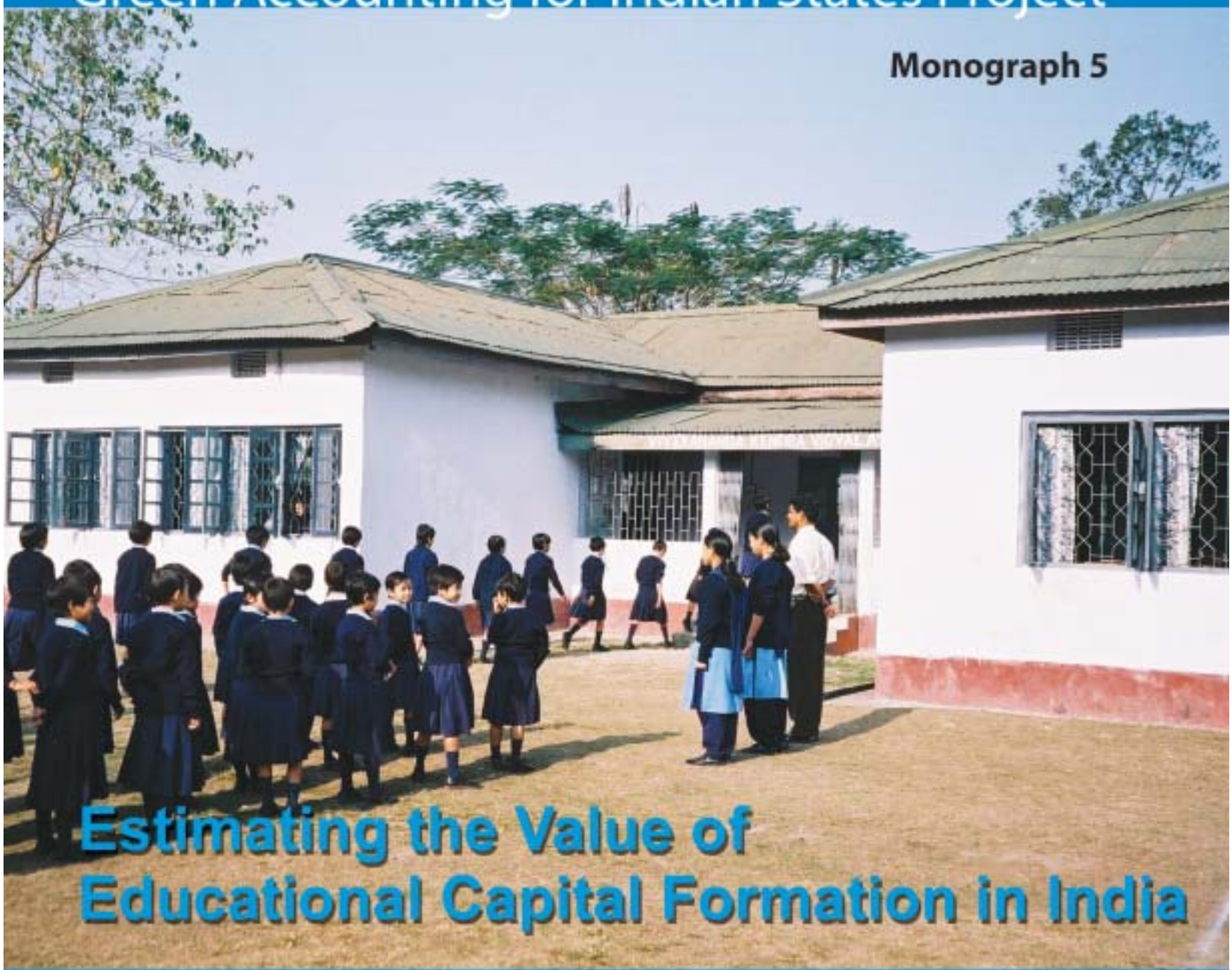
Green Accounting for Indian States Project

Monograph 5



Estimating the Value of Educational Capital Formation in India

Haripriya Gundimeda
Sanjeev Sanyal
Rajiv Sinha
Pavan Sukhdev

GIST
Green Indian States Trust

March 2007

Estimating the value of educational capital formation in India

Monograph 5

GAISP (Green Accounting for Indian States Project)

Haripriya Gundimeda <gharipriya@gmail.com>
Associate Professor, Madras School of Economics

Sanjeev Sanyal <sanjeev.sanyal@db.com>
Director, GAISP

Rajiv Sinha <rajiv.sinha@asu.edu>
Professor, Arizona State University, USA, and Director, GAISP

Pavan Sukhdev <pavan.sukhdev@db.com>
Director, GAISP

Project Sponsors

GIST
Green Indian States Trust

Green Indian States Trust

Published by
TERI Press
The Energy and Resources Institute
Darbari Seth Block
IHC Complex
Lodhi Road
New Delhi – 110 003
India

Tel. 2468 2100 or 2468 2111
Fax 2468 2144 or 2468 2145
India +91 • Delhi (0) 11
E-mail teripress@teri.res.in
Web www.teriin.org

for
Green Indian States Trust
4 B, Cross Street
Srinagar Colony
Chennai – 600 015, India

For further details, log on to

www.gistindia.org

Acknowledgements
The directors of GAISP wish to thank the Green Indian States Trust for their principal sponsorship of this Monograph. We would also like to thank Mr. P Yesuthasen (Trustee, GIST), Mr S. Kishore Kumar (Research Associate, GAISP), TERI Press and Dr. Giles Atkinson (London School of Economics) for his review of this monograph.

Printed in India by Rajkamal Electric Press, Delhi

Contents

List of acronyms ..... ***v***

Background ..... ***vii***

Introduction **1**

Measurement of human capital **2**

Framework for accounting for human capital formation in India ... **5**

Data description **10**

Value of human capital formation **14**

Value of human capital **15**

Results **21**

Conclusions **35**

Appendix I **36**

Appendix II **37**

References **38**

Bibliography **39**

List of acronyms

AEC	Adult Education Centre
GAISP	Green Accounting for Indian States and Union Territories Project
GDP	gross national product
GSDP	gross state domestic product
HSDP	human state domestic capital
MNC	multinational company
MPCE	monthly per capita expenditure
NFEC	non-formal education course
NSS	National Sample Survey
NSSO	National Sample Survey Organization
OECD	Organization for Economic Cooperation and Development
OLC	ordinary least squares
SNA	system of national accounts
TLC	total literacy campaign

Estimating the value of educational capital formation in India

Background

In common with most developing countries, India faces many trade-offs in its attempt to reduce poverty and improve the living standards of its people. There is a need for an empirical basis on which to base policy decisions on trade-offs between the many competing priorities of a developing country, including inter-generational claims. Available measures of development, including the current SNA (system of national accounts), with its primary focus on GDP (gross domestic product) growth rates, do not capture many vital aspects of national wealth such as changes in the quality of health, changes in the extent of education, and changes in the quality and extent of India's environmental resources. GDP accounts and their state-level equivalents GSDP (gross state domestic product) accounts are, therefore, inadequate for properly evaluating the trade-offs encountered by India's policy-makers.

In recognition of the fact that GDP growth is too narrow a measure of economic growth and does not serve as an adequate measure of national wealth, we propose to build a 'Green Accounting' framework for India and its states. This monograph is an outcome of GAISP (Green Accounting for Indian States and Union Territories Project)[1] that aims to develop top-down economic models for annual estimates of adjusted GSDP for India's states and union territories, thus capturing true 'value addition' at not just the national level but the state level too.

India has a federal political structure, and the state legislature and state administration have considerable impact on local environmental policies and standards. Although the states are governed by the same national laws on environment, pollution, forests, and wildlife, their environmental attitudes, policies, and the range and effectiveness of their environmental and forest management programmes differ significantly. This feature has not been captured systematically as there are no metrics to distinguish between the sound and unsound environmental performance by the state governments; sustainable development remains unmeasurable, and therefore unmanageable, at the state level.

GAISP aims to construct a standardized set of metrics at the state level, comprising stock and flow accounts that capture hitherto unaccounted 'externalities', and hence, provide the means to adjust the GDP and GSDP accounts. These so-called 'Green Accounts' for India and its states will provide a much better measure of development than the GDP and GSDP growth measures, and will encourage the emergence of sustainable development as a focus of economic policy at the operative state level. With the help of these 'Green Accounts', it would be possible to

[1] Information about GAISP and copies of its reports can be obtained from www.gistindia.org

conduct trade-offs in policy choices being made today (with no yardsticks and low transparency) in a manner that would provide for economic evaluation, unbiased countrywide benchmarking, and eventually a high degree of transparency and public accountability.

