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CENTER FOR CHINESE AGRICULTURAL POLICY

AGRICULTURE, FOOD SECURITY, AND POVERTY IN CHINA

Past Performance, Future Prospects, and Implications for Agricultural R&D Policy

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Nearly three decades of economic reform in China have achieved remarkable economic growth and structural changes. During the 1980s, 1990s, and early 2000s, China has become one of the fastest-growing economies in the world. The nation's gross domestic product (GDP) grew at nearly 10 percent annually over the past 30 years. China's rapid economic growth has been associated with unprecedented progress in poverty alleviation and a rise in the Chinese standard of living. The rural poverty head count fell from 260 million in 1978 to less than 30 million in 2003. The rural poverty rate has fallen equally fast, plunging from 32.9 percent in 1978 to less than 3 percent after 2003.

China's rapid economic growth would not have been possible without successful growth in the agricultural sector. This growth, proceeding at a rate of almost 5 percent per year, has played a key role in the nation's transition from an economy dominated by agriculture to one dominated by the industrial and service sectors. The growth in agricultural productivity enabled China to release its large pool of abundant rural labor, providing cheap labor for industrialization.

Fueled by technological change and market reforms, the growth of agricultural production in China since the 1950s has outpaced the rise in population. Per capita food availability, household food security, and nutrition have improved for a vast majority of the population. In 2000, per capita food availability reached 3,040 kcal per day, a level that is 14 percent higher than the average of developing countries and 8 percent higher than the world average.

According to the baseline projections of almost every major economic modeling team in the world, China's economic growth is projected to continue in the coming decades. Most projections suggest that the economy of China will grow almost 5 times larger, perhaps more, over the next 20 years. If this rate of growth is attained, it will make China the third-largest economy in the world. Such rapid growth is likely to have profound impacts on China's own population and on the rest of the world—even under the most modest scenarios.

Because of the implications for China and the rest of the world, it is important to understand China's likely future growth and the evolution of its agricultural economy. Therefore, this brief aims to explore the alternative futures that agricultural knowledge, science, and technology (AKST) hold for China, as part of a global, developing-country-focused effort to analyze the role and future of agricultural research and development in connection with the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). The brief analyzes what the growth of China's economy might mean for China and the rest of the world, focusing in particular on the role of technology in promoting agricultural productivity growth, food security, and poverty reduction.

ALTERNATIVE INVESTMENTS IN AGRICULTURAL RESEARCH AND DEVELOPMENT (R&D)

In order to have a better understanding of China's agriculture sector in the coming decades, projections of China's agricultural demand, supply, and trade were conducted using China's Agricultural Policy Simulation and Projection Model (CAPSiM), developed by the Center for Chinese Agricultural Policy.

In order to project China's future food economy up to 2050 under alternative investment strategies, three alternative scenarios were formulated: a baseline scenario, a low-agricultural-R&D-investment scenario, and a high-agricultural-R&D-investment scenario. The baseline scenario assumes that the average annual growth of agricultural R&D investment will be 8 percent in 2006–2020, 7 percent in 2020–2030, and 5 percent in 2030–2050. The high-agricultural-R&D-investment scenario assumes that China will, in the coming decades, sustain its recent upturn in investment funding. Compared with the baseline, the high-agricultural-R&D-investment scenario assumes an annual growth rate that is 2 percentage points higher than the baseline in each of the projection periods. The low-agricultural-R&D-investment scenario assumes that China's commitment to agricultural-productivity-enhancing investment has reached its peak in recent years and will start to fall in the coming decades. Under this scenario, the average annual growth rate of agricultural R&D investment will fall from more than 10 percent in recent years to 6 percent in 2006–2020, 5 percent in 2020–2030, and 4 percent in 2030–2050.

RESULTS OF ALTERNATIVE R&D INVESTMENT SCENARIOS

According to baseline projections, a number of factors will drive China's future demand for food. While overall population growth will not have a significant impact on aggregate food demand, continued rapid urbanization will have a large impact on food consumption patterns and the composition of the food economy. Over the next several decades, income growth will lead to increased consumption of nearly all foods except rice, wheat, and some coarse grains. According to the baseline projections, China will be able to provide most of its food grains (rice and wheat). Indeed, China will continue to export moderate amounts of rice under the baseline. Wheat imports will be needed to provide for only 1 percent of consumption. Imports of feed grains and oilseeds (especially maize and soybeans), on the other hand, will

need to increase greatly. In fact, under the baseline scenario, China would need to import 5–10 percent of its maize.

