0	122.9	131.4	–6.7
China	237.8	136.1	215.4	148.2	236.0	304.2	202.2	164.9	166.7	179.1	132.2
India	–47.9	–78.2	–87.8	–32.3	–26.8	–22.1	–15.3	–51.2	–66.6	–67.4	–121.2
ASEAN-5[3]	45.4	49.4	6.3	–3.6	22.4	30.7	43.5	49.3	38.5	36.2	–1.2
Emerging and Developing Europe	–86.9	–119.5	–81.9	–72.0	–59.9	–35.3	–32.8	–49.6	–62.2	–63.2	–72.6
Latin America and the Caribbean	–95.3	–111.3	–136.6	–162.8	–184.5	–174.0	–96.2	–85.4	–116.9	–133.6	–171.5
Brazil	–75.8	–77.0	–74.2	–74.8	–104.2	–59.4	–23.5	–9.8	–33.5	–40.1	–51.1
Mexico	–5.0	–12.4	–18.4	–30.9	–23.7	–29.3	–22.8	–18.8	–23.3	–28.5	–31.0
Middle East, North Africa, Afghanistan, and Pakistan	170.6	413.1	411.4	331.2	188.0	–123.3	–130.3	–28.0	17.8	–9.1	–64.5
Sub-Saharan Africa	–10.5	–8.8	–26.9	–36.2	–63.7	–91.5	–57.6	–39.8	–48.7	–55.6	–81.9
South Africa	–5.6	–9.2	–20.3	–21.6	–18.7	–14.0	–9.6	–7.9	–10.6	–11.9	–15.4
Analytical Groups											
By Source of Export Earnings											
Fuel	309.6	619.9	597.1	465.4	311.3	–77.4	–86.2	63.6	145.4	113.0	60.3
Nonfuel	–27.8	–240.8	–241.4	–288.0	–142.5	17.7	–4.3	–88.8	–169.1	–189.0	–405.8
Of Which, Primary Products	–11.7	–31.0	–68.0	–81.8	–55.4	–54.8	–43.8	–56.0	–61.9	–69.6	–87.0
By External Financing Source											
Net Debtor Economies	–282.7	–381.4	–433.5	–399.9	–369.6	–309.7	–217.2	–232.3	–310.2	–336.3	–490.5
Net Debtor Economies by Debt-Servicing Experience											
Economies with Arrears and/or Rescheduling during 2012–16	–21.2	–31.5	–50.5	–50.1	–35.1	–47.7	–52.5	–39.1	–35.4	–38.0	–59.3
Memorandum											
World	**264.0**	**330.0**	**361.4**	**378.1**	**386.3**	**236.1**	**226.2**	**371.0**	**322.2**	**211.2**	**68.8**
European Union	–23.9	62.4	188.4	269.2	286.0	338.0	332.5	417.2	470.7	495.1	529.2
Low-Income Developing Countries	–15.5	–19.6	–31.5	–39.6	–45.8	–77.2	–44.4	–30.8	–48.9	–58.8	–89.5
Middle East and North Africa	170.0	408.1	413.9	333.7	190.0	–122.0	–126.8	–15.9	33.4	5.9	–46.5

Table A10. Summary of Current Account Balances *(continued)*

(Percent of GDP)

									Projections		
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023
Advanced Economies	**0.0**	**–0.1**	**0.0**	**0.4**	**0.5**	**0.7**	**0.7**	**0.8**	**0.7**	**0.5**	**0.7**
United States	–2.9	–2.9	–2.6	–2.1	–2.1	–2.4	–2.4	–2.4	–3.0	–3.4	–3.0
Euro Area	–0.1	–0.1	1.4	2.2	2.4	3.2	3.4	3.5	3.2	3.2	2.9
Germany	5.6	6.1	7.0	6.7	7.5	8.9	8.5	8.0	8.2	8.2	7.8
France	–0.8	–1.0	–1.2	–0.9	–1.3	–0.4	–0.9	–1.4	–1.3	–0.9	–0.2
Italy	–3.4	–3.0	–0.3	1.0	1.9	1.5	2.7	2.9	2.6	2.2	0.9
Spain	–3.9	–3.2	–0.2	1.5	1.1	1.1	1.9	1.7	1.6	1.7	1.8
Japan	3.9	2.1	1.0	0.9	0.8	3.1	3.8	4.0	3.8	3.7	4.0
United Kingdom	–3.8	–2.4	–4.2	–5.5	–5.3	–5.2	–5.8	–4.1	–3.7	–3.4	–2.9
Canada	–3.6	–2.8	–3.6	–3.2	–2.4	–3.6	–3.2	–3.0	–3.2	–2.5	–1.7
Other Advanced Economies[1]	5.0	4.1	4.1	5.1	5.2	5.8	5.4	5.0	5.2	5.1	4.7
Emerging Market and Developing Economies	**1.2**	**1.4**	**1.3**	**0.6**	**0.5**	**–0.2**	**–0.3**	**–0.1**	**–0.1**	**–0.2**	**–0.7**
Regional Groups											
Commonwealth of Independent States[2]	3.2	4.0	2.4	0.6	2.1	2.8	0.0	1.3	2.8	2.3	1.9
Russia	4.1	4.7	3.2	1.5	2.8	5.0	2.0	2.6	4.5	3.8	3.4
Excluding Russia	0.3	1.7	–0.6	–2.2	0.0	–3.1	–5.6	–2.7	–2.5	–2.3	–2.1
Emerging and Developing Asia	2.4	0.8	1.0	0.7	1.5	2.0	1.4	0.9	0.6	0.6	0.0
China	3.9	1.8	2.5	1.5	2.2	2.7	1.8	1.4	1.2	1.2	0.6
India	–2.8	–4.3	–4.8	–1.7	–1.3	–1.1	–0.7	–2.0	–2.3	–2.1	–2.6
ASEAN-5[3]	2.7	2.6	0.3	–0.2	1.1	1.5	2.0	2.1	1.5	1.3	0.0
Emerging and Developing Europe	–5.0	–6.3	–4.4	–3.6	–2.9	–1.9	–1.8	–2.6	–2.9	–2.7	–2.5
Latin America and the Caribbean	–1.9	–1.9	–2.3	–2.7	–3.1	–3.4	–1.9	–1.6	–2.1	–2.3	–2.4
Brazil	–3.4	–2.9	–3.0	–3.0	–4.2	–3.3	–1.3	–0.5	–1.6	–1.8	–1.9
Mexico	–0.5	–1.0	–1.5	–2.4	–1.8	–2.5	–2.1	–1.6	–1.9	–2.2	–2.0
Middle East, North Africa, Afghanistan, and Pakistan	6.1	12.7	12.4	9.8	5.4	–4.0	–4.2	–0.9	0.5	–0.3	–1.5
Sub-Saharan Africa	–0.8	–0.6	–1.7	–2.2	–3.8	–6.0	–4.1	–2.6	–2.9	–3.1	–3.2
South Africa	–1.5	–2.2	–5.1	–5.9	–5.3	–4.4	–3.3	–2.3	–2.9	–3.1	–3.4
Analytical Groups											
By Source of Export Earnings											
Fuel	6.4	10.5	9.7	7.3	5.1	–1.6	–1.9	1.3	2.7	2.0	0.9
Nonfuel	–0.2	–1.2	–1.1	–1.2	–0.6	0.1	0.0	–0.3	–0.6	–0.6	–0.9
Of Which, Primary Products	–0.8	–1.9	–3.9	–4.6	–3.2	–3.1	–2.7	–3.1	–3.3	–3.5	–3.5
By External Financing Source											
Net Debtor Economies	–2.5	–3.0	–3.3	–2.9	–2.6	–2.4	–1.7	–1.7	–2.1	–2.1	–2.3
Net Debtor Economies by Debt-Servicing Experience											
Economies with Arrears and/or Rescheduling during 2012–16	–3.2	–4.2	–6.3	–6.0	–4.2	–6.0	–6.8	–5.5	–4.8	–4.8	–5.7
Memorandum											
World	**0.4**	**0.5**	**0.5**	**0.5**	**0.5**	**0.3**	**0.3**	**0.5**	**0.4**	**0.2**	**0.1**
European Union	–0.1	0.3	1.1	1.5	1.5	2.1	2.0	2.4	2.4	2.4	2.2
Low-Income Developing Countries	–1.2	–1.3	–1.9	–2.2	–2.4	–4.2	–2.5	–1.7	–2.5	–2.7	–2.8
Middle East and North Africa	6.6	13.5	13.4	10.6	5.9	–4.4	–4.6	–0.6	1.1	0.2	–1.2

Table A10. Summary of Current Account Balances *(continued)*

(Percent of exports of goods and services)