The first phase of GAISP consists of eight monographs, each of which will evaluate a particular area or related set of areas of adjustments to GSDP accounts.

These eight monographs are as follows.

1 The value of timber, carbon, fuelwood, and non-timber forest produce in India's forests

2 Estimating the value of agricultural cropland and pastureland in India

3 The value of India's sub-soil assets

4 The value of biodiversity in India's forests

5 Estimating the value of educational capital formation in India

6 Investments in health and pollution control, and their value to India

7 Accounting of the ecological services of Indian forests: soil conservation, water augmentation, and flood prevention

8 Estimating the value of freshwater resources in India

All adjustments calculated in the above eight GAISP monographs apply to the same set of GSDP accounts (for instance, for year ended March 2003) and they are all additive. The website of GAISP (http\\: www.gistindia.org) will carry a running record of cumulative adjustments to these GSDP accounts by states. To a first-order approximation, these adjustments may be added/subtracted, as indicated, to GSDP growth percentages for 2002/03.

The final report of GAISP will summarize and consolidate the work done on these eight monographs and will include 'adjusted GSDP' measures for the states and significant union territories in India, along with a commentary on the policy implications of our results.

Estimating the value of educational capital formation in India

Introduction

Human capital is one of the most important assets of a country and a key determinant of a country's economic performance. However, since national accounts are confined to physical capital, they generally fail to reflect the impact of human capital. Moreover, the treatment of human capital in national accounts is considered quite controversial as elements of investment are often treated as consumption. For example, expenditure on primary education generates streams of future income, but this expense is regarded as consumption rather than investment. Direct expenditures on health, internal migration to access better job opportunities, earnings forgone by potential labour force (students above 18 years of age still attending school), workers acquiring on-the-job training, and the use of leisure time to improve skills and knowledge are further examples. Yet, nowhere do these expenditures enter into the national accounts. In addition, there is a distortion in the estimates of factor input (land and labour costs) for the production of goods and services that draw from both market and non-market sources. For example, the cost of students' time is not included in the education sector, and neither is the time and effort put by parents into their children's development. Similarly, post-school investments by individuals in the formation of human capital are also not included. In the recent past, national accounts have been used to analyse resource allocation, productivity, growth, and income distribution. Therefore, it is necessary to make appropriate adjustments in the framework and the underlying concepts of national accounting.

Human capital, though frequently discussed, is difficult to measure. This study aims to review major issues in the measurement of human capital and present some empirical measures of human capital for India. Human capital can be defined in many ways, but in this paper, we have used the following definition adopted by OECD (Organization for Economic Cooperation and Development) (1998): 'the knowledge, skills, competences, and other attributes embodied in individuals that are relevant to economic activity'. Beginning with the seminal contributions of Becker (1966), Mincer (1974), and Schultz (1961), most of the work on human capital has centered on estimating returns to education. Education is an important component of economic activity, although investment in education is only one of the many forms of investment in human capital. The idea behind this is that investment in human beings, like investment in tangible forms of capital such as buildings and industrial equipment, generates a stream of future benefits. Education is regarded as an investment in human capital because benefits accrue to an educated individual over a lifetime of activities. Educational expenditure in India averages about 4.2% of the

GDP; so estimating the returns to investment in education is useful for making comparisons with other forms of investment.

The main objective of this monograph is to provide empirical estimates of the educational capital formation in different Indian states. Our results are particularly interesting because they capture the value being generated through an expansion in education (especially at the primary level). On a per capita basis, the value of human capital in India nearly doubled between 1993 and 2001, and the value of human capital formation was more than five times the gross fixed capital formation. The highest values for human capital formation in 2001 were for Uttar Pradesh, Maharashtra, Andhra Pradesh, West Bengal, and Bihar. However, on a per capita basis, the smaller states and union territories – Delhi, Chandigarh, Himachal Pradesh, Goa, and Kerala – topped the list. In gross terms, the largest beneficiaries of these human capital adjustments were Bihar, Jammu and Kashmir, Nagaland, Uttar Pradesh, Mizoram, and Manipur. In these states, the ratio of the adjusted GSDP to GSDP varied between 2.05 and 3.1. Thus, in these states, investment in education had the greatest impact. It is seen that the biggest gains have accrued to states that are considered the least developed—north-eastern states like Nagaland, Mizoram, and Manipur, and populous ones like Bihar and Uttar Pradesh. In contrast, the relatively educated states of Kerala and Goa have received the least benefits (note, however, that city-states like Delhi and Chandigarh have done somewhat better, presumably because they are able to generate increasing returns to human capital clustering). This is to be expected since the returns to spreading basic education should be higher in those areas where education is a scarce resource.

Measurement of human capital

The concept of human capital has gained prominence in economics over the past 30 years (Becker 1966; Schultz 1961). In general, three methods have been used to estimate the value of human beings: the 'cost-based approach' (cost-of-production approach), the 'income-based approach' (capitalized earnings procedure), and the 'educational stock-based approach' (see Le, Gibson, and Oxley 2006 for detailed review on cost- and income-based methods, and Wößmann 2003 for educational stock-based approaches). The cost-based approach to human capital measurement has its origins in the cost-of-production method of Engel (1883). This approach involves estimating the total cost of producing a human being. The cost-based approach is retrospective, focusing mainly on the historical costs of production. In this method, human capital is estimated using the depreciated value of the dollar amount spent on an individual. The main disadvantages of the cost-based approaches according to Le, Gibson, and Oxley (2006) are: (1) when evaluating physical capital by costs, there is not necessarily a relationship between investment and the quality of output; (2) the components entering into the production of human capital and their prices are not well-defined; and (3) the depreciation rate matters a great deal. Jorgenson and

Fraumeni (1989) stressed that the cost-based estimates of investment in education fail to account for the time invested in education, and further, this approach disregards the value of non-market activities by considering only the costs of education and rearing rather than considering lifetime labour income.

The income-based approach measures the total human capital embodied in an individual who has completed his schooling by the total discounted values of expected future stream of lifetime earnings. This method is said to be forward-looking (prospective) because it focuses on expected returns to investment. Jorgenson and Fraumeni (1989, 1992) present the most comprehensive study to date using the income-based approach to measure human capital. An important contribution of their approach is that the procedure for discounting future income streams to the present value has been simplified. They define 'investment in human capital in any year as the sum of lifetime incomes for all individuals born in that year and all immigrants plus the imputed labour compensation for formal schooling for all individuals enrolled in the school'. According to them, even newborn babies have a positive value. This value is added to GDP along with the rest of the investment in human capital. The value of the human capital embodied in the child increases when the child becomes a year older, implying that the stock of each intermediate phase needed for the subsequent phase of unqualified human capital is taken into account (Aulin-Ahmavaraa 2004). Jorgenson and Fraumeni (1989, 1992) argue that human capital is not restricted to market activities alone, and hence, impute the value of labour compensation for non-market activities too. This is done on the basis of hourly compensation of the respective services in market production. For computing the value of qualified human capital, the only input considered is 10 hours per day to satisfy physiological needs such as sleeping and eating. They also consider the time spent in formal schooling as one of the inputs in the production of unqualified human capital. Its value is equal to its impact on the full lifetime income (which also includes the value of the time spent in household work and leisure, and in formal schooling) less tuition and fees.

While the methodology underlying it is prospective in nature, the income-based method is not without its limitations. For example, while the model assumes that the differences in wages truly reflect differences in productivity, wages often vary for reasons unrelated to productivity. In addition, data on earnings is not as widely available as data on investments, especially in the case of developing countries where the wage rate is often not observable. Finally, these estimates of human capital are quite sensitive to the choice of the discount rate and the age of retirement.