The results of alternative scenarios of investment in agricultural R&D show that China can best protect its future agricultural and food security by investing heavily in agricultural technology. Under the high-R&D-investment scenario, China is projected to achieve grain self-sufficiency in the future, one of the major targets of its agriculture policy. In addition, the results show that China could produce a surplus of rice and wheat for export, given more investment in agricultural R&D. The high-investment scenario also projects increased maize productivity, making China nearly self sufficient in animal feed between 2020 and 2050. This near reversal in maize imports—from a large importer to being nearly in balance—is one of the major impacts of greatly increasing agricultural R&D investment.

High levels of R&D investment will also significantly increase the exports of China's labor-intensive products while reducing its imports of land-intensive products. Compared with the baseline projections, the high-R&D-investment scenario projects greater exports (or self-sufficiency rates) of horticultural products, pork, poultry, and fish and lower imports of wheat, maize, soybean, other edible oils, and some livestock products.

On the other hand, if China lowers its R&D investments, the nation is projected to require imports of nearly all agricultural commodities in the coming decades. For example, under the low-R&D-investment scenario, self-sufficiency rates (measured as production divided by consumption) of all agricultural commodities will fall by about 2–6 percent. The level of grain self-sufficiency under the low-agricultural-R&D-investment scenario would fall below the national target of 95 percent after 2020 and drop by nearly 10 percent by 2050. Low investment in agricultural R&D would also turn China from a major rice exporter into a major rice importer by 2050. Annual maize imports would reach nearly 30 million metric tons in the coming decades.

In addition to having an impact on food security, high agricultural R&D investment would also improve income distribution and help reduce poverty. In 2001, about 12 percent of China's rural population was living on less than US$1/day. Under the high-R&D-investment scenario, with rising income from both agricultural and non-agricultural sectors, poverty in rural areas would be completely eliminated by 2020. Poverty elimination is achieved much earlier under the high-R&D-investment scenario than under both the baseline (after 2030) and the low-agricultural-R&D-investment (by 2040) scenarios.

THE ROLE OF RESEARCH AND DEVELOPMENT FOR THE FUTURE OF AGRICULTURE IN CHINA

While progress in agriculture has been significant, there are also great challenges ahead. With the transition from a planned to a market-oriented economy mostly complete, China's main challenge has shifted to broader development issues.

China's rapid economic growth and the rise in the nation's overall wealth have been accompanied by widening income inequality both among and within regions. In addition, while successful technology innovation will help China continue to increase its agricultural productivity, China faces the great challenge of water scarcity. Water shortages, particularly in northern China, and increasing competition from industry and domestic use, do not provide much hope for large gains in irrigation expansion or in areas already under irrigation.

In addition to water scarcity, trends suggest that there may be considerable stress being put on the agricultural land base. While judicious use of modern technologies is essential to achieve efficient food production, inappropriate uses, such as the excessive application of fertilizers and pesticides, could result in serious environmental problems and food safety concerns. The decline in cultivated land and rising water scarcity are thus among the greatest concerns regarding national food (grain) security. While China is currently a net food exporter, there is also growing concern that rising incomes in China, and the resulting increase in demand for food, will put pressure on food prices and global food and agricultural trade in the coming decades.

While there are a number of challenges facing China's agricultural sector, there are reasons to be optimistic about China's food economy. The high level of China's grain security under the baseline scenario (97–98 percent) suggests that China will not have to rely on large grain imports if the recent trend of investment in agricultural R&D is retained in the future. The projection results of the high-R&D-investment scenario suggest that China would be able to meet nearly all of its grain and food needs over the next 50 years. To meet this target, according to our results, China would have to further raise its investment in agricultural R&D. In contrast, China's food imports would rise significantly if investments in agricultural R&D were to fall below current levels.

The results from this study also have implications for the rest of world. China's agricultural development and investment in new technology would contribute to global food security by both increasing food supply and stabilizing, or even lowering, world food prices. For those countries with agricultural economic structures that are complementary to China's, there would be emerging opportunities offered by China's increasing imports of certain agricultural products. However, countries that have similar agricultural export structures would compete for the same export markets.

China's experience demonstrates the importance of technological development and public investment in improving agricultural productivity, farmer income, and food security in a nation with limited supplies of land and other natural resources. Technology has been the engine of China's agricultural productivity growth in the past and will continue to play a major role in boosting China's agricultural development and improving the nation's food security in the 21st century.

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