	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019	2023
Advanced Economies	**–0.1**	**–0.3**	**0.0**	**1.4**	**1.5**	**2.2**	**2.4**	**2.8**	**2.2**	**1.7**	**2.0**
United States	–23.2	–20.9	–19.2	–15.2	–15.7	–19.2	–20.5	–20.0	–24.5	–27.4	–22.6
Euro Area	–0.3	–0.4	5.4	8.6	9.2	11.5	12.7	12.6	. . .	. . .	. . .
Germany	13.3	13.6	15.3	14.8	16.3	19.0	18.5	17.0	17.5	17.3	16.1
France	–3.1	–3.4	–4.1	–2.9	–4.2	–1.4	–2.8	–4.7	–4.7	–3.0	–0.8
Italy	–13.5	–11.1	–1.2	3.4	6.5	5.2	9.1	9.2	7.9	6.7	2.5
Spain	–15.3	–11.0	–0.8	4.7	3.3	3.4	5.8	4.8	4.5	4.7	4.9
Japan	25.4	13.9	6.5	5.5	4.3	17.1	23.2	22.4	20.6	20.3	22.4
United Kingdom	–13.4	–7.8	–14.3	–18.7	–18.9	–19.0	–20.5	–13.3	–11.9	–10.9	–10.0
Canada	–12.4	–9.1	–11.9	–10.7	–7.6	–11.4	–10.4	–9.7	–10.2	–8.1	–5.7
Other Advanced Economies[1]	8.6	6.8	6.8	8.4	8.7	9.9	9.6	8.8	9.1	8.9	8.1
Emerging Market and Developing Economies	**4.0**	**4.5**	**3.9**	**2.0**	**2.1**	**–0.7**	**–1.2**	**–0.3**	**–0.2**	**–0.7**	**–2.9**
Regional Groups											
Commonwealth of Independent States[2]	10.3	12.1	7.4	2.0	6.8	8.9	–0.1	4.3	8.9	7.5	6.1
Russia	15.3	17.0	12.1	5.6	10.2	17.5	7.7	9.8	16.1	14.2	12.1
Excluding Russia	0.6	3.2	–1.2	–5.0	0.1	–8.4	–14.9	–6.6	–5.7	–5.4	–5.6
Emerging and Developing Asia	8.3	2.8	3.3	2.6	5.8	8.2	6.2	3.7	2.7	2.7	–0.1
China	14.8	6.8	9.9	6.3	9.6	12.9	9.2	6.8	6.3	6.4	4.0
India	–12.6	–17.3	–19.4	–6.9	–5.7	–5.3	–3.5	–10.4	–12.1	–11.1	–13.9
ASEAN-5[3]	6.1	5.5	0.7	–0.4	2.3	3.4	4.8	4.7	3.4	2.9	–0.1
Emerging and Developing Europe	–14.8	–17.3	–11.9	–9.7	–7.6	–5.0	–4.6	–6.1	–6.7	–6.3	–5.6
Latin America and the Caribbean	–9.6	–9.1	–10.8	–12.9	–14.8	–16.1	–9.2	–7.3	–9.3	–10.2	–10.6
Brazil	–32.7	–26.3	–26.4	–26.8	–39.5	–26.5	–10.8	–3.9	–12.5	–14.4	–15.4
Mexico	–1.6	–3.4	–4.8	–7.7	–5.7	–7.3	–5.7	–4.3	–5.0	–5.7	–4.9
Middle East, North Africa, Afghanistan, and Pakistan	13.6	27.0	24.3	20.8	13.4	–9.9	–11.7	–2.4	1.7	–0.3	–3.9
Sub-Saharan Africa	–2.7	–1.8	–5.6	–7.5	–14.0	–26.5	–18.4	–11.0	–11.8	–13.0	–16.0
South Africa	–5.2	–7.3	–17.3	–19.0	–17.0	–14.5	–10.8	–7.6	–9.5	–10.2	–11.4
Analytical Groups											
By Source of Export Earnings											
Fuel	16.5	25.3	22.6	18.4	13.7	–4.1	–5.5	3.7	7.7	6.0	3.0
Nonfuel	–0.6	–4.1	–4.0	–4.5	–2.2	0.3	–0.1	–1.4	–2.3	–2.5	–4.2
Of Which, Primary Products	–3.0	–6.7	–14.9	–18.0	–12.4	–14.2	–11.6	–13.3	–13.3	–14.1	–14.2
By External Financing Source											
Net Debtor Economies	–9.5	–10.6	–11.8	–10.6	–9.7	–9.1	–6.4	–6.1	–7.3	–7.3	–8.1
Net Debtor Economies by Debt-Servicing Experience											
Economies with Arrears and/or Rescheduling during 2012–16	–10.2	–12.8	–20.9	–20.8	–15.7	–26.0	–31.4	–20.6	–16.7	–16.5	–20.2
Memorandum											
World	**1.3**	**1.5**	**1.5**	**1.6**	**1.7**	**1.2**	**1.1**	**1.6**	**1.3**	**0.8**	**0.2**
European Union	–0.4	0.8	2.6	3.5	3.6	4.7	4.6	5.3	5.2	5.2	4.5
Low-Income Developing Countries	–4.2	–4.1	–6.6	–7.7	–8.6	–16.1	–9.3	–5.6	–7.7	–8.4	–8.7
Middle East and North Africa	13.9	27.3	25.0	21.4	13.8	–10.1	–11.7	–1.4	2.9	0.8	–2.9

[1]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.
[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[3]Indonesia, Malaysia, Philippines, Thailand, Vietnam.

Table A11. Advanced Economies: Balance on Current Account

(Percent of GDP)

									Projections		
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023
Advanced Economies	**0.0**	**–0.1**	**0.0**	**0.4**	**0.5**	**0.7**	**0.7**	**0.8**	**0.7**	**0.5**	**0.7**
United States	–2.9	–2.9	–2.6	–2.1	–2.1	–2.4	–2.4	–2.4	–3.0	–3.4	–3.0
Euro Area[1]	–0.1	–0.1	1.4	2.2	2.4	3.2	3.4	3.5	3.2	3.2	2.9
Germany	5.6	6.1	7.0	6.7	7.5	8.9	8.5	8.0	8.2	8.2	7.8
France	–0.8	–1.0	–1.2	–0.9	–1.3	–0.4	–0.9	–1.4	–1.3	–0.9	–0.2
Italy	–3.4	–3.0	–0.3	1.0	1.9	1.5	2.7	2.9	2.6	2.2	0.9
Spain	–3.9	–3.2	–0.2	1.5	1.1	1.1	1.9	1.7	1.6	1.7	1.8
Netherlands	7.4	9.1	10.8	9.9	8.6	8.7	8.4	9.8	9.6	8.9	7.7
Belgium	1.8	–1.1	–0.1	–0.3	–0.9	–0.1	0.1	0.1	0.3	0.2	0.5
Austria	2.9	1.6	1.5	1.9	2.5	1.9	2.1	2.1	2.5	2.0	1.9
Greece	–11.4	–10.0	–3.8	–2.0	–1.6	–0.2	–1.1	–0.8	–0.8	–0.6	0.0
Portugal	–10.1	–6.0	–1.8	1.6	0.1	0.1	0.6	0.5	0.2	–0.1	–1.4
Ireland	–1.2	–1.6	–2.6	2.1	1.6	10.9	3.3	12.5	9.8	8.7	6.5
Finland	1.2	–1.8	–1.9	–1.6	–1.3	–1.0	–1.4	0.7	1.4	1.9	2.2
Slovak Republic	–4.7	–5.0	0.9	1.9	1.1	–1.7	–1.5	–1.5	–0.3	0.5	0.7
Lithuania	–1.3	–4.5	–1.4	0.8	3.2	–2.8	–1.1	1.0	–0.1	–0.6	–2.8
Slovenia	–0.1	0.2	2.1	4.4	5.8	4.4	5.2	6.5	5.7	5.2	2.8
Luxembourg	6.7	6.0	5.6	5.5	5.2	5.1	4.8	5.5	5.4	5.3	5.0
Latvia	2.0	–3.2	–3.6	–2.7	–1.7	–0.5	1.4	–0.8	–1.9	–2.2	–2.5
Estonia	1.8	1.3	–1.9	0.5	0.3	2.0	1.9	3.2	2.0	0.7	–2.5
Cyprus	–11.3	–4.1	–6.0	–4.9	–4.3	–1.5	–4.9	–4.7	–4.1	–4.6	–4.5
Malta	–4.7	–0.2	1.7	2.7	8.8	4.5	6.5	10.2	9.9	9.5	9.6
Japan	3.9	2.1	1.0	0.9	0.8	3.1	3.8	4.0	3.8	3.7	4.0
United Kingdom	–3.8	–2.4	–4.2	–5.5	–5.3	–5.2	–5.8	–4.1	–3.7	–3.4	–2.9
Korea	2.6	1.6	4.2	6.2	6.0	7.7	7.0	5.1	5.5	5.8	5.6
Canada	–3.6	–2.8	–3.6	–3.2	–2.4	–3.6	–3.2	–3.0	–3.2	–2.5	–1.7
Australia	–3.7	–3.1	–4.3	–3.4	–3.1	–4.7	–3.1	–2.3	–1.9	–2.3	–2.3
Taiwan Province of China	8.3	7.8	8.9	10.0	11.7	14.3	13.6	13.8	13.6	13.5	13.5
Switzerland	14.8	7.9	10.3	11.3	8.5	10.9	9.4	9.3	9.7	9.4	9.0
Sweden	6.0	5.6	5.6	5.2	4.5	4.5	4.2	3.2	3.1	3.1	3.0
Singapore	23.4	22.1	17.0	16.5	18.7	18.6	19.0	18.8	18.9	18.7	16.0
Hong Kong SAR	7.0	5.6	1.6	1.5	1.4	3.3	4.0	3.0	3.1	3.2	3.5
Norway	10.9	12.4	12.5	10.3	10.5	7.9	3.8	5.1	6.1	6.5	7.0
Czech Republic	–3.6	–2.1	–1.6	–0.5	0.2	0.2	1.1	1.1	0.3	0.4	–1.4
Israel	3.7	2.2	0.5	3.1	4.0	4.9	3.5	3.0	2.6	2.7	3.0
Denmark	6.6	6.6	6.3	7.8	8.9	8.8	7.3	7.6	7.6	7.2	6.3
New Zealand	–2.3	–2.8	–3.9	–3.2	–3.2	–3.1	–2.3	–2.7	–2.6	–3.0	–2.8
Puerto Rico	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Macao SAR	39.4	40.9	39.3	40.2	34.2	25.3	26.9	30.4	32.1	33.1	34.8
Iceland	–6.6	–5.2	–3.9	5.9	4.0	5.3	7.7	3.6	3.3	2.6	3.8
San Marino	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Memorandum											
Major Advanced Economies	–0.8	–0.8	–1.0	–0.8	–0.7	–0.5	–0.4	–0.3	–0.6	–0.7	–0.5
Euro Area[2]	0.5	0.8	2.2	2.8	3.0	3.7	3.6	3.8	3.8	3.7	3.4

[1]Data corrected for reporting discrepancies in intra-area transactions.
[2]Data calculated as the sum of the balances of individual euro area countries.

Table A12. Emerging Market and Developing Economies: Balance on Current Account

(Percent of GDP)