The 'educational stock-based approach' follows from the insights of Smith (1937) that the creation of specialized labour requires the use of scarce inputs, typically education/learning. Due to this emphasis on

'education', the most commonly used measures of the stock of human capital include education-augmented labour input, adult literacy rates, school enrollment ratios, and the average years of schooling of the working-age population. Barro and Lee (1993, 1996, 2001) and Lee and Barro (2001) popularized this approach that, in its simplest form, is measured by the years of schooling. The idea behind this approach is that the activities like formal education, on-the-job training, specific training, and other recognized investments in human capital have an influence on earnings. Thus, the total amount invested in human capital and the rate of return on this investment can be estimated from using the information on observed earnings. Based on the assumptions that only the costs of schooling are the forgone earnings and that each individual starts working after completion of school, the pioneering work of Mincer (1958, 1974) demonstrated that the natural logarithm of wage could be expressed as a function of the years of schooling, the post-schooling experience, and its quadratic term. Thus, the estimated coefficients of the years of schooling in the wage regression provide a direct measure for returns to schooling.

In the Indian context, Hamilton and Clemens (1999) and Kunte, Hamilton, Dixon, *et al*. (1998) provided estimates of human capital based on their concept of the 'genuine savings rate'. Other than these, the only other estimates are those of Sharma and Ram (1974) and Duraisamy (2000). Sharma and Ram (1974) attempted to revise the national accounts of India for 1960/61 through 1965/66. They argued that the outlay in the education sector in India does not include the value of student's time; actual or imputed rental of school buildings and structures; cost of school supervision and administration; other general costs (such as equipment, library costs, contingencies); and the value of books and stationary used by students. They revised the estimates of (1) educational outlay (or the activities in the education sector), (2) gross capital formation, and (3) gross national product. The modified estimates, though first approximations, which cover only a part of the human capital formation, nevertheless indicate an upward revision of the estimate of activity in the education sector by about 200%–300%, of gross capital formation by about 50%, and gross national product by 4%–7%. These values show the magnitude of distortions involved in conventional procedures. Sharma and Ram (1974) produced work at an all-India level with the objective of reorienting the national accounts so that the expenditure on education was appropriately treated as investment.

Duraisamy (2000) augmented the Mincerian earnings function and estimated the returns to education in India by gender, age cohort, and location (by rural–urban) for the period 1993/94, and changes in returns over the period 1983–94. He used the 'employment and unemployment survey' data from two rounds of NSS (National Sample Surveys) for 1983 and 1993/94, which provide information on the activity status, wages/salary, and days worked, besides individual characteristics such as

age, educational level, and region of residence. Duraisamy allowed for educational level dummies instead of years of schooling for the schooling variable. His results show that there is evidence of considerable change in the reward for education, especially for women, between 1983 and 1993/94. The younger age cohorts (15–29 and 30–44) receive higher returns to the additional year of education at the primary, middle, and secondary levels, while those in the 45–65 age cohort receive higher returns to college education than the younger age groups. The returns to primary education are rather low, while in general, returns per year at the secondary level are the highest.

Framework for accounting for human capital formation in India

Human capital can be treated in a manner analogous to physical capital and can be measured both in physical and monetary terms. While measuring the physical capital, the stocks of productive capital like buildings, machinery, and quantity of land play an important role. By comparing the stock of physical capital at the beginning and by extrapolating the estimates of capital stocks on the basis of certain assumptions about the efficiency life of the asset and the depreciation pattern, one can estimate the accumulation of physical capital in physical terms. In a similar way, while measuring human capital, the level of skills, knowledge, and experience can play an important role. By accounting for the stock of human capital at the beginning and the end of the accounting period, the accumulation of human capital can be estimated. Hence, the first step in the accounting framework involves developing physical accounts for identified human capital. However, the expression of human capital in physical terms has its limitations. For example, in this form, human capital cannot be compared with other market activities. Hence, it is important to place a value on human capital so as to convert it into monetary terms. This is difficult but can be done using economic theory. The second step, therefore, involves placing a value on human capital stock.

The value of an asset in economic theory is equal to the present value of future earnings. As the asset ages, the net present value of its remaining earning declines. If all else remains equal, this is termed 'economic depreciation'. For example, in the official system of National Accounts, depreciation of capital goods (or consumption of fixed capital) is measured as the difference in the economic value of the asset (in real terms) at the beginning and the end of the accounting period. Applying the same logic to human capital, we can argue that the value of human capital is equal to the present value of its future earnings. However, the principal difference between physical and human capital is that physical capital cannot appreciate because of its use and experience. However, the stock of human capital can vary for a variety of reasons. The value of human stock changes due to birth, death, on-the-job training, migration, depreciation, and new investments in education. The value of human capital can increase because of one additional year of working experience due to skills acquired from on-the-job training. Decreases can occur as a result

of fewer available years because of ageing (depreciation), a consequence of the finite working life of an individual. The impact of on-the-job training and depreciation can be assessed by measuring the differences in earning among alternative age groups with the same education cohort. The net effect of on-the-job training and depreciation depends on age and educational characteristics. The net effect is positive for higher education levels in the early stages of life but becomes negative once an individual becomes old enough. Investment in education is measured by the increments in lifetime labour income, arising from additional schooling of the person from the same age cohort.

In this monograph, we use a combination of the education stock-based approach, and the income-based and cost-based approaches to place a value on the stock of human capital for different Indian states. Our focus is restricted to market income so the value of human capital stocks used in non-market production is not included. Further, we focus only on the individuals in employment, since these people are directly participating in economic production, and so their human capital is arguably a better measure of the country's productive capacity.

The framework chosen should address the following issues.

- Human capital comprises innate abilities that differ greatly among individuals due to hereditary factors, knowledge, and skills acquired through education, intergenerational transfers, work experience, and socialization.
- The acquisition of human capital is not always determined by individuals. Often, the decision to impart education is made by their parents and is dependent upon social status.
- Due to the differences in the quality of primary and secondary educational institutions, two individuals with the same educational qualifications but from different institutions will not necessarily contribute equally to human capital investment.
- Human capital formation is also affected by the quality of the work environment. For example, individuals tend to be more productive if the infrastructure is good or possesses advanced scientific equipment.

Hence, whatever be the method we use, it is critical to control these factors during the measurement of human capital. We used the following framework to estimate the value of human capital formation in India

Step 1 In Step 1, we used the Mincerian earning function approach. Under the earning function framework, the wage of an individual is assumed to depend on the level of schooling, skills possessed, technical qualifications, on-the-job training (job experience is used as a proxy), and other socio-economic characteristics that represent the innate abilities of the individual (see Table 1 for description of variables used in the Mincerian specification and Table 2 for the descriptive statistics).

Table 1

Description of variables used in Mincerian specification

Variable	*Description*
Ln (daily wages in Rs)	Log of daily wages obtained by dividing the total wages and salaries (in cash and in kind) receivable for the work done in the reference week by the total number of days reported working in that week.
Sex	Dummy for sex. If the person is male, sex takes the value of 1, otherwise takes the value of 0. The variable is introduced to capture the differences in wages because of the gender difference.
Sector	Dummy for sector. It takes the value of 1 if rural, otherwise 0. This variable is introduced to capture the differences in wages between rural and urban areas.
Social group	Dummy for social group. A person belonging to SC/ST takes the value of 1, otherwise 0. This dummy tries to capture the differences in wages between reserved and unreserved communities.
Hhpro1	Dummy for household's main profession. This dummy takes the value of 1 if the person is self-employed, otherwise it takes the value of 0.
Hhpro2	Dummy for household's main profession. The dummy takes the value of 1 if the person is an agricultural labourer, otherwise it takes the value of 0 (agricultural labourers are paid manual labour [any job performed on a farm incidental with farm operation and paid wholly in cash or kind]).
Hhpro3	Dummy for household's main profession. The dummy takes the value of 1 if the person is a casual labourer, otherwise it takes the value of 0 (a person doing the work on a hourly, daily, or weekly basis is termed as casual labourer).
Hhpro4	Dummy for household's main profession. The dummy takes the value of 1 if the person is a salaried employee (regular working class) otherwise it takes the value of 0.
edu1	Dummy for illiterate. Takes value of 1 if illiterate, otherwise it takes the value of 0.
edu2	Dummy for non-formal education. Takes the value of 1 if the person has obtained non-formal education (adult literacy programmes), otherwise takes the value of 0.
edu3	Dummy for below primary educational level. Takes the value of 1 if the person could not finish primary education, otherwise takes the value of 0.
edu4	Dummy for primary education. Takes the value of 1 if the highest educational attainment of the person at the time of carrying out the survey is primary education, otherwise it takes the value 0.
edu5	Dummy for middle school. Takes the value of 1 if the person has completed middle school, otherwise it takes the value 0.
edu6	Dummy for secondary school. Takes the value of 1 if the person has completed secondary school, otherwise it takes the value 0.
edu7	Dummy for higher secondary educational level. Takes the value of 1 if the person has completed higher secondary level, otherwise it takes the value of 0.
edu8	Dummy for graduate. Takes the value of 1 if the person has completed his/her graduation, otherwise it takes the value of 0.
Skill	Skill captured by technical education. Takes the value of 1 if the person has diploma or technical certificate (one- or two-year training courses where specific skills are enhanced), otherwise it takes the value of 0.
Experience (in years)	The variable is defined as potential experience equal to age less years of schooling less 5.
$(\text{Experience})^2$	This variable has been included to take care of diminishing returns. Experience matters only to a certain extent, beyond which the utility may not be much.
MPCE (in Rs)	Monthly per capita expenditure is used as proxy for income, as income data is not available and expenditure is the next best easily available measure.

$$\text{Ln(wage)} = + \beta_1(\text{Sex}) + \beta_2(\text{Sector}) + \beta_3(\text{Social group}) + \sum_{i=1}^{8}\beta_{4i}\text{edu(i)} +$$

$$\sum_{i=1}^{4}\beta_{5i}\text{hhpro(i)} + \beta_6(\text{Skill}) + \beta_7(\text{Experience}) + \beta_8(\text{Experience})^2 +$$

$$\beta_9(\text{MPCE}) + \varepsilon \qquad (1)$$

Step 2 From this earning function, we estimated the marginal rate of return for different levels of schooling and obtained the predicted wages for different age cohorts by the educational levels.

Step 3 Using the predicted wage for different age cohorts and different educational levels, we estimated the present value of lifetime labour income for different educational levels using a modified formula outlined by Jorgenson and Fraumeni (1989, 1992) and Wei (2001). According to these approaches, the total human capital embodied in an individual is the discounted stream of future returns that will accrue to the individual. The present value of the lifetime labour income of an individual is the discounted value of future income weighted by the probability of survival and the discount rate. For this, we considered two stages: (1) work and study stage (age group 15–25), and (2) work-only stage (age group 26–60).

Using the predicted wages obtained in Step 2, we estimated the present value of lifetime labour income for different educational levels. The formula for calculating the lifetime labour income differs depending upon which of the two stages the person is in. The following formula was used to estimate the annual lifetime income:

Work-only stage

$$HK^{e_i}_a(x) = W^{e_i}_a Y^{e_i}_a + HK^{e_i}_{a+1}(x)S_{a,a+1}(1 + g)/(1 + i)$$

where

$HK^{e_i}_a$ is the human capital of person of age a and educational qualification e_i

$W^{e_i}_a$ is the employment rate of person of age a and educational qualification e_i

$Y^{e_i}_a$ is the annual labour income of person of age a and educational qualification e_i

$HK^{e_i}_{a+1}$ is the human capital of person of age (a + 1) and educational qualification e_i

$S_{a,a+1}$ is the probability that a person of age a will survive till age a+1

g is the growth rate of wages

i is the discount rate (4%)

The lifetime labour income of a person aged 60 is considered to be 0. The lifetime labour income of a person aged 59 is just his annual current labour income while the lifetime labour income of a person at age 58 is the sum of his annual current labour income and the present value of lifetime labour income of a person an year older having the same educational level multiplied by the survival probability of a person who is an year older and income growth rate and divided by the discount rate.

Work and study stage

$$HK^{e_i}_{a}(x) = W^{e_i}_{a} Y^{e_i}_{a} + Enrol^{e_i+1}_{a} * S_{a,a+1} * HK^{e_i+1}_{a+1}(x) + (1 - Enrol^{e_i+1}_{a}) * S_{a,a+1} * HK^{e_i}_{a+1}(x) * (1 + g) / (1 + i)$$

where

$HK^{e_i}_{a}$ is the human capital of person of age a and educational qualification e_i

$W^{e_i}_{a}$ is the employment rate of person of age a and educational qualification e_i

$Y^{e_i}_{a}$ is the annual labour income of person of age a and educational qualification e_i

$HK^{e_i}_{a+1}$ is the human capital of person of age (a+1) and educational qualification e_i

$HK^{e_i+1}_{a+1}$ is the human capital of person of age (a+1) and educational qualification e_{i+1}

$S_{a,a+1}$ is the probability that a person of age a will survive till age a+1

$Enrol^{e_i+1}_{a}$ the enrollment rate that a person of age a will enroll to a higher educational level e_{i+1}

g is the growth rate of wages

i is the discount rate (4%)

The average real income growth rate per year was taken as 6% and a discount rate of 4% was used. From the gross income, we deducted the present value of expenditures incurred by an individual in education for each educational level (taken from the Institute of Applied Manpower Research 2002). This gave the net lifetime labour income for different age cohorts and educational levels.

Step 4 We multiplied the present value of annualized life income for different educational qualifications for different age cohorts with the population in each educational group in different age cohorts from the census data. The values were estimated for different Indian states. This gave the total value of the human capital in different Indian states.

Step 5 The difference in the value of human capital stock between the years gave the value of human capital formation. This can be compared with other national accounting indicators.

Data description

For the empirical estimation in Steps 1, 2, and 3, we worked mainly with surveys of employment and unemployment conducted for 1993 and 1998 by NSSO (National Sample Survey Organization). The NSSO data is a cross-sectional survey covering almost 120 000 households and nearly 600 000 individuals, including all the states and union territories of India. The data set contains detailed information about the daily activity status, wages/salaries, and socio-economic characteristics like age, sex, region, educational level, martial status, and so on. A description of the sampling techniques used by NSSO is given in Appendix 1. The expected income, which depends on the cross-sectional age–income profiles, is combined with the probability of enrollment in further education, the probability of working, and the age-specific survival rates, which are taken from different sources.

From this, the present value of lifetime income for a person of a given gender and education level is computed using the Census of Population data from 1991 and 2001. However, as the information published by NSSO is for 1993, we projected the population of 1991 to 1993 levels using annualized growth rates by states. The detailed construction of variables and their source of data are explained in the following sections.

Educational attainment

We measured educational attainment using the highest qualifications obtained instead of the calendar years of schooling. We took the following nine categories of educational attainment as used in the census: (1) illiterate, (2) non-formal education, (3) below primary, (4) primary, (5) middle, (6) secondary, (7) higher secondary, (8) technical/diploma, and (9) graduate and above (in agriculture, engineering, medicine, and other subjects). The persons who obtained education through AEC (adult education centre), NFEC (non-formal education course) or TLC (total literacy campaign) were considered under non-formal education. If a person had graduated in more than one discipline then the degree last obtained was considered. We took the data for the whole population from the Census of India 1991 and 2001.

Employment rates

Employment rate is defined as the proportion of those in the labour force who are working for pay, either part-time or full-time. The employment rate data for marginal workers (persons who did not work for the major part of the reference period) and main workers (persons who worked for the major part of the reference period, that is six months) is obtained for 1991 and 2001 from the census data. However, the data by age cohort and educational levels for all the states are available only for the main workers. As the focus of this monograph is on market activities, we included neither the value of home services nor those people whose employment status was not specified.