									Projections		
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023
Commonwealth of Independent States[1]	**3.2**	**4.0**	**2.4**	**0.6**	**2.1**	**2.8**	**0.0**	**1.3**	**2.8**	**2.3**	**1.9**
Russia	4.1	4.7	3.2	1.5	2.8	5.0	2.0	2.6	4.5	3.8	3.4
Excluding Russia	0.3	1.7	–0.6	–2.2	0.0	–3.1	–5.6	–2.7	–2.5	–2.3	–2.1
Armenia	–13.6	–10.4	–10.0	–7.3	–7.6	–2.6	–2.3	–2.6	–2.8	–2.8	–4.6
Azerbaijan	28.4	26.0	21.4	16.6	13.9	–0.4	–3.6	3.5	5.6	7.0	7.2
Belarus	–14.5	–8.2	–2.8	–10.0	–6.6	–3.3	–3.5	–1.8	–2.5	–2.7	–1.7
Georgia	–10.3	–12.8	–11.7	–5.8	–10.7	–12.0	–12.8	–9.3	–10.5	–9.5	–7.7
Kazakhstan	0.9	5.3	0.5	0.5	2.8	–2.8	–6.7	–2.9	–1.4	–1.3	–0.3
Kyrgyz Republic	–2.2	–2.9	3.7	–13.3	–16.0	–16.0	–12.1	–7.8	–13.6	–12.2	–10.1
Moldova	–7.5	–11.7	–6.7	–4.2	–3.9	–5.7	–4.0	–4.7	–3.7	–4.7	–4.0
Tajikistan	–9.6	–7.3	–9.2	–7.8	–2.8	–6.0	–3.8	–2.6	–5.2	–4.7	–4.0
Turkmenistan	–12.9	–0.8	–0.9	–7.3	–6.1	–15.6	–19.9	–11.5	–9.0	–7.8	–7.6
Ukraine[2]	–2.2	–6.3	–8.1	–9.2	–3.9	–0.3	–4.1	–3.7	–3.7	–3.5	–4.0
Uzbekistan	7.1	5.7	1.2	2.8	1.7	0.7	0.7	3.7	0.2	–1.1	–2.3
Emerging and Developing Asia	**2.4**	**0.8**	**1.0**	**0.7**	**1.5**	**2.0**	**1.4**	**0.9**	**0.6**	**0.6**	**0.0**
Bangladesh	0.4	–1.0	0.7	1.2	1.2	1.7	0.6	–1.2	–2.0	–2.3	–1.7
Bhutan	–22.2	–29.8	–21.4	–25.4	–26.4	–28.3	–29.1	–20.5	–19.6	–15.9	–3.8
Brunei Darussalam	36.6	34.7	29.8	20.9	30.7	16.0	9.6	6.1	5.0	13.1	18.6
Cambodia	–9.3	–5.9	–8.2	–13.0	–9.8	–9.3	–8.8	–8.8	–10.7	–9.5	–7.8
China	3.9	1.8	2.5	1.5	2.2	2.7	1.8	1.4	1.2	1.2	0.6
Fiji	–4.5	–5.1	–1.4	–9.7	–7.6	–3.6	–5.0	–4.5	–5.2	–4.5	–3.5
India	–2.8	–4.3	–4.8	–1.7	–1.3	–1.1	–0.7	–2.0	–2.3	–2.1	–2.6
Indonesia	0.7	0.2	–2.7	–3.2	–3.1	–2.0	–1.8	–1.7	–1.9	–1.9	–2.0
Kiribati	–2.2	–13.1	–4.4	8.3	25.0	46.7	19.4	9.0	17.0	7.1	–15.7
Lao P.D.R.	–16.5	–15.3	–26.0	–28.4	–20.0	–18.0	–12.0	–13.0	–14.9	–13.7	–9.2
Malaysia	10.1	10.9	5.2	3.5	4.4	3.0	2.4	3.0	2.4	2.2	1.9
Maldives	–7.3	–14.8	–6.6	–4.3	–3.2	–7.4	–24.5	–22.1	–18.0	–15.2	–10.5
Marshall Islands	–20.9	2.0	0.1	–5.3	1.9	16.5	8.5	5.5	4.5	3.8	–2.3
Micronesia	–15.4	–18.8	–13.4	–10.1	1.2	4.2	3.3	3.6	3.2	3.1	3.2
Mongolia	–13.0	–26.5	–27.4	–25.4	–11.3	–4.0	–6.3	–8.8	–6.4	–8.3	2.0
Myanmar	–1.1	–1.8	–4.0	–4.9	–2.2	–5.1	–3.9	–5.3	–5.4	–5.6	–5.8
Nauru	46.3	26.1	38.1	18.8	–13.5	–9.5	1.7	0.7	–0.7	0.1	2.1
Nepal	–2.4	–1.0	4.8	3.3	4.5	5.0	6.3	–0.4	–3.6	–3.1	–2.6
Palau	–9.0	–11.8	–11.2	–11.6	–15.0	–7.7	–10.4	–13.6	–13.4	–13.8	–13.4
Papua New Guinea	–20.4	–24.0	–36.1	–30.8	1.3	13.3	16.7	16.8	20.2	19.2	15.9
Philippines	3.6	2.5	2.8	4.2	3.8	2.5	–0.3	–0.4	–0.5	–0.6	–1.2
Samoa	–7.0	–4.3	–6.3	–0.4	–8.1	–2.8	–4.2	–1.3	–1.8	–3.4	–4.0
Solomon Islands	–32.9	–8.3	1.7	–3.4	–4.3	–3.0	–3.9	–4.4	–5.0	–6.4	–5.9
Sri Lanka	–1.9	–7.1	–5.8	–3.4	–2.5	–2.4	–2.4	–2.9	–2.7	–2.5	–2.1
Thailand	3.4	2.5	–0.4	–1.2	3.7	8.0	11.7	10.8	9.3	8.6	3.5
Timor-Leste	42.0	41.4	41.0	42.3	27.0	6.4	–21.6	–13.0	–22.6	–24.7	–21.3
Tonga	–19.0	–16.8	–12.3	–8.3	–10.7	–14.7	–12.7	–10.9	–12.1	–11.9	–9.7
Tuvalu	–42.2	–63.6	–36.4	–17.1	–15.2	–23.8	–32.0	–19.2	–20.5	–29.7	–25.3
Vanuatu	–5.4	–8.1	–6.5	–3.3	–0.3	–10.6	–4.1	–9.0	–9.2	–8.6	–7.4
Vietnam	–3.8	0.2	6.0	4.5	4.9	–0.1	3.0	4.1	3.0	2.4	0.5
Emerging and Developing Europe	**–5.0**	**–6.3**	**–4.4**	**–3.6**	**–2.9**	**–1.9**	**–1.8**	**–2.6**	**–2.9**	**–2.7**	**–2.5**
Albania	–11.3	–13.2	–10.1	–9.3	–10.8	–8.6	–7.6	–7.2	–6.7	–6.7	–6.1
Bosnia and Herzegovina	–6.0	–9.5	–8.7	–5.3	–7.4	–5.7	–5.1	–5.2	–5.9	–6.5	–4.8
Bulgaria	–1.7	0.3	–0.9	1.3	0.1	0.0	2.3	4.5	3.0	2.3	0.1
Croatia	–1.1	–0.7	–0.1	0.9	2.0	4.5	2.5	3.7	3.0	2.1	0.3
Hungary	0.3	0.7	1.8	3.8	1.5	3.5	6.0	3.6	2.5	2.4	2.0
Kosovo	–11.6	–12.7	–5.8	–3.6	–7.0	–8.7	–8.9	–8.7	–8.9	–8.6	–7.7
FYR Macedonia	–2.0	–2.5	–3.2	–1.6	–0.5	–2.0	–2.7	–1.3	–1.5	–1.8	–2.7
Montenegro	–22.7	–17.6	–18.5	–14.5	–15.2	–13.2	–18.1	–18.9	–19.0	–17.8	–10.2
Poland	–5.4	–5.2	–3.7	–1.3	–2.1	–0.6	–0.3	0.0	–0.9	–1.2	–2.1
Romania	–5.1	–5.0	–4.8	–1.1	–0.7	–1.2	–2.1	–3.5	–3.7	–3.7	–3.5
Serbia	–6.4	–8.6	–11.5	–6.1	–6.0	–4.7	–3.1	–4.6	–4.5	–4.1	–3.8
Turkey	–5.8	–8.9	–5.5	–6.7	–4.7	–3.7	–3.8	–5.5	–5.4	–4.8	–3.3

Table A12. Emerging Market and Developing Economies: Balance on Current Account *(continued)*
(Percent of GDP)

									Projections		
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2023
Latin America and the Caribbean	**–1.9**	**–1.9**	**–2.3**	**–2.7**	**–3.1**	**–3.4**	**–1.9**	**–1.6**	**–2.1**	**–2.3**	**–2.4**
Antigua and Barbuda	. . .	. . .	. . .	. . .	2.0	6.8	0.2	–7.0	–12.1	–2.3	–1.0
Argentina	–0.4	–1.0	–0.4	–2.1	–1.6	–2.7	–2.7	–4.8	–5.1	–5.5	–5.9
The Bahamas	–7.9	–10.9	–14.3	–14.2	–20.2	–14.3	–7.7	–16.4	–13.6	–8.8	–4.7
Barbados	–5.6	–11.8	–8.4	–8.4	–9.3	–6.1	–4.4	–3.7	–3.0	–2.9	–2.5
Belize	–2.9	–1.1	–1.2	–4.5	–7.8	–9.8	–9.0	–7.7	–6.0	–5.8	–5.0
Bolivia	3.9	0.3	7.2	3.4	1.7	–5.8	–5.7	–5.8	–5.4	–5.2	–4.2
Brazil	–3.4	–2.9	–3.0	–3.0	–4.2	–3.3	–1.3	–0.5	–1.6	–1.8	–1.9
Chile	1.4	–1.6	–3.9	–4.0	–1.7	–2.3	–1.4	–1.5	–1.8	–1.9	–2.2
Colombia	–3.0	–2.9	–3.1	–3.3	–5.2	–6.4	–4.3	–3.4	–2.6	–2.6	–2.3
Costa Rica	–3.2	–5.3	–5.1	–4.8	–4.8	–3.6	–2.6	–3.1	–3.1	–3.0	–3.3
Dominica	. . .	. . .	. . .	. . .	–7.1	–1.9	0.8	–17.8	–37.1	–21.5	–10.4
Dominican Republic	–7.5	–7.5	–6.5	–4.1	–3.3	–1.9	–1.1	–0.2	–1.0	–1.4	–2.6
Ecuador	–2.3	–0.5	–0.2	–1.0	–0.5	–2.1	1.5	–0.4	–0.1	0.3	0.9
El Salvador	–2.5	–4.8	–5.4	–6.5	–4.8	–3.6	–2.0	–2.2	–3.2	–3.1	–3.9
Grenada	. . .	. . .	. . .	. . .	–4.4	–3.8	–3.2	–6.6	–7.1	–6.4	–7.0
Guatemala	–1.4	–3.4	–2.6	–2.5	–2.1	–0.2	1.5	1.4	1.1	0.6	–1.3
Guyana	–8.4	–12.2	–11.3	–13.3	–9.5	–5.1	0.3	–4.2	–5.2	–4.7	44.1
Haiti	–1.5	–4.3	–5.7	–6.6	–8.5	–3.1	–1.0	–2.9	–4.1	–3.0	–3.1
Honduras	–4.3	–8.0	–8.5	–9.5	–6.9	–4.7	–2.7	–1.7	–3.9	–4.0	–3.9
Jamaica	–8.0	–12.2	–11.1	–9.2	–7.5	–3.2	–2.7	–2.8	–2.9	–2.9	–0.8
Mexico	–0.5	–1.0	–1.5	–2.4	–1.8	–2.5	–2.1	–1.6	–1.9	–2.2	–2.0
Nicaragua	–8.9	–11.9	–10.7	–10.9	–7.1	–9.0	–8.6	–6.2	–7.8	–7.7	–8.4
Panama	–10.3	–12.6	–10.0	–9.4	–13.1	–7.9	–5.5	–6.1	–6.0	–4.3	–3.6
Paraguay	0.2	0.8	–1.2	2.1	–0.2	–1.1	1.5	–1.8	–2.0	–1.2	–0.5
Peru	–2.4	–1.8	–2.8	–4.7	–4.4	–4.8	–2.7	–1.3	–0.7	–1.1	–2.0
St. Kitts and Nevis	. . .	. . .	. . .	. . .	–4.9	–9.7	–11.4	–12.6	–13.1	–12.1	–10.2
St. Lucia	. . .	. . .	. . .	. . .	3.4	6.9	–1.9	0.3	–1.0	–0.6	–0.1
St. Vincent and the Grenadines	. . .	. . .	. . .	. . .	–25.7	–14.9	–15.8	–14.4	–13.5	–13.1	–10.6
Suriname	14.9	9.8	3.3	–3.8	–7.9	–16.5	–3.1	8.9	6.3	5.2	1.8
Trinidad and Tobago	18.9	16.8	13.2	20.4	14.5	3.8	–10.7	–5.6	–3.0	–4.0	–6.5
Uruguay	. . .	. . .	–4.0	–3.4	–3.0	–0.7	1.6	1.6	0.6	–0.1	–1.5
Venezuela	1.9	4.9	0.8	2.0	2.3	–6.6	–1.6	2.0	2.4	3.6	2.5
Middle East, North Africa, Afghanistan, and Pakistan	**6.1**	**12.7**	**12.4**	**9.8**	**5.4**	**–4.0**	**–4.2**	**–0.9**	**0.5**	**–0.3**	**–1.5**
Afghanistan	29.4	26.6	10.8	0.3	5.5	7.5	7.1	1.6	0.6	–0.2	–1.9
Algeria	7.5	9.9	5.9	0.4	–4.4	–16.5	–16.6	–12.3	–9.3	–9.7	–4.0
Bahrain	3.0	8.8	8.4	7.4	4.6	–2.4	–4.6	–3.9	–3.2	–3.3	–4.3
Djibouti	2.8	–13.1	–18.8	–23.3	–25.1	–31.8	–30.4	–23.2	–19.5	–18.8	–11.5
Egypt	–1.9	–2.5	–3.6	–2.2	–0.9	–3.7	–6.0	–6.5	–4.4	–3.9	–3.2
Iran	4.2	10.4	6.0	6.7	3.2	0.3	4.0	4.3	7.0	6.3	6.0
Iraq	1.6	10.9	5.1	1.1	2.6	–6.5	–8.6	0.7	0.2	–1.6	–4.4
Jordan	–7.1	–10.3	–15.2	–10.4	–7.3	–9.1	–9.3	–8.7	–8.5	–7.9	–6.4
Kuwait	31.8	42.9	45.5	40.3	33.4	3.5	–4.5	2.0	5.8	3.6	–0.3
Lebanon	–20.2	–15.2	–25.7	–29.5	–31.2	–19.6	–23.3	–25.0	–25.8	–25.2	–23.4
Libya[3]	21.1	9.9	29.9	0.0	–78.4	–54.4	–24.7	2.2	–10.7	–10.9	–6.0
Mauritania	–8.2	–5.0	–24.1	–22.0	–27.3	–19.8	–14.9	–10.0	–9.9	–8.4	1.4
Morocco	–4.4	–7.6	–9.3	–7.6	–5.9	–2.1	–4.4	–3.8	–3.6	–3.5	–2.0
Oman	8.3	13.0	10.2	6.6	5.2	–15.9	–18.4	–11.5	–6.2	–6.0	–8.6
Pakistan	–2.2	0.1	–2.1	–1.1	–1.3	–1.0	–1.7	–4.1	–4.8	–4.4	–3.8
Qatar	19.1	31.1	33.2	30.4	24.0	8.4	–5.5	1.3	2.5	1.8	1.6
Saudi Arabia	12.7	23.6	22.4	18.1	9.8	–8.7	–3.7	2.7	5.4	3.6	–2.2
Somalia	. . .	. . .	. . .	–3.6	–5.3	–4.7	–6.3	–6.7	–7.2	–6.5	–5.3
Sudan[4]	–1.8	–0.4	–8.6	–10.1	–8.1	–10.2	–8.9	–5.5	–6.2	–6.8	–5.8
Syria[5]	–2.8	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Tunisia	–4.8	–7.4	–8.3	–8.4	–9.1	–8.9	–8.8	–10.1	–9.2	–7.8	–5.8
United Arab Emirates	4.2	12.6	19.7	19.0	13.5	4.9	1.4	4.7	5.3	5.1	4.0
Yemen	–3.4	–3.0	–1.7	–3.1	–1.7	–6.5	–5.2	–1.0	–6.5	–3.8	–2.7