Annual income

The wages and salary income received are taken from the NSSO 1993 and 1998 data. NSSO gives information on the weekly wages received by an individual and the total number of days spent in different principal usual activities (the work in which a person spent a relatively longer time during the 365 days is considered the principal usual activity status of the person). Persons working for more than four hours a day are treated as full-time workers, whereas if they work for more than one hour but less than four hours are considered part-time workers. The total wages received are computed by dividing the total wages or earnings received in cash and kind by the total number of days in each activity. Table 3 gives the mean annual wage rate classified by different

Table 2

Descriptive statistics of the variables used in the Mincerian estimation model for 1993 and 1998

	Wages	*Male*	*Urban*	*SC/ST*	*Self-employed*	*Agricultural labour*	*Casual labour*	*Salaried employee*	*Experience*	*MPCE*
1993										
Illiterate	2.92	0.60	0.77	0.47	0.52	0.22	0.08	0.04	29.90	257.36
	(0.94)	(0.49)	(0.42)	(0.50)	(0.50)	(0.41)	(0.28)	(0.20)	(11.95)	(225.63)
Non-formal education	3.29	0.81	0.62	0.33	0.34	0.22	0.23	0.07	27.45	322.42
	(1.01)	(0.39)	(0.49)	(0.47)	(0.47)	(0.41)	(0.42)	(0.26)	(11.58)	(247.75)
Below primary	3.28	0.85	0.61	0.33	0.33	0.25	0.20	0.06	25.41	317.77
	(0.96)	(0.36)	(0.49)	(0.47)	(0.47)	(0.43)	(0.40)	(0.24)	(11.65)	(246.55)
Primary	3.41	0.86	0.53	0.32	0.25	0.26	0.27	0.07	22.07	347.76
	(1.00)	(0.34)	(0.50)	(0.47)	(0.43)	(0.44)	(0.44)	(0.25)	(11.22)	(322.26)
Middle	3.61	0.92	0.43	0.27	0.15	0.19	0.38	0.11	19.04	399.04
	(1.05)	(0.31)	(0.50)	(0.44)	(0.36)	(0.39)	(0.49)	(0.32)	(10.75)	(309.64)
Matric	4.02	0.87	0.37	0.19	0.06	0.08	0.51	0.20	20.41	513.45
	(1.04)	(0.34)	(0.48)	(0.39)	(0.24)	(0.27)	(0.50)	(0.40)	(10.93)	(388.13)
Higher secondary	4.20	0.85	0.33	0.20	0.03	0.03	0.58	0.21	18.38	565.16
	(1.02)	(0.36)	(0.47)	(0.40)	(0.18)	(0.17)	(0.49)	(0.41)	(9.82)	(454.63)
Technical degree and diploma	4.49	0.81	0.30	0.13	0.01	0.03	0.64	0.24	17.92	777.23
	(0.95)	(0.39)	(0.46)	(0.33)	(0.10)	(0.16)	(0.48)	(0.43)	(10.18)	(664.15)
Graduate	4.63	0.81	0.21	0.09	0.01	0.01	0.72	0.17	16.54	898.64
	(1.08)	(0.39)	(0.41)	(0.29)	(0.09)	(0.09)	(0.45)	(0.37)	(9.25)	(983.41)
1998										
Illiterate	3.33	0.59	0.78	0.82	0.56	0.22	0.07	0.03	30.57	410.26
	(0.71)	(0.49)	(0.41)	(0.38)	(0.50)	(0.41)	(0.26)	(0.18)	(11.56)	(222.34)
Non-formal education	3.71	0.81	0.65	0.70	0.40	0.22	0.19	0.06	29.08	510.53
	(0.84)	(0.39)	(0.48)	(0.46)	(0.49)	(0.42)	(0.39)	(0.24)	(11.12)	(366.41)
Below primary	3.68	0.83	0.64	0.73	0.37	0.26	0.17	0.05	25.67	495.22
	(0.76)	(0.38)	(0.48)	(0.44)	(0.48)	(0.44)	(0.38)	(0.22)	(11.57)	(314.55)
Primary	3.82	0.86	0.56	0.70	0.28	0.26	0.24	0.07	21.82	535.31
	(0.78)	(0.35)	(0.50)	(0.46)	(0.45)	(0.44)	(0.43)	(0.25)	(11.39)	(306.62)
Middle	4.02	0.90	0.48	0.64	0.20	0.20	0.33	0.10	18.41	617.68
	(0.83)	(0.30)	(0.50)	(0.48)	(0.40)	(0.40)	(0.47)	(0.30)	(10.87)	(377.94)
Matric	4.51	0.88	0.39	0.53	0.09	0.11	0.49	0.18	20.01	796.78
	(0.87)	(0.33)	(0.49)	(0.50)	(0.29)	(0.31)	(0.50)	(0.38)	(11.04)	(650.75)
Higher secondary	4.76	0.85	0.35	0.48	0.05	0.06	0.54	0.22	18.96	913.19
	(0.84)	(0.36)	(0.48)	(0.50)	(0.22)	(0.23)	(0.50)	(0.42)	(10.33)	(704.56)
Technical degree and diploma	5.04	0.80	0.26	0.46	0.02	0.03	0.65	0.20	17.39	1195.47
	(0.82)	(0.40)	(0.44)	(0.50)	(0.12)	(0.18)	(0.48)	(0.40)	(10.66)	(820.54)
Graduate	5.29	0.79	0.22	0.32	0.01	0.01	0.69	0.18	17.11	1317
	(0.79)	(0.40)	(0.41)	(0.47)	(0.09)	(0.12)	(0.46)	(0.39)	(9.57)	(938.93)

MPCE – **monthly** per capita expenditure

educational levels. The statistics show that on an average, real income increased from 1993 to 1998. There is an income gap between university degree holders and the less educated persons, and this gap appears to have widened over time. However, as we did the analysis for the two periods 1993 and 2001, we extrapolated the recorded wages in 1998 for different educational levels using the average growth rate of wages in different states. These daily wages are multiplied with 365 to get the annual income for different educational levels.

Enrollment rates

The probabilities of enrolling (that is, enrollment rates) in different educational levels for all the states are obtained from the survey conducted by NSSO on education and health (52nd round [1995/96]). The enrollment rate in our study is taken as the net attendance ratio by a broad class-group (NSSO gives the information for classes 1–5, 6–8, 9–10, and 11–12). However, this information is available only for 1995. So we assumed that the same proportion of population enrolled in both the years 1991 and 2001 (but applied these proportions to the census data in 1991 and 2001). That is, if 20% of the students attended school in Classes XI and XII, we assumed the same proportion for both the years 1991 and 2001, but let the overall population totals fluctuate from census to census. However, the enrollment ratios for the technical and diploma category and degree and above are not available. Hence, we derived this information from the age-specific attendance ratio, by broad age grouping in general education, for the 18–24 age group published by NSSO as follows. First we used the total population in the two education levels (technical and graduate) from census 1991 and 2001. From this total population enrolled in the technical and graduate levels, we estimated the proportions of population in the technical/diploma category and the graduate and above category. These proportions are used as weights. We multiplied these weights with the age-specific attendance ratio of the age group 18–24 to obtain the corresponding enrollment rates in the technical/diploma and the graduate and above educational levels. Table 12 gives the probability of enrollment by state.

Survival rates

The survival rate is the last variable needed to calculate the expected value of lifetime income. This was obtained from the Office of the Registrar General (taken from www.indiastat.com), which publishes information on the life expectancy for 1993–97 for different age classes (Table 4). The probability of dying between the exact age x and x + n is published for the age intervals 0–1, 1–5, 5–10, 10–15, and so on up to 70 and above. We computed the probability of survival as 1 minus probability of death. The estimates are available for 16 states. For the states for which information was not available, an all-India average was used. The same survival rate was assumed for both 1993 and 2001. Moreover, as survival rates are classified only by gender and age, we assumed that the probabilities of surviving do not vary with the level of education.

Table 3

Mean annual wages (in rupees) received for different educational qualifications by different age cohorts for 1993 and 1998

Age cohort	*Illiterate*	*Non-formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	Technical *degree and diploma*	*Graduate and above*
1993									
15–20	5 917	6 437	6 782	7 505	8 179	8 550	11 142	13 887	10 573
21–25	6 753	8 135	8 902	10 097	11 081	12 944	15 747	23 956	17 364
26–30	6 691	9 520	8 823	10 888	13 268	17 757	21 302	29 703	26 694
31–35	7 191	10 415	10 810	12 119	15 573	21 951	26 851	37 728	32 071
36–40	7 273	11 827	11 393	13 359	18 131	26 413	29 291	41 030	35 482
41–45	7 727	11 995	12 360	15 211	19 294	30 761	33 333	48005	39 085
46–50	7 260	13 663	13 421	16 280	22 118	33 391	35 142	52 522	41 767
51–55	7 068	14 944	13 695	18 193	24 961	37 134	36 659	52 921	44 613
56–60	6 484	11 588	12 552	17 432	21 916	30 643	34 562	60 473	49 401
1998									
15–20	12 831	16 514	15 714	14 872	15 625	20 042	19 022	34 202	16 701
21–25	13 124	18 495	16 959	19 248	22 200	27 299	34 399	52 279	38 214
26–30	13 856	15 094	19 768	22 366	26 024	36 534	48 771	89 486	64 791
31–35	14 175	18 605	18 362	25 273	31 130	50 527	64 185	106 521	89 419
36–40	15 087	26 604	22 239	27 911	40 429	60 926	78 620	132 823	106 096
41–45	15 397	22 798	23 060	30 487	49 160	75 177	94 856	156 669	132 047
46–50	15 406	28 880	27 355	36 516	51 552	86 269	114 564	178 559	153 473
51–55	15 677	26 936	27 040	41 242	55 982	99 727	125 836	208 821	168 461
56–60	15 625	32 182	33 305	33 766	65 248	114 215	132 819	203 049	178 554