Table A12. Emerging Market and Developing Economies: Balance on Current Account *(continued)*

(Percent of GDP)

	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019	2023
Sub-Saharan Africa	**–0.8**	**–0.6**	**–1.7**	**–2.2**	**–3.8**	**–6.0**	**–4.1**	**–2.6**	**–2.9**	**–3.1**	**–3.2**
Angola	9.1	12.6	12.2	6.7	–3.0	–10.0	–5.1	–4.5	–2.2	–0.1	–2.9
Benin	–8.2	–7.3	–7.4	–7.4	–8.6	–9.0	–9.4	–9.4	–8.5	–7.9	–5.1
Botswana	–2.8	3.1	0.3	8.9	15.4	7.8	11.7	10.8	8.3	7.5	6.7
Burkina Faso	–2.3	–4.0	–6.7	–11.3	–8.1	–8.5	–7.3	–8.3	–7.5	–6.5	–6.7
Burundi	–12.2	–14.4	–18.6	–19.3	–18.5	–17.7	–13.1	–12.7	–13.2	–11.9	–9.9
Cabo Verde	–12.4	–16.3	–12.6	–4.9	–9.1	–3.2	–2.8	–8.8	–9.5	–10.0	–9.9
Cameroon	–2.5	–2.7	–3.3	–3.6	–4.0	–3.8	–3.2	–2.5	–2.5	–2.4	–2.4
Central African Republic	–10.2	–7.6	–4.6	–3.0	–5.6	–9.0	–9.1	–10.2	–9.3	–9.2	–5.4
Chad	–8.5	–5.8	–7.8	–9.1	–8.9	–13.6	–9.2	–5.2	–4.3	–5.5	–4.0
Comoros	–0.4	–6.0	–5.5	–7.0	–6.3	0.0	–7.4	–4.9	–6.9	–8.5	–7.1
Democratic Republic of the Congo	–10.5	–5.2	–4.6	–5.0	–4.6	–3.7	–3.1	–0.5	0.3	–0.9	–2.1
Republic of Congo	7.3	14.0	17.7	13.8	1.4	–54.1	–74.1	–12.7	3.0	4.8	–9.2
Côte d'Ivoire	1.9	10.4	–1.2	–1.4	1.4	–0.6	–1.1	–1.2	–1.5	–1.3	–1.5
Equatorial Guinea	–20.2	–5.7	–1.1	–2.5	–4.3	–17.7	–11.8	–0.5	–0.9	–13.3	0.1
Eritrea	–6.1	3.2	2.7	3.6	4.0	–1.4	–2.1	–2.4	–1.5	–2.1	–2.6
Ethiopia	–1.4	–2.5	–6.9	–5.9	–6.4	–10.2	–9.0	–8.1	–6.5	–6.3	–4.1
Gabon	14.9	24.0	17.9	7.3	7.6	–5.6	–10.1	–4.8	–1.5	–1.9	7.4
The Gambia	–16.3	–11.7	–7.0	–10.3	–10.8	–15.0	–8.9	–14.3	–18.4	–16.9	–13.6
Ghana	–8.6	–9.0	–11.7	–11.9	–9.5	–7.7	–6.7	–4.5	–4.1	–4.0	–4.1
Guinea	–6.4	–18.4	–20.0	–12.5	–13.4	–15.4	–31.9	–23.0	–19.1	–10.0	–10.6
Guinea-Bissau	–8.3	–1.3	–8.4	–4.6	0.5	2.3	1.3	0.1	–3.3	–2.6	–1.7
Kenya	–5.9	–9.2	–8.4	–8.8	–10.4	–6.7	–5.2	–6.4	–6.2	–5.7	–5.2
Lesotho	–8.9	–13.4	–8.4	–5.5	–4.9	–4.5	–7.4	–6.9	–12.2	–12.1	–13.8
Liberia	–20.7	–17.6	–17.3	–21.6	–26.3	–26.5	–18.5	–22.4	–22.5	–22.4	–19.9
Madagascar	–10.2	–7.0	–7.6	–5.9	–0.3	–1.9	0.6	–3.4	–4.0	–4.8	–4.8
Malawi	–8.6	–8.6	–9.2	–8.4	–8.3	–9.4	–13.6	–10.0	–8.9	–8.1	–7.6
Mali	–10.7	–5.1	–2.2	–2.9	–4.7	–5.3	–7.2	–6.2	–6.9	–6.4	–6.4
Mauritius	–10.3	–13.8	–7.3	–6.3	–5.7	–4.9	–4.4	–6.0	–7.4	–8.7	–2.1
Mozambique	–16.1	–25.3	–44.7	–42.9	–38.2	–40.3	–39.2	–16.1	–16.9	–44.6	–117.7
Namibia	–3.5	–3.0	–5.7	–4.0	–10.8	–12.6	–14.1	–1.4	–3.6	–5.1	–8.3
Niger	–19.8	–25.1	–16.1	–16.8	–15.4	–20.5	–15.5	–13.2	–16.1	–16.7	–12.0
Nigeria	3.6	2.6	3.8	3.7	0.2	–3.2	0.7	2.5	0.5	0.4	0.2
Rwanda	–7.2	–7.4	–11.2	–8.7	–11.8	–13.3	–14.3	–6.8	–8.4	–9.2	–5.9
São Tomé and Príncipe	–22.9	–27.7	–21.9	–13.8	–21.9	–12.6	–6.0	–13.0	–11.3	–9.9	–7.0
Senegal	–4.4	–8.0	–10.9	–10.5	–9.0	–7.0	–5.5	–9.4	–7.9	–7.5	–6.4
Seychelles	–19.4	–23.0	–21.1	–11.9	–23.1	–18.6	–18.3	–16.0	–14.4	–13.9	–12.1
Sierra Leone	–22.7	–65.0	–31.8	–17.5	–18.2	–17.4	–19.4	–21.9	–18.9	–21.6	–19.7
South Africa	–1.5	–2.2	–5.1	–5.9	–5.3	–4.4	–3.3	–2.3	–2.9	–3.1	–3.4
South Sudan	. . .	18.2	–15.9	–3.9	–1.6	–7.2	1.8	–6.0	–6.1	–4.3	–1.8
Swaziland	–8.6	1.0	12.7	19.3	21.6	26.7	16.7	14.6	15.4	15.0	15.7
Tanzania	–7.7	–10.8	–11.6	–10.6	–10.1	–8.4	–4.5	–3.8	–5.4	–6.0	–4.7
Togo	–5.8	–7.8	–7.6	–13.2	–10.0	–11.0	–9.6	–8.2	–7.8	–6.4	–2.5
Uganda	–8.0	–9.9	–6.8	–7.2	–7.8	–6.7	–3.4	–4.5	–6.9	–9.5	–3.1
Zambia	7.5	4.7	5.4	–0.6	2.1	–3.9	–4.5	–3.3	–2.6	–1.9	–1.3
Zimbabwe[6]	–14.3	–20.1	–13.1	–16.6	–14.2	–9.5	–3.4	–2.6	–2.6	–2.4	–2.5

[1]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.
[2]Starting in 2014, data exclude Crimea and Sevastopol.
[3]See country-specific notes for Libya in the "Country Notes" section of the Statistical Appendix.
[4]Data for 2011 exclude South Sudan after July 9. Data for 2012 and onward pertain to the current Sudan.
[5]Data for Syria are excluded for 2011 onward owing to the uncertain political situation.
[6]The Zimbabwe dollar ceased circulating in early 2009. Data are based on IMF staff estimates of price and exchange rate developments in US dollars. IMF staff estimates of US dollar values may differ from authorities' estimates.