Table 4

Probability of survival for different age groups

State	*15–20*	*21–25*	*26–30*	*31–35*	*36–40*	*41–45*	*46–50*	*51–55*	*56–60*
Arunachal Pradesh	0.99	0.99	0.99	0.99	0.98	0.97	0.96	0.94	0.92
Assam	0.99	0.99	0.98	0.98	0.97	0.97	0.95	0.92	0.90
Bihar	0.99	0.99	0.98	0.98	0.98	0.97	0.96	0.94	0.91
Gujarat	0.99	0.99	0.99	0.99	0.98	0.98	0.97	0.95	0.93
Haryana	0.99	0.99	0.99	0.99	0.99	0.98	0.98	0.96	0.94
Himachal Pradesh	0.99	0.99	0.99	0.99	0.98	0.98	0.97	0.94	0.93
Karnataka	0.99	0.99	0.99	0.99	0.98	0.98	0.97	0.94	0.92
Kerala	0.997	0.995	0.994	0.992	0.991	0.986	0.978	0.965	0.945
Madhya Pradesh	0.99	0.99	0.98	0.98	0.98	0.97	0.95	0.94	0.90
Maharashtra	0.99	0.99	0.99	0.99	0.98	0.98	0.97	0.95	0.93
Orissa	0.99	0.98	0.98	0.98	0.98	0.97	0.95	0.93	0.91
Punjab	0.99	0.99	0.99	0.98	0.98	0.98	0.97	0.95	0.94
Rajasthan	0.99	0.99	0.99	0.99	0.98	0.98	0.96	0.95	0.94
Tamil Nadu	0.99	0.99	0.99	0.99	0.98	0.98	0.97	0.95	0.92
Uttar Pradesh	0.99	0.99	0.98	0.98	0.98	0.97	0.95	0.94	0.92
West Bengal	0.99	0.99	0.99	0.99	0.99	0.98	0.97	0.95	0.92
India	**0.99**	**0.99**	**0.99**	**0.99**	**0.98**	**0.98**	**0.97**	**0.95**	**0.92**

Educational expenditures

The ratio of expenditure on education to the total budget in different states is taken as a proxy for the average educational expenditure. The data has been obtained from the Institute of Applied Manpower Research (2002). From this, the educational expenditure per state is obtained by dividing the total allocated expenditure with the total number of students.

Value of human capital formation

Physical accounts

Our analysis period is 1993–2001. The opening stocks are the stocks of population, categorized by age cohorts and educational qualification, present at the beginning of 1993. The closing stocks are the stocks of population in different age cohorts, categorized by educational qualifications, present at the end of the accounting period, that is 2003. We divided the entire sample into nine different age cohorts in five year class groups: 0–5, 5–10, 10–15, 15–20, 21– 25 … 56–60, 60+, and so on, and considered nine groups of educational qualifications. The changes between the beginning and end of the accounting period are due to investments in human capital (new enrollments in different educational qualifications), new workers joining the labour force, net migration, and changes in inventories (age group 0–14 is treated as inventories) and depreciation (retirement of the population above 60). Tables 5a and 5b show the distribution of population by education for the two years 1993 and 2001 at an all-India level. It is apparent that the share of the graduates has increased from 2.4% in 1993 to 3.7% in 2001 across all age cohorts. Meanwhile, the distribution of illiterates and non-formal education has decreased from 63% to 45%. Table 6 shows that the probability of participating in the labour force rises with the level of education.

Since we are interested in estimating the human capital for those participating in the workforce, the number of persons aged less than 15 and greater than 60 was not taken into consideration. Tables 7a and 7b give the distribution of population of ages 15–60 in different educational groups for various states and union territories. From these tables, we can see that states like Uttar Pradesh, Maharashtra, Bihar, West Bengal, Andhra Pradesh, and so on have large populations; Bihar, Uttar Pradesh, Jammu and Kashmir, Arunachal Pradesh have a higher proportion of illiterates; and Chandigarh, Delhi, Manipur, and Puducherry have a higher proportion of people educated up to the graduate level and above. There has been an increase in the proportion of graduates in the working population (aged 15–60) for all the states between 1993 and 2001. Table 8 gives the change in the working population between 1993 and 2001. The change in the working population is decomposed into new potential workers (earlier the persons under age 15 now falling under potential labour force, irrespective of the fact whether or not they actually take up the work), net migration, and depreciation (retirement of population above 60). The physical accounts are given in Table 9. In the next step, the physical accounts are monetized using the returns to education approach.

Table 5a

Percentage distribution of population by education for 1993 at an all-India level

Age cohort	*Illiterate*	*Non-formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Technical degree and diploma*	*Graduate and above*	*Total*
0–6	32	0	0	0	0	0	0	0	0	153 002 596
7–14	12	25	63	35	16	0	0	0	0	166 916 025
15–20	5	9	5	12	25	25	23	8	0	81 526 639
21–25	6	9	4	9	14	18	29	22	20	76 435 416
26–30	7	9	4	9	11	14	15	17	21	71 112 450
31–35	6	8	4	7	9	11	10	12	17	60 792 870
36–40	6	8	4	7	7	10	8	10	14	55 264 644
41–45	5	7	3	5	5	7	6	9	10	44 565 755
46–50	5	6	3	4	4	5	4	8	7	37 823 424
51–55	4	5	2	3	3	4	2	6	5	31 807 757
56–60	3	4	2	2	2	2	1	4	3	22 438 358
60+	9	10	5	5	3	4	2	5	4	59 881 466
Total	63.3	4.0	4.3	14.3	11.0	6.0	2.6	0.4	2.6	861 567 400

Table 5b

Percentage distribution of population by education for 2001 at an all-India level

Age cohort	*Illiterate*	*Non-formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Technical degree and diploma*	*Graduate and above*	*Total*
0–6	35	0	0	0	0	0	0	0	0	163 819 614
7–14	10	9	61	35	15	0	0	0	0	199 774 276
15–20	4	9	5	13	26	27	18	7	0	100 205 964
21–25	5	12	4	9	14	16	29	22	18	89 751 298
26–30	6	12	4	8	11	13	16	17	21	83 411 863
31–35	6	11	4	7	9	11	11	13	16	74 265 467
36–40	6	11	4	7	7	9	8	10	13	70 566 441
41–45	5	8	4	5	5	7	6	7	10	55 731 441
46–50	5	7	3	5	4	6	4	6	8	47 402 475
51–55	4	5	2	3	3	4	3	6	6	36 582 410
56–60	3	4	2	2	2	3	2	5	3	27 649 317
60+	10	11	6	5	3	4	3	7	5	76 613 898
Total	45.5	1.9	14.1	14.3	8.8	7.7	3.7	0.4	3.7	1 025 774 464

Value of human capital

Estimating the returns to education

The physical accounts derived in Step 1 should be multiplied with the mean wages received for different educational qualifications by different age cohorts. We cannot use the average wage received by different age cohorts for different educational qualifications because on using this approach, some factors like skills, parental background, and quality of schooling cannot be observed. We attempted to smooth out the data by using a Mincerian Earning Function. Under the earnings function approach, the wage of an individual is assumed to depend upon the level of schooling, on-the-job training (work experience is used as a proxy), socio-economic characteristics, family background, skill, income of the family, and so on. In the model, both Exp and Exp^2 variables are in-