Table A13. Summary of Financial Account Balances

(Billions of US dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	Projections 2019
Advanced Economies										
Financial Account Balance	–168.1	–224.1	–130.0	230.6	342.0	322.2	438.4	424.4	335.8	231.8
Direct Investment, Net	340.7	358.9	111.9	155.4	213.5	35.7	–14.5	433.1	315.0	327.3
Portfolio Investment, Net	–969.0	–1,111.5	–246.3	–539.9	30.6	176.1	374.4	–126.9	–149.1	–287.5
Financial Derivatives, Net	–114.1	–6.4	–98.3	73.9	–12.4	–105.3	45.3	41.3	29.2	51.2
Other Investment, Net	261.5	191.7	–155.0	399.5	–11.7	4.0	–137.2	–70.6	68.0	64.3
Change in Reserves	352.9	349.8	273.2	153.1	134.9	226.8	179.6	170.4	92.9	93.7
United States										
Financial Account Balance	–446.4	–525.6	–448.9	–404.0	–326.8	–333.2	–377.7	–349.2	–606.4	–763.8
Direct Investment, Net	85.8	173.1	126.9	104.7	101.2	–195.0	–167.8	75.7	–102.7	–95.5
Portfolio Investment, Net	–620.8	–226.3	–498.3	–30.7	–120.8	–53.6	–196.7	–247.5	–481.7	–608.1
Financial Derivatives, Net	–14.1	–35.0	7.1	2.2	–54.3	–25.2	15.8	26.4	–12.7	9.3
Other Investment, Net	100.9	–453.4	–89.0	–477.1	–249.4	–53.0	–31.0	–202.1	–9.3	–69.5
Change in Reserves	1.8	15.9	4.5	–3.1	–3.6	–6.3	2.1	–1.7	0.0	0.0
Euro Area										
Financial Account Balance	–16.9	–40.9	184.3	443.7	351.9	314.9	343.3	466.6	. . .	. . .
Direct Investment, Net	82.3	124.9	59.4	23.8	95.6	268.2	246.6	–0.5	. . .	. . .
Portfolio Investment, Net	–81.4	–383.3	–175.8	–156.9	35.0	107.0	461.0	432.6	. . .	. . .
Financial Derivatives, Net	–4.4	5.5	38.9	42.1	65.5	96.8	20.5	10.5	. . .	. . .
Other Investment, Net	–27.1	197.7	242.9	528.5	150.0	–168.7	–402.1	25.5	. . .	. . .
Change in Reserves	13.7	14.3	19.0	6.2	5.8	11.7	17.4	–1.4	. . .	. . .
Germany										
Financial Account Balance	123.7	167.7	194.3	300.0	316.3	259.6	269.1	311.4	346.8	364.1
Direct Investment, Net	60.6	10.3	33.6	26.0	96.6	59.9	23.8	47.7	52.7	47.5
Portfolio Investment, Net	154.1	–51.4	66.8	209.6	175.0	217.9	230.4	226.1	278.6	288.7
Financial Derivatives, Net	17.6	39.8	30.9	31.8	42.3	29.2	36.1	10.1	31.1	30.2
Other Investment, Net	–110.7	165.1	61.1	31.4	5.6	–45.0	–23.1	28.9	–15.6	–2.3
Change in Reserves	2.1	3.9	1.7	1.2	–3.3	–2.4	1.9	–1.4	0.0	0.0
France										
Financial Account Balance	–1.6	–78.6	–48.0	–19.2	–10.3	–13.5	–31.8	–36.8	–39.1	–26.6
Direct Investment, Net	34.3	19.8	19.4	–13.9	47.2	–2.6	29.0	33.7	41.6	46.6
Portfolio Investment, Net	–155.0	–335.1	–50.6	–79.3	–23.8	51.5	–4.0	–19.3	–32.5	–33.2
Financial Derivatives, Net	–4.1	–19.4	–18.4	–22.3	–31.8	12.0	0.7	7.7	16.4	25.1
Other Investment, Net	115.5	263.8	–3.6	98.2	–2.9	–82.4	–60.0	–61.2	–67.2	–68.0
Change in Reserves	7.7	–7.7	5.2	–1.9	1.0	8.0	2.5	2.3	2.6	2.8
Italy										
Financial Account Balance	–107.1	–79.9	–4.1	29.0	68.5	40.0	73.7	53.4	58.3	53.0
Direct Investment, Net	21.3	17.2	6.8	0.9	3.1	2.7	–3.3	–9.0	0.8	1.0
Portfolio Investment, Net	62.5	25.6	–22.4	–5.4	5.5	109.1	176.6	111.4	79.9	49.3
Financial Derivatives, Net	6.6	–10.1	7.5	4.0	–4.8	2.6	–3.3	–6.6	–2.8	–0.7
Other Investment, Net	–198.9	–113.9	2.1	27.5	65.9	–75.0	–95.1	–45.5	–19.5	3.3
Change in Reserves	1.4	1.3	1.9	2.0	–1.3	0.6	–1.3	3.0	0.0	0.0

Table A13. Summary of Financial Account Balances *(continued)*

(Billions of US dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019
Spain										
Financial Account Balance	–58.9	–43.4	0.5	41.6	14.8	23.1	27.9	24.9	27.3	30.0
Direct Investment, Net	–1.9	12.8	–27.2	–24.6	8.6	31.0	18.5	24.1	26.7	28.1
Portfolio Investment, Net	–46.6	43.1	53.7	–83.6	–12.1	10.2	55.1	12.5	–3.2	–2.1
Financial Derivatives, Net	–11.4	2.9	–10.7	1.4	1.7	–1.1	–2.9	0.0	0.0	0.0
Other Investment, Net	0.0	–116.2	–18.2	147.8	11.5	–22.6	–51.8	–11.7	3.7	4.0
Change in Reserves	1.1	13.9	2.8	0.7	5.1	5.6	9.1	0.0	0.0	0.0
Japan										
Financial Account Balance	247.3	158.4	53.9	–4.3	58.9	178.6	266.7	153.1	191.1	195.6
Direct Investment, Net	72.5	117.8	117.5	144.7	118.6	131.0	134.6	146.2	134.0	147.0
Portfolio Investment, Net	147.9	–162.9	28.8	–280.6	–42.2	131.5	282.2	–54.4	–48.9	–46.2
Financial Derivatives, Net	–11.9	–17.1	6.7	58.1	34.0	17.7	–16.7	30.4	32.2	33.4
Other Investment, Net	–5.5	43.4	–61.1	34.8	–60.1	–106.7	–127.7	7.4	63.3	50.4
Change in Reserves	44.3	177.3	–37.9	38.7	8.5	5.1	–5.7	23.6	10.5	11.0
United Kingdom										
Financial Account Balance	–112.4	–48.1	–92.5	–132.5	–148.0	–138.9	–143.4	–87.4	–112.4	–105.4
Direct Investment, Net	–10.1	53.4	–34.8	–11.2	–176.1	–116.2	–219.5	84.6	67.5	57.4
Portfolio Investment, Net	–201.0	–215.5	275.0	–284.3	22.6	–212.3	–193.2	–87.7	0.0	0.0
Financial Derivatives, Net	–69.3	7.4	–65.8	63.4	31.2	–128.6	29.3	12.5	1.9	–9.1
Other Investment, Net	158.6	98.6	–279.1	91.8	–37.5	286.1	231.1	–105.6	–194.8	–167.9
Change in Reserves	9.4	7.9	12.1	7.8	11.7	32.2	8.8	8.8	13.0	14.1
Canada										
Financial Account Balance	–58.3	–49.4	–62.7	–56.9	–42.2	–57.8	–51.5	–49.3	–57.3	–48.6
Direct Investment, Net	6.3	12.5	12.8	–12.0	1.3	22.2	36.3	10.2	21.7	22.5
Portfolio Investment, Net	–109.9	–104.3	–63.8	–27.1	–32.9	–44.8	–119.2	–65.7	–83.2	–85.9
Financial Derivatives, Net	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Other Investment, Net	41.4	34.3	–13.4	–22.5	–15.9	–43.8	25.8	6.2	4.1	14.9
Change in Reserves	3.9	8.1	1.7	4.7	5.3	8.5	5.6	0.0	0.0	0.0
Other Advanced Economies[1]										
Financial Account Balance	243.6	278.5	240.8	364.1	339.5	287.3	327.7	308.8	371.4	382.2
Direct Investment, Net	93.5	–6.5	–34.8	26.3	–7.5	–109.9	–76.9	–99.0	–78.5	–72.8
Portfolio Investment, Net	–57.1	46.8	148.7	138.4	180.1	334.0	273.2	276.7	321.3	341.5
Financial Derivatives, Net	–15.2	31.1	–28.3	–33.5	–23.5	–14.2	0.7	–27.9	–35.0	–37.0
Other Investment, Net	–16.8	88.5	–104.0	143.1	97.1	–83.4	–10.9	43.7	119.1	104.1
Change in Reserves	279.3	125.1	274.7	101.3	106.3	175.9	151.0	138.3	64.6	63.7
Emerging Market and Developing Economies										
Financial Account Balance	137.1	237.3	113.2	38.7	15.8	–276.2	–431.5	–254.9	4.8	–56.4
Direct Investment, Net	–455.9	–530.9	–491.4	–482.9	–415.4	–340.5	–279.9	–375.3	–388.5	–396.4
Portfolio Investment, Net	–222.5	–148.0	–237.5	–156.7	–115.3	113.1	–44.7	–163.0	–84.6	–78.1
Financial Derivatives, Net	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Other Investment, Net	–22.9	166.5	408.8	89.5	409.5	461.8	386.2	135.7	343.6	325.1
Change in Reserves	837.2	745.0	432.0	590.8	128.4	–515.5	–482.4	164.6	143.6	102.6

Table A13. Summary of Financial Account Balances *(continued)*
(Billions of US dollars)

									Projections	
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Regional Groups										
Commonwealth of Independent States[2]										
Financial Account Balance	75.9	100.9	52.1	2.5	12.2	52.8	2.1	63.1	65.6	56.3
Direct Investment, Net	–8.5	–15.2	–27.6	–3.6	19.2	0.9	–34.6	–5.0	–0.3	–1.8
Portfolio Investment, Net	–14.2	17.9	3.5	–0.2	28.8	12.0	–2.4	–15.8	–4.8	–4.2
Financial Derivatives, Net	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Other Investment, Net	36.0	64.3	44.3	27.5	73.0	39.4	28.8	21.9	22.1	27.2
Change in Reserves	60.9	32.0	30.5	–21.5	–114.1	–6.8	9.8	61.7	48.4	35.0
Emerging and Developing Asia										
Financial Account Balance	148.4	65.2	9.7	33.0	149.5	86.9	–40.0	–85.0	131.1	137.8
Direct Investment, Net	–225.0	–277.3	–221.9	–273.2	–203.4	–139.9	–27.7	–157.8	–153.8	–145.0
Portfolio Investment, Net	–91.3	–58.0	–115.6	–64.7	–123.9	82.7	31.9	–50.5	–21.9	–23.9
Financial Derivatives, Net	0.2	–0.3	1.5	–2.0	0.4	–1.5	–10.2	–11.5	–10.0	–10.6
Other Investment, Net	–97.5	–28.7	207.4	–78.7	280.8	461.5	346.2	–58.9	244.2	244.9
Change in Reserves	562.9	431.3	139.1	451.1	195.4	–316.0	–379.8	193.8	73.1	73.0
Emerging and Developing Europe										
Financial Account Balance	–89.1	–107.1	–66.3	–62.3	–43.5	–9.7	–14.1	–42.9	–45.9	–49.6
Direct Investment, Net	–26.7	–39.8	–27.6	–26.5	–32.8	–34.8	–30.9	–23.0	–28.5	–32.3
Portfolio Investment, Net	–45.8	–53.5	–70.0	–40.0	–19.3	24.6	–4.2	–25.0	–21.2	–18.9
Financial Derivatives, Net	0.0	1.6	–2.9	–1.4	0.3	–1.8	0.1	–0.9	0.8	0.8
Other Investment, Net	–52.5	–30.1	6.5	–12.9	8.6	12.7	–2.8	18.7	–3.9	–10.4
Change in Reserves	35.9	14.6	27.8	18.5	–0.2	–10.4	23.6	–12.7	6.9	11.1
Latin America and the Caribbean										
Financial Account Balance	–114.5	–126.4	–146.7	–187.7	–205.1	–192.5	–103.9	–88.5	–109.6	–131.9
Direct Investment, Net	–110.0	–144.6	–153.6	–147.5	–139.4	–134.4	–136.9	–137.9	–137.0	–138.5
Portfolio Investment, Net	–96.0	–109.4	–83.9	–101.9	–110.9	–60.5	–49.5	–33.5	–37.0	–45.2
Financial Derivatives, Net	0.7	5.5	2.3	1.7	4.4	1.4	–1.1	4.4	0.6	0.7
Other Investment, Net	–0.2	14.1	29.5	48.2	1.8	30.0	62.8	59.2	44.6	42.8
Change in Reserves	90.9	108.0	59.0	11.7	39.0	–29.0	20.8	29.0	19.1	8.3
Middle East, North Africa, Afghanistan, and Pakistan										
Financial Account Balance	122.5	320.3	285.8	306.7	180.3	–133.1	–208.8	–55.4	5.4	–20.2
Direct Investment, Net	–48.9	–21.6	–26.1	–8.6	–29.6	–0.3	–7.6	–16.9	–27.8	–29.6
Portfolio Investment, Net	25.2	74.2	56.8	72.1	131.9	69.5	–6.9	–18.0	11.1	18.6
Financial Derivatives, Net	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Other Investment, Net	60.1	129.5	100.5	114.9	61.6	–63.3	–48.3	101.1	39.7	18.3
Change in Reserves	86.1	138.2	154.7	128.1	16.2	–139.3	–146.4	–121.9	–17.9	–28.0
Sub-Saharan Africa										
Financial Account Balance	–6.0	–15.6	–21.4	–53.5	–77.5	–80.6	–66.6	–46.3	–41.9	–48.8
Direct Investment, Net	–36.8	–32.5	–34.5	–23.5	–29.3	–32.0	–42.2	–34.7	–41.0	–49.2
Portfolio Investment, Net	–0.4	–19.3	–28.4	–22.0	–21.8	–15.2	–13.6	–20.3	–10.9	–4.7
Financial Derivatives, Net	–0.2	–1.7	–1.7	–0.8	–1.5	–0.4	0.9	1.1	0.0	0.0
Other Investment, Net	31.2	17.5	20.5	–9.4	–16.2	–18.4	–0.5	–6.3	–3.1	2.3
Change in Reserves	0.5	20.7	21.0	2.9	–7.9	–14.1	–10.4	14.7	14.1	3.2

Table A13. Summary of Financial Account Balances *(continued)*
(Billions of US dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	Projections 2018	2019
Analytical Groups										
By Source of Export Earnings										
Fuel										
Financial Account Balance	251.8	512.2	445.8	375.9	223.6	–85.7	–165.2	53.7	128.8	101.4
Direct Investment, Net	–31.2	–23.8	–33.3	10.8	7.0	7.4	–29.5	–7.3	–12.8	–13.9
Portfolio Investment, Net	20.2	87.0	47.2	78.2	162.8	79.9	–7.2	–25.1	20.6	21.6
Financial Derivatives, Net	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Other Investment, Net	145.8	253.0	196.0	186.4	155.1	9.2	33.7	147.7	90.3	84.0
Change in Reserves	115.1	194.7	234.5	100.2	–106.5	–189.5	–162.6	–61.9	30.5	9.6
Nonfuel										
Financial Account Balance	–113.1	–274.9	–332.7	–337.3	–207.9	–190.5	–266.3	–308.6	–124.0	–157.8
Direct Investment, Net	–422.4	–507.1	–458.1	–493.7	–422.4	–347.9	–250.3	–367.9	–375.7	–382.4
Portfolio Investment, Net	–242.7	–235.0	–284.7	–234.8	–278.1	33.1	–37.5	–137.9	–105.2	–99.8
Financial Derivatives, Net	0.7	5.8	–1.0	–2.4	3.6	–2.2	–10.3	–7.0	–8.6	–9.2
Other Investment, Net	–168.3	–86.6	212.8	–96.8	254.4	452.7	352.5	–12.0	253.3	241.1
Change in Reserves	721.0	550.3	197.5	490.6	234.9	–326.0	–319.7	226.5	113.1	93.0
By External Financing Source										
Net Debtor Economies										
Financial Account Balance	–288.2	–393.6	–433.7	–420.0	–382.8	–293.5	–237.9	–231.6	–273.1	–307.2
Direct Investment, Net	–228.7	–285.5	–292.5	–284.4	–295.4	–286.1	–299.1	–292.9	–307.6	–329.7
Portfolio Investment, Net	–210.1	–181.0	–198.9	–175.9	–198.8	–39.3	–50.9	–110.7	–70.0	–62.6
Financial Derivatives, Net	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Other Investment, Net	–83.9	–65.8	–58.1	–21.1	–11.4	32.7	31.9	65.5	29.0	15.3
Change in Reserves	234.6	135.9	116.6	63.0	117.9	1.3	92.6	124.8	85.0	79.4
Net Debtor Economies by Debt-Servicing Experience										
Economies with Arrears and/or Rescheduling during 2012–16										
Financial Account Balance	–11.7	–25.9	–54.5	–44.0	–29.0	–41.1	–55.1	–35.8	–28.6	–33.8
Direct Investment, Net	–21.8	–21.0	–26.9	–24.6	–20.6	–26.5	–27.6	–24.7	–26.4	–31.9
Portfolio Investment, Net	–11.2	0.9	–1.5	–10.2	–0.4	1.8	–1.4	–21.1	–16.1	–6.5
Financial Derivatives, Net	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Other Investment, Net	7.3	6.4	–3.2	–11.8	0.7	–22.2	–23.1	10.2	5.7	4.6
Change in Reserves	14.2	–11.8	–24.7	3.2	–8.3	6.1	–2.5	0.0	8.7	–0.1
Memorandum										
World										
Financial Account Balance	–31.0	13.2	–16.8	269.3	357.8	46.0	6.8	169.4	340.6	175.4

Note: The estimates in this table are based on individual countries' national accounts and balance of payments statistics. Country group composites are calculated as the sum of the US dollar values for the relevant individual countries. Some group aggregates for the financial derivatives are not shown because of incomplete data. Projections for the euro area are not available because of data constraints.

[1]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.

[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.

Table A14. Summary of Net Lending and Borrowing
(Percent of GDP)

	Averages								Projections		
											Average
	2000–09	2004–11	2012	2013	2014	2015	2016	2017	2018	2019	2020–23
Advanced Economies											
Net Lending and Borrowing	–0.8	–0.7	0.1	0.5	0.5	0.5	0.7	0.8	0.7	0.5	0.6
Current Account Balance	–0.9	–0.7	0.0	0.4	0.5	0.7	0.7	0.8	0.7	0.5	0.6
Savings	21.9	21.4	21.3	21.5	22.1	22.4	21.9	22.0	22.2	22.3	22.6
Investment	22.6	22.0	21.0	20.9	21.2	21.2	21.0	21.2	21.5	21.8	22.1
Capital Account Balance	0.0	0.0	0.0	0.0	0.0	–0.1	0.0	0.0	0.0	0.0	0.0
United States											
Net Lending and Borrowing	–4.5	–4.3	–2.6	–2.1	–2.1	–2.4	–2.4	–2.3	–3.0	–3.3	–3.3
Current Account Balance	–4.5	–4.3	–2.6	–2.1	–2.1	–2.4	–2.4	–2.4	–3.0	–3.4	–3.3
Savings	17.7	16.5	17.7	18.3	19.3	19.4	18.0	17.5	17.2	17.4	17.8
Investment	21.9	20.8	19.4	19.8	20.1	20.4	19.7	19.8	20.2	20.8	21.1
Capital Account Balance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
Euro Area											
Net Lending and Borrowing	–0.1	0.0	1.5	2.4	2.6	3.1	3.4	3.3	. . .	. . .	. . .
Current Account Balance	–0.2	–0.1	1.4	2.2	2.4	3.2	3.4	3.5	3.2	3.2	3.0
Savings	22.8	22.7	22.3	22.4	22.9	23.8	24.0	24.4	24.6	24.8	24.9
Investment	22.5	22.2	20.1	19.6	19.9	20.0	20.4	20.9	21.1	21.3	21.6
Capital Account Balance	0.1	0.1	0.1	0.2	0.1	–0.1	0.0	–0.2	. . .	. . .	. . .
Germany											
Net Lending and Borrowing	3.4	5.5	7.0	6.7	7.5	8.9	8.6	8.0	8.2	8.2	7.9
Current Account Balance	3.4	5.6	7.0	6.7	7.5	8.9	8.5	8.0	8.2	8.2	7.9
Savings	23.7	25.3	26.3	26.2	27.0	28.1	27.7	27.7	28.0	28.2	28.2
Investment	20.3	19.8	19.3	19.5	19.5	19.1	19.2	19.7	19.7	20.0	20.3
Capital Account Balance	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
France											
Net Lending and Borrowing	1.0	–0.1	–1.2	–0.8	–1.2	–0.4	–0.9	–1.4	–1.3	–0.9	–0.3
Current Account Balance	1.0	–0.2	–1.2	–0.9	–1.3	–0.4	–0.9	–1.4	–1.3	–0.9	–0.3
Savings	23.3	22.6	21.4	21.4	21.5	22.3	22.1	22.0	21.9	22.2	22.6
Investment	22.4	22.7	22.6	22.3	22.7	22.8	23.0	23.4	23.2	23.1	22.9
Capital Account Balance	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Italy											
Net Lending and Borrowing	–0.8	–1.8	–0.1	0.9	2.1	1.8	2.6	2.9	2.7	2.3	1.5
Current Account Balance	–0.9	–1.9	–0.3	1.0	1.9	1.5	2.7	2.9	2.6	2.2	1.4
Savings	20.2	19.2	17.5	17.9	18.9	18.9	19.8	20.4	20.2	20.1	19.8
Investment	21.1	21.1	17.9	17.0	17.0	17.3	17.1	17.5	17.7	17.9	18.4
Capital Account Balance	0.1	0.1	0.2	0.0	0.2	0.2	–0.2	0.0	0.1	0.1	0.1
Spain											
Net Lending and Borrowing	–5.5	–6.0	0.3	2.2	1.6	1.8	2.2	1.9	1.8	1.9	2.0
Current Account Balance	–6.2	–6.5	–0.2	1.5	1.1	1.1	1.9	1.7	1.6	1.7	1.7
Savings	22.2	21.1	19.8	20.2	20.5	21.5	22.4	22.8	23.1	23.3	23.5
Investment	28.3	27.6	20.0	18.7	19.5	20.4	20.5	21.1	21.5	21.7	21.8
Capital Account Balance	0.7	0.5	0.5	0.6	0.5	0.7	0.2	0.2	0.2	0.2	0.2
Japan											
Net Lending and Borrowing	3.1	3.4	0.9	0.7	0.7	3.0	3.7	4.0	3.7	3.6	4.0
Current Account Balance	3.2	3.4	1.0	0.9	0.8	3.1	3.8	4.0	3.8	3.7	4.0
Savings	27.9	26.9	23.6	24.1	24.7	27.1	27.4	28.0	28.3	28.4	28.7
Investment	24.7	23.5	22.7	23.2	23.9	24.0	23.6	24.0	24.6	24.7	24.7
Capital Account Balance	–0.1	–0.1	0.0	–0.1	0.0	–0.1	–0.1	–0.1	–0.1	–0.1	–0.1
United Kingdom											
Net Lending and Borrowing	–2.9	–3.3	–4.3	–5.6	–5.4	–5.3	–5.9	–4.1	–3.8	–3.5	–3.1
Current Account Balance	–2.9	–3.3	–4.2	–5.5	–5.3	–5.2	–5.8	–4.1	–3.7	–3.4	–3.1
Savings	14.4	13.3	11.5	10.5	11.8	11.8	11.1	12.8	13.3	13.7	14.4
Investment	17.3	16.6	15.7	16.1	17.1	17.0	16.9	16.9	17.0	17.1	17.5
Capital Account Balance	0.0	0.0	0.0	–0.1	–0.1	–0.1	–0.1	–0.1	–0.1	–0.1	–0.1