Table 6

Labour force participation rates for 2001

State/union territory	*Illiterate*	*Literate but below matric/ secondary*	*Matric/ secondary but below graduate*	*Technical diploma or certificate not equal to degree*	*Technical degree or diploma equal to degree or postgraduate degree*
Andhra Pradesh	0.45	0.35	0.45	0.61	0.60
Arunachal Pradesh	0.41	0.37	0.57	0.86	0.85
Assam	0.27	0.34	0.44	0.70	0.72
Bihar	0.29	0.30	0.49	0.57	0.64
Goa	0.26	0.32	0.43	0.66	0.73
Gujarat	0.35	0.39	0.51	0.71	0.73
Haryana	0.32	0.34	0.54	0.71	0.67
Himachal Pradesh	0.40	0.45	0.55	0.74	0.71
Jammu and Kashmir	0.32	0.28	0.48	0.64	0.68
Karnataka	0.42	0.39	0.50	0.65	0.67
Kerala	0.13	0.31	0.32	0.52	0.61
Madhya Pradesh	0.36	0.39	0.49	0.71	0.68
Maharashtra	0.34	0.39	0.49	0.63	0.72
Manipur	0.34	0.37	0.46	0.67	0.68
Meghalaya	0.33	0.43	0.50	0.79	0.79
Mizoram	0.22	0.59	0.61	0.80	0.88
Nagaland	0.41	0.36	0.45	0.77	0.73
Orissa	0.31	0.34	0.38	0.66	0.67
Punjab	0.31	0.31	0.50	0.65	0.63
Rajasthan	0.36	0.39	0.53	0.68	0.72
Sikkim	0.40	0.48	0.63	0.85	0.83
Tamil Nadu	0.39	0.40	0.46	0.57	0.60
Tripura	0.29	0.33	0.43	0.65	0.72
Uttar Pradesh	0.26	0.29	0.49	0.67	0.65
West Bengal	0.28	0.34	0.41	0.69	0.68
Andaman and Nicobar Islands	0.24	0.36	0.49	0.73	0.80
Chandigarh	0.25	0.29	0.47	0.65	0.63
Dadra Nagar Haveli	0.45	0.45	0.71	0.81	0.83
Daman and Diu	0.29	0.45	0.64	0.76	0.81
Delhi	0.18	0.26	0.46	0.69	0.68
Lakshadweep	0.05	0.21	0.48	0.77	0.85
Puducherry	0.24	0.31	0.43	0.62	0.63

cluded to account for the concavity[2] of the age-earnings profile. The Mincerian specification is given as follows.

$$\text{Lntwrec} = \alpha + \beta_1\text{sex1} + \beta_2\text{Sector} + \beta_3\text{Socialgroup} + \beta_4\text{hhpro1} + \beta_5\text{hhpro2} + \beta_6\text{hhpro3} + \beta_7\text{hhpro4} + \beta_8\text{edu2} + \beta_9\text{edu3} + \beta_{10}\text{edu4} + \beta_{11}\text{edu5} + \beta_{12}\text{edu6} + \beta_{13}\text{edu7} + \beta_{14}\text{edu8} + \beta_{15}\text{skill} + \beta_{16}\text{exp} + \beta_{17}\text{exp}^2 + \beta_{18}\,\text{MPCE} + \varepsilon \quad (2)$$

[2] Over time, the influence of work experience on wages increases but at a decreasing rate.

Table 7a

Distribution of population of ages 15–60 years in different educational groups for various states and union territories (for 1993/94)

State/union territory	*Illiterate*	*Non-formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Technical degree and diploma*	*Graduate and above*	*Total*
Andhra Pradesh	21 886 379	158 329	2 237 095	5 209 167	2 251 911	3 598 694	1 627 277	256 271	1 570 992	38 796 115
Arunachal Pradesh	283 534	1 737	33 835	52 678	54 980	32 559	15 645	2363	16 164	493 495
Assam	5 819 155	77 517	723 785	1 635 245	2 015 009	1 391 471	432 200	21 466	386 857	12 502 705
Bihar	15 829 353	560 832	1 534 083	2 989 474	5 184 585	3 594 805	785 115	52 995	1 676 738	32 207 981
Goa	179 993	2 401	51 668	115 542	153 666	139 324	49 605	14 635	51 586	758 421
Gujarat	9 843 198	43 728	1 632 137	5 095 742	2 569 042	3 093 840	1 065 670	229 239	1 097 014	24 669 610
Haryana	4 007 525	12 107	337 697	1 344 876	1 175 304	1 341 862	450 902	84 740	417 858	9 172 872
Himachal Pradesh	1 009 804	5 373	177 464	607 099	455 190	444 643	120 849	29 725	113 222	2 963 369
Jammu and Kashmir	1 711 473	112 307	66 912	298 160	587 216	575 741	217 120	5 273	206 381	3 780 581
Karnataka	11 686 605	109 866	2 038 931	3 436 788	3 081 805	3 258 641	1 154 445	316 863	1 210 945	26 294 889
Kerala	1 491 437	255 673	1 343 415	4 096 463	5 460 447	3 232 891	930 073	413 912	848 730	18 073 041
Madhya Pradesh	19 550 156	267 980	3 134 712	4 750 294	3 296 776	1 841 141	1 889 175	92 213	1 467 621	36 290 067
Maharashtra	15 502 290	227 648	3 229 649	6 868 880	8 436 168	6 649 881	2 293 756	473 411	2 661 758	46 343 441
Manipur	410 668	26 566	41 168	94 336	246 649	123 100	63 157	2 642	80 524	1 088 809
Meghalaya	457 889	15 961	128 893	117 835	134 807	48 738	28 940	2 858	30 489	966 411
Mizoram	59 721	1 893	91 448	89 916	100 927	32 748	11 184	2 074	12 917	402 827
Nagaland	277 835	10 413	53 016	112 480	164 784	74 078	29 442	1 611	23 647	747 306
Orissa	9 008 833	196 795	2 111 807	2 036 123	2 481 869	1 232 776	475 332	120 281	602 217	18 266 035
Punjab	4 802 882	34 948	338 540	1 789 053	1 579 860	2 177 956	505 972	93 721	608 145	11 931 079
Rajasthan	13 989 429	205 449	1 189 851	2 696 388	2 456 265	1 415 945	973 576	41 132	877 239	23 845 274
Sikkim	103 251	4 107	23 206	32 618	33 054	24 276	8 557	265	7 182	236 517
Tamil Nadu	13 029 971	466 378	2 447 663	6 403 371	4 423 061	4 505 049	1 525 414	282 065	1 468 820	34 551 793
Tripura	575 849	5 436	236 215	277 687	259 945	85 815	43 779	2694	65 295	1 552 715
Uttar Pradesh	43 333 390	1 159 209	2 367 587	7 195 708	8 280 137	6 289 484	3 912 971	164 814	3 086 520	75 789 820
West Bengal	16 150 573	353 055	3 557 998	6 634 585	6 507 378	3 005 345	1 527 402	79 705	2 065 061	39 881 101
Andaman and Nicobar Islands	48 666	337	16 635	35 772	30 791	24 069	10 781	1 997	8 017	177 064
Chandigarh	99 171	664	9 482	45 147	52 173	84 962	41 387	7 351	93 737	434 074
Dadra Nagar Haveli	50 823	80	4 536	11 111	5 752	7 227	2 425	1 142	2376	85 472
Daman and Diu	19 079	61	194	19 953	9640	8826	2861	939	2386	63 939
Delhi	1 448 350	13 181	115 277	656 323	963 499	1 039 740	674 202	47 785	1 070 384	6 028 740
Lakshadweep	4 981	1 446	3 585	8 065	6 792	3 565	355	825	643	30 256
Puducherry	125 145	1 748	34 417	101 296	89 022	87 017	30 945	7 531	34 681	511 802
India	212 797 407	4 333 224	29 312 902	64 858 175	62 548 502	49 466 210	20 900 515	2 854 538	21 866 148	468 937 621

Table 7b

Distribution of population of ages 15–60 in different educational groups for various states and union territories (for 2001)