Table A14. Summary of Net Lending and Borrowing *(continued)*
(Percent of GDP)

	Averages								Projections		
											Average
	2000–09	2004–11	2012	2013	2014	2015	2016	2017	2018	2019	2020–23
Canada											
Net Lending and Borrowing	1.1	–0.4	–3.6	–3.2	–2.4	–3.6	–3.2	–3.0	–3.2	–2.5	–1.8
Current Account Balance	1.1	–0.4	–3.6	–3.2	–2.4	–3.6	–3.2	–3.0	–3.2	–2.5	–1.8
Savings	23.0	22.8	21.3	21.7	22.5	20.5	20.0	20.7	20.8	21.5	22.5
Investment	21.9	23.2	24.9	24.9	24.9	24.1	23.2	23.7	23.9	24.1	24.4
Capital Account Balance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Advanced Economies[1]											
Net Lending and Borrowing	3.8	4.1	4.1	5.2	5.1	5.4	5.5	4.8	5.1	5.0	4.8
Current Account Balance	3.8	4.1	4.1	5.1	5.2	5.8	5.4	5.0	5.2	5.1	4.9
Savings	29.8	30.4	30.3	30.4	30.5	30.9	30.2	30.2	30.5	30.5	30.2
Investment	25.6	25.9	26.0	25.1	25.2	24.8	24.7	25.3	25.4	25.4	25.5
Capital Account Balance	–0.1	0.0	0.0	0.1	–0.1	–0.4	0.1	–0.2	0.0	–0.1	–0.1
Emerging Market and Developing Economies											
Net Lending and Borrowing	2.6	2.9	1.3	0.7	0.6	0.0	–0.2	0.0	0.1	–0.1	–0.4
Current Account Balance	2.5	2.8	1.3	0.6	0.5	–0.2	–0.3	–0.1	–0.1	–0.2	–0.5
Savings	29.5	32.2	33.5	32.8	33.0	32.6	31.8	32.2	32.8	32.9	32.5
Investment	27.3	29.6	32.4	32.4	32.6	32.9	32.1	32.3	32.9	33.0	33.0
Capital Account Balance	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Regional Groups											
Commonwealth of Independent States[2]											
Net Lending and Borrowing	6.0	4.8	2.2	0.6	0.6	2.8	0.0	1.3	2.8	2.4	1.9
Current Account Balance	6.5	5.1	2.4	0.6	2.1	2.8	0.0	1.3	2.8	2.3	1.9
Savings	27.4	27.1	27.2	24.3	25.1	26.1	24.7	25.9	26.8	26.9	26.4
Investment	21.1	22.0	24.8	23.6	22.9	23.0	24.3	24.4	23.8	24.4	24.3
Capital Account Balance	–0.5	–0.3	–0.2	0.0	–1.5	0.0	0.0	0.0	0.0	0.0	0.0
Emerging and Developing Asia											
Net Lending and Borrowing	3.7	3.9	1.0	0.8	1.6	2.0	1.4	0.9	0.7	0.6	0.3
Current Account Balance	3.6	3.8	1.0	0.7	1.5	2.0	1.4	0.9	0.6	0.6	0.3
Savings	38.4	42.4	43.7	43.0	43.6	42.4	41.0	40.9	40.9	40.6	39.5
Investment	35.2	38.8	42.6	42.3	42.0	40.4	39.6	40.0	40.2	40.0	39.2
Capital Account Balance	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emerging and Developing Europe											
Net Lending and Borrowing	–4.5	–5.3	–3.4	–2.5	–1.7	–0.6	–1.1	–1.9	–1.8	–1.9	–1.9
Current Account Balance	–4.8	–5.8	–4.4	–3.6	–2.9	–1.9	–1.8	–2.6	–2.9	–2.7	–2.6
Savings	19.7	19.9	20.5	21.5	22.1	22.9	22.5	23.2	23.1	23.3	23.6
Investment	24.2	25.7	24.9	25.0	25.0	24.7	24.1	25.5	25.9	25.9	26.0
Capital Account Balance	0.3	0.5	0.9	1.1	1.3	1.3	0.6	0.6	1.0	0.9	0.6
Latin America and the Caribbean											
Net Lending and Borrowing	–0.1	–0.1	–2.3	–2.7	–3.1	–3.3	–1.9	–1.5	–2.1	–2.2	–2.4
Current Account Balance	–0.2	–0.2	–2.3	–2.7	–3.1	–3.4	–1.9	–1.6	–2.1	–2.3	–2.4
Savings	20.1	21.2	20.0	19.2	17.9	18.1	17.2	17.5	17.3	17.5	18.2
Investment	20.4	21.3	22.5	22.4	21.7	22.0	19.4	19.1	19.4	19.8	20.6
Capital Account Balance	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle East, North Africa, Afghanistan, and Pakistan											
Net Lending and Borrowing	8.0	9.6	11.9	10.0	6.1	–3.6	–4.1	–0.8	0.8	0.0	–1.1
Current Account Balance	8.3	10.1	12.4	9.8	5.4	–4.0	–4.2	–0.9	0.5	–0.3	–1.3
Savings	34.7	37.4	37.9	36.1	33.0	24.9	24.1	26.4	28.6	27.8	26.4
Investment	27.0	28.0	25.9	25.9	26.8	28.4	27.6	27.0	27.4	27.2	26.8
Capital Account Balance	0.2	0.2	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1
Sub-Saharan Africa											
Net Lending and Borrowing	2.0	2.4	–0.6	–1.8	–3.4	–5.6	–3.6	–2.2	–2.6	–2.7	–2.9
Current Account Balance	0.7	0.9	–1.7	–2.2	–3.8	–6.0	–4.1	–2.6	–2.9	–3.1	–3.2
Savings	20.3	21.6	19.5	18.7	18.3	16.1	16.1	17.8	17.6	18.1	18.1
Investment	19.7	20.6	21.0	21.0	21.9	21.8	19.8	20.2	20.5	21.1	21.2
Capital Account Balance	1.3	1.5	1.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3

Table A14. Summary of Net Lending and Borrowing *(continued)*
(Percent of GDP)

	Averages								Projections		
	2000–09	2004–11	2012	2013	2014	2015	2016	2017	2018	2019	Average 2020–23
Analytical Groups											
By Source of Export Earnings											
Fuel											
Net Lending and Borrowing	9.3	10.1	9.3	7.4	4.7	–1.5	–1.8	1.2	2.9	2.2	1.2
Current Account Balance	9.6	10.4	9.7	7.3	5.1	–1.6	–1.9	1.3	2.7	2.0	1.1
Savings	33.9	35.0	34.7	32.0	30.2	26.5	24.8	27.1	28.7	28.3	26.6
Investment	24.7	25.0	25.4	24.9	25.4	28.3	26.2	25.5	25.4	25.5	24.8
Capital Account Balance	0.0	0.0	–0.1	0.0	–0.7	–0.1	–0.1	0.0	0.0	0.0	0.0
Nonfuel											
Net Lending and Borrowing	0.8	0.8	–0.9	–1.0	–0.4	0.2	0.1	–0.2	–0.4	–0.5	–0.7
Current Account Balance	0.6	0.6	–1.1	–1.2	–0.6	0.1	0.0	–0.3	–0.6	–0.6	–0.8
Savings	28.4	31.4	33.2	33.1	33.7	33.8	33.1	33.2	33.5	33.6	33.4
Investment	28.0	30.9	34.2	34.2	34.3	33.8	33.2	33.5	34.1	34.2	34.2
Capital Account Balance	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
By External Financing Source											
Net Debtor Economies											
Net Lending and Borrowing	–1.0	–1.4	–3.0	–2.6	–2.3	–2.1	–1.5	–1.5	–1.8	–1.9	–2.0
Current Account Balance	–1.3	–1.7	–3.3	–2.9	–2.6	–2.4	–1.7	–1.7	–2.1	–2.1	–2.2
Savings	22.1	23.4	23.0	22.5	22.5	22.1	22.3	22.9	23.0	23.3	24.1
Investment	23.6	25.2	26.2	25.3	25.1	24.5	23.9	24.5	25.0	25.4	26.2
Capital Account Balance	0.3	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.2
Net Debtor Economies by Debt-Servicing Experience											
Economies with Arrears and/or Rescheduling during 2012–16											
Net Lending and Borrowing	–0.3	–1.6	–5.7	–5.8	–4.0	–5.8	–6.7	–5.3	–4.5	–4.5	–5.2
Current Account Balance	–0.8	–2.1	–6.3	–6.0	–4.2	–6.0	–6.8	–5.5	–4.8	–4.8	–5.4
Savings	20.9	20.7	14.7	13.4	14.3	11.8	12.1	13.8	15.9	16.5	17.4
Investment	22.2	22.7	20.6	19.2	18.3	17.8	18.7	19.1	20.5	21.1	22.7
Capital Account Balance	0.6	0.6	0.6	0.2	0.3	0.3	0.1	0.3	0.2	0.2	0.2
Memorandum											
World											
Net Lending and Borrowing	0.0	0.3	0.5	0.6	0.5	0.3	0.3	0.5	0.4	0.3	0.2
Current Account Balance	0.0	0.3	0.5	0.5	0.5	0.3	0.3	0.5	0.4	0.2	0.1
Savings	23.9	24.6	26.0	26.0	26.4	26.4	25.8	26.1	26.4	26.6	26.9
Investment	23.8	24.4	25.3	25.3	25.6	25.8	25.2	25.6	26.0	26.4	26.7
Capital Account Balance	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1

Note: The estimates in this table are based on individual countries' national accounts and balance of payments statistics. Country group composites are calculated as the sum of the US dollar values for the relevant individual countries. This differs from the calculations in the April 2005 and earlier issues of the *World Economic Outlook,* in which the composites were weighted by GDP valued at purchasing power parities as a share of total world GDP. The estimates of gross national savings and investment (or gross capital formation) are from individual countries' national accounts statistics. The estimates of the current account balance, the capital account balance, and the financial account balance (or net lending/net borrowing) are from the balance of payments statistics. The link between domestic transactions and transactions with the rest of the world can be expressed as accounting identities. Savings (S) minus investment (I) is equal to the current account balance (CAB) ($S - I = CAB$). Also, net lending/net borrowing (NLB) is the sum of the current account balance and the capital account balance (KAB) ($NLB = CAB + KAB$). In practice, these identities do not hold exactly; imbalances result from imperfections in source data and compilation as well as from asymmetries in group composition due to data availability.

[1]Excludes the G7 (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries.

[2]Georgia, Turkmenistan, and Ukraine, which are not members of the Commonwealth of Independent States, are included in this group for reasons of geography and similarity in economic structure.

Table A15. Summary of World Medium-Term Baseline Scenario

	Averages				Projections		Averages	
	2000–09	2010–19	2016	2017	2018	2019	2016–19	2020–23
	Annual Percent Change							
World Real GDP	**3.9**	**3.9**	**3.2**	**3.8**	**3.9**	**3.9**	**3.7**	**3.7**
Advanced Economies	1.8	2.0	1.7	2.3	2.5	2.2	2.2	1.6
Emerging Market and Developing Economies	6.1	5.2	4.4	4.8	4.9	5.1	4.8	5.0
Memorandum								
Potential Output								
Major Advanced Economies	1.9	1.3	1.4	1.5	1.6	1.7	1.6	1.5
World Trade, Volume[1]	**5.0**	**4.9**	**2.3**	**4.9**	**5.1**	**4.7**	**4.2**	**3.9**
Imports								
Advanced Economies	3.6	4.5	2.7	4.0	5.1	4.5	4.1	3.2
Emerging Market and Developing Economies	9.0	5.9	1.8	6.4	6.0	5.6	4.9	5.3
Exports								
Advanced Economies	3.9	4.6	2.0	4.2	4.5	3.9	3.7	3.3
Emerging Market and Developing Economies	7.9	5.4	2.6	6.4	5.1	5.3	4.8	4.7
Terms of Trade								
Advanced Economies	–0.2	0.1	0.9	–0.2	0.6	0.2	0.4	0.0
Emerging Market and Developing Economies	1.5	0.1	–1.4	0.6	1.1	–0.5	0.0	0.0
World Prices in US Dollars								
Manufactures	1.7	0.3	–5.2	1.4	1.9	1.3	–0.2	0.8
Oil	13.1	–0.6	–15.7	23.3	18.0	–6.5	3.5	–2.1
Nonfuel Primary Commodities	5.3	1.6	–1.5	6.8	5.6	0.5	2.8	–0.5
Consumer Prices								
Advanced Economies	2.0	1.6	0.8	1.7	2.0	1.9	1.6	2.0
Emerging Market and Developing Economies	6.8	5.1	4.3	4.0	4.6	4.3	4.3	4.1
Interest Rates	*Percent*							
Real Six-Month LIBOR[2]	1.1	–0.7	–0.2	–0.3	–0.2	0.9	0.0	1.5
World Real Long-Term Interest Rate[3]	2.1	0.5	0.4	–0.2	0.0	0.5	0.2	0.9
Current Account Balances	*Percent of GDP*							
Advanced Economies	–0.9	0.4	0.7	0.8	0.7	0.5	0.7	0.6
Emerging Market and Developing Economies	2.5	0.4	–0.3	–0.1	–0.1	–0.2	–0.2	–0.5
Total External Debt								
Emerging Market and Developing Economies	31.0	27.9	29.6	29.7	28.4	27.7	28.9	26.3
Debt Service								
Emerging Market and Developing Economies	9.3	9.9	10.7	9.9	9.4	9.4	9.9	9.0

[1]Data refer to trade in goods and services.
[2]London interbank offered rate on US dollar deposits minus percent change in US GDP deflator.
[3]GDP-weighted average of 10-year (or nearest-maturity) government bond rates for Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

WORLD ECONOMIC OUTLOOK
SELECTED TOPICS

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World Economic Outlook: Spillovers and Cycles in the Global Economy	April 2007
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IMF EXECUTIVE BOARD DISCUSSION OF THE OUTLOOK, APRIL 2018

The following remarks were made by the Chair at the conclusion of the Executive Board's discussion of the Fiscal Monitor, Global Financial Stability Report, *and* World Economic Outlook *on April 2, 2018.*

Executive Directors broadly shared the key messages of the flagship reports and found the analytical chapters topical, relevant, and insightful. They welcomed the broadbased recovery of the global economy, supported by a pickup in investment and trade. Directors observed that global growth is expected to rise further in the near term. Meanwhile, inflation remains muted in many countries. Subdued labor productivity growth and population aging continue to hold back growth in advanced economies. While the recent commodity price increase has supported a recovery in commodity-dependent emerging market and developing economies, the ongoing adjustment processes continue to weigh on growth.

Directors agreed that risks around the short-term outlook are broadly balanced, but beyond the next several quarters, risks are tilted to the downside. On the upside, the cyclical pickup in advanced economy growth may prove stronger than expected as slack in labor markets may be larger than currently assessed. On the downside, a sharp tightening of global financial conditions could have negative repercussions for growth, while financial vulnerabilities accumulated over years of low interest rates could amplify the impact of asset price movements on the financial system, putting growth at risk in the medium term. Most Directors noted that the tax reform in the United States is procyclical and may trigger inflation pressure and a faster-than-anticipated withdrawal of monetary accommodation, as well as widen global imbalances, although the view was also expressed that the reform would boost investment and efficiency, and thus move the US economy to a higher, sustainable growth path. An abrupt tightening of global financial conditions, especially if accompanied by capital flow reversals, could be challenging for several emerging markets and low-income developing countries, notwithstanding improved resilience of their financial systems. Downside risks are particularly evident from escalating trade protectionism and inward-looking policies. Record-high levels of global debt, geopolitical tensions, and climate events also threaten global growth prospects.

Against this backdrop, Directors underscored that the cyclical upswing provides a golden opportunity to advance policies and reforms to strengthen medium-term prospects and reduce vulnerabilities. Priorities are to raise potential output, ensure the gains are widely shared, enhance economic and financial resilience, and safeguard debt sustainability. Directors stressed that a multilateral framework that is open, resilient, and adhered to by all can support growth and benefit the global economy. Enhanced commitment to multilateral cooperation is particularly needed to reduce trade barriers and distortionary trade practices, and to promote a rule-based multilateral trading system that works for all. Directors also called for multilateral cooperation to further reduce incentives for cross-border profit shifting and tax evasion, avoid tax competition, implement the postcrisis financial regulatory reform agenda, and address other shared challenges such as refugees, security threats, cyber risks, and climate change. Reducing excess external imbalances requires policy efforts to lift the contribution of domestic sources of growth above overall GDP growth in surplus countries and to boost potential output and saving in deficit countries.

Directors concurred that monetary accommodation should continue in advanced economies with inflation below target. Where output is close to potential and inflation is rising toward target, a gradual, data-dependent, and well-communicated withdrawal of monetary support is warranted. Directors supported the call for fiscal policy to start rebuilding buffers now, where appropriate, to create room for an eventual downturn and prevent fiscal vulnerabilities from becoming a source of stress. Fiscal adjustment is warranted in most countries, calibrated to avoid procyclicality and anchored on fiscal reforms that increase productivity and promote human and physical capital. In countries that have ample fiscal space and are operating at or close to capacity, fiscal policy should be used to facilitate growth-enhancing structural reforms. Directors also saw a role for fiscal policy in promoting equality, and for labor and immigration policies in boosting labor supply.

Directors agreed that digitalization presents both opportunities and risks. Digitalization can reduce tax compliance costs, improve spending efficiency, and enhance social protection. At the same time, it creates challenges for fiscal policy and the international tax system. Directors noted that mitigating risks from digitalization would require a comprehensive reform agenda, adequate resources, and a coordinated approach toward a long-term vision of the international tax architecture.

Directors welcomed the increased resilience of the banking system and stressed the importance of completing and implementing the postcrisis regulatory reform agenda. They encouraged policymakers to develop and deploy micro and macroprudential tools to address financial vulnerabilities, and to closely monitor risks related to credit allocation and increasingly synchronized house prices across countries. The global implications of Brexit-related challenges also call for close cross-border cooperation. Directors concurred that, while crypto assets do not pose an immediate threat to financial stability, if widely used, they may raise issues about investor and consumer protection, money laundering, and tax evasion.

Directors agreed that enhancing the quality of credit intermediation, avoiding credit booms that lead to excessive risk taking, and, where feasible, permitting exchange rate flexibility can help emerging market and developing economies enhance their resilience to external shocks. Directors welcomed China's progress in reducing financial vulnerabilities and encouraged further efforts to strengthen its regulatory and supervisory frameworks, particularly in the shadow banking sector.

Directors noted that low-income developing countries face multiple challenges in their effort to progress toward the 2030 Sustainable Development Goals. They expressed concern over the broad-based increase in public debt burdens, the increasing number of countries at high risk of debt distress, and data gaps. These underscore the urgent need for fiscal prudence, improved debt management capacity, and greater debt transparency on the part of both debtors and creditors, as well as concerted efforts from the international community. Several countries need to make room in their budgets to accommodate higher spending on social services such as health care and education, and public investment, by mobilizing domestic revenues and improving spending efficiency. Commodity exporters and those vulnerable to climate-related events face additional complex challenges of diversifying their economies. While country circumstances differ, common priorities for promoting economic diversification and employment include increasing access to credit, expanding vocational skills training, and improving the quality of infrastructure.

Directors expressed concern over the stalled progress in the catching-up process of emerging market and developing economies. They noted that, to facilitate income convergence, policies should aim to strengthen governance, improve educational and health outcomes, and lower entry barriers for new firms.