State/union territory	*Illiterate*	*Non formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Technical degree and diploma*	*Graduate and above*	*Total*
Andhra Pradesh	19 580 511	1 196 734	3 262 632	7 467 654	2 603 906	5 565 732	3 078 532	419 292	2 712 392	45 887 385
Arunachal Pradesh	270 732	7 239	50 031	83 223	71 398	61 291	31 706	2 677	25 789	604 086
Assam	5 535 698	229 598	1 701 140	1 811 524	2 097 444	2 277 468	771 042	21 371	649 424	15 094 709
Bihar	29 920 227	1 471 632	2 693 698	6 740 669	4 742 547	6 144 026	2 487 151	93 154	2 761 775	57 054 879
Goa	149 189	11 602	83 194	115 753	130 685	149 267	150 088	13 924	93 449	897 151
Gujarat	9 674 740	216 336	3 251 529	5 099 736	3 614 436	4 104 295	2 345 822	389 213	1 794 789	30 490 896
Haryana	3 894 974	118 510	431 805	1 939 454	1 675 477	2 149 367	817 978	109 572	761 580	11 898 717
Himachal Pradesh	792 964	44 851	204 784	689 171	580 477	783 033	286 645	37 926	210 923	3 630 774
Jammu and Kashmir	2 627 950	172 446	102 742	457 821	901 664	884 045	333 385	8 096	316 896	5805045
Karnataka	11 194 022	418 329	2 797 362	4 980 387	2 955 144	4 951 794	2 012 585	459 336	2 122 100	31 891 059
Kerala	1 324 635	189 922	1 983 029	3 657 439	5 220 484	4 324 771	1 536 485	575 533	1 370 065	20 182 363
Madhya Pradesh	16 526 212	1 863 397	4750322	7 018 242	5 457 070	3 685 206	2 450 035	109 502	2 397 397	44 257 383
Maharashtra	12 759 251	1 019 805	6 463 000	9 215 318	7 767 304	10 029 852	4 846 883	450 035	4 653 778	57205226
Manipur	343 763	28 993	51 002	142 723	261 193	210 973	127 518	2 286	141 330	1 309 781
Meghalaya	426 614	35 007	230 174	177 140	131 722	125 154	52 602	1 568	48 999	1 228 980
Mizoram	48 656	10 970	113 995	126 991	116 563	56 221	24 967	1 055	25 580	524 998
Nagaland	375 519	24 593	65 689	185 830	192 437	179 824	84 467	2 119	55 909	1 166 387
Orissa	7 992 643	309 954	2 494 069	3 625 044	2 233 237	2 533 864	1 009 297	145 146	1 151 931	21 495 185
Punjab	4 245 474	160 903	412 025	2 289 775	2 073 148	3 090 925	1 129 588	134 163	917 001	14 453 002
Rajasthan	12 459 229	1 433 867	2 699 507	4 255 557	3 649 223	2 786 979	1 144 069	36 307	1 401 332	29 866 070
Sikkim	97 459	5 803	45 468	60 896	43 423	35 148	17 948	678	14 018	320 841
Tamil Nadu	10 524 693	3 551 720	2 346 384	7 274 414	5 400 948	5 651 433	2 478 918	459 093	2 070 173	39 757 776
Tripura	497 121	20 988	277 444	442 369	344 919	153 220	51 171	3 003	95 957	1 886 192
Uttar Pradesh	44 119 448	2 311 883	3 434 335	10 889 997	12 388 989	9 307 037	6 189 399	135 997	5 168 020	93 945 105
West Bengal	15 351 473	678 189	7 509 890	7 475 609	6 979 342	4 487 697	2 188 024	87 495	2945693	47 703 412
Andaman and Nicobar Islands	43 007	1 526	20 767	47 768	50 191	33 599	18 317	2 635	14 639	232 449
Chandigarh	111 335	4 796	14 456	65 952	73 754	117 470	67 936	8 976	128 132	592 807
Dadra Nagar Haveli	58 870	1 059	9 487	15 408	13 281	15 039	10 231	2 613	7 808	133 796
Daman and Diu	23 312	364	9 049	18 756	18 215	15 394	14 092	1 602	6 098	106 882
Delhi	1 642 718	72 914	263 693	1 094 902	1 267 873	1 584 919	995 650	45 912	1 646 841	8 615 422
Lakshadweep	3 795	1 759	5 823	8 740	8 380	5 272	624	791	946	36 130
Puducherry	108 074	8 105	30 454	111 494	117 818	119 337	53 607	15 100	65 835	629 824
India	212 724 308	15 623 794	47 808 979	87 585 756	73 182 692	75 619 652	36 806 762	3 776 170	35 776 599	588 904 712

Table 8

Percentage increase in population in different educational groups in 2001 over the year 1993

State/union territory	*Illiterate*	*Non-formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Technical degree and diploma*	*Graduate and above*	*Total*
Andhra Pradesh	–0.11	6.56	0.46	0.43	0.16	0.55	0.89	0.64	0.73	0.18
Arunachal Pradesh	–0.05	3.17	0.48	0.58	0.30	0.88	1.03	0.13	0.60	0.22
Assam	–0.05	1.96	1.35	0.11	0.04	0.64	0.78	0.00	0.68	0.21
Bihar	0.89	1.62	0.76	1.25	–0.09	0.71	2.17	0.76	0.65	0.77
Goa	–0.17	3.83	0.61	0.00	–0.15	0.07	2.03	–0.05	0.81	0.18
Gujarat	–0.02	3.95	0.99	0.00	0.41	0.33	1.20	0.70	0.64	0.24
Haryana	–0.03	8.79	0.28	0.44	0.43	0.60	0.81	0.29	0.82	0.30
Himachal Pradesh	–0.21	7.35	0.15	0.14	0.28	0.76	1.37	0.28	0.86	0.23
Jammu and Kashmir	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Karnataka	–0.04	2.81	0.37	0.45	–0.04	0.52	0.74	0.45	0.75	0.21
Kerala	–0.11	–0.26	0.48	–0.11	–0.04	0.34	0.65	0.39	0.61	0.12
Madhya Pradesh	–0.15	5.95	0.52	0.48	0.66	1.00	0.30	0.19	0.63	0.22
Maharashtra	–0.18	3.48	1.00	0.34	–0.08	0.51	1.11	–0.05	0.75	0.23
Manipur	–0.16	0.09	0.24	0.51	0.06	0.71	1.02	–0.13	0.76	0.20
Meghalaya	–0.07	1.19	0.79	0.50	–0.02	1.57	0.82	–0.45	0.61	0.27
Mizoram	–0.19	4.80	0.25	0.41	0.15	0.72	1.23	–0.49	0.98	0.30
Nagaland	0.35	1.36	0.24	0.65	0.17	1.43	1.87	0.32	1.36	0.56
Orissa	–0.11	0.58	0.18	0.78	–0.10	1.06	1.12	0.21	0.91	0.18
Punjab	–0.12	3.60	0.22	0.28	0.31	0.42	1.23	0.43	0.51	0.21
Rajasthan	–0.11	5.98	1.27	0.58	0.49	0.97	0.18	–0.12	0.60	0.25
Sikkim	–0.06	0.41	0.96	0.87	0.31	0.45	1.10	1.56	0.95	0.36
Tamil Nadu	–0.19	6.62	–0.04	0.14	0.22	0.25	0.63	0.63	0.41	0.15
Tripura	–0.14	2.86	0.17	0.59	0.33	0.79	0.17	0.11	0.47	0.21
Uttar Pradesh	0.02	0.99	0.45	0.51	0.50	0.48	0.58	–0.17	0.67	0.24
West Bengal	–0.05	0.92	1.11	0.13	0.07	0.49	0.43	0.10	0.43	0.20
Andaman and Nicobar	–0.12	3.53	0.25	0.34	0.63	0.40	0.70	0.32	0.83	0.31
Chandigarh	0.12	6.22	0.52	0.46	0.41	0.38	0.64	0.22	0.37	0.37
Dadra Nagar Haveli	0.16	12.27	1.09	0.39	1.31	1.08	3.22	1.29	2.29	0.57
Daman and Diu	0.22	5.01	45.58	–0.06	0.89	0.74	3.93	0.71	1.56	0.67
Delhi	0.13	4.53	1.29	0.67	0.32	0.52	0.48	–0.04	0.54	0.43
Lakshadweep	–0.24	0.22	0.62	0.08	0.23	0.48	0.76	–0.04	0.47	0.19
Puducherry	–0.14	3.64	–0.12	0.10	0.32	0.37	0.73	1.01	0.90	0.23
India	–0.0003	2.61	0.63	0.35	0.17	0.53	0.76	0.32	0.64	0.26

The description of the variables has been given in Table 1.

From this, the marginal rates of returns per each completed level of schooling are estimated using $r_k = (\beta_j - \beta_{j-1})$, and the predicted values are used to compute lifetime income. The use of OLS (ordinary least squares) in estimating Equation (2) results in biased estimates, as the dependent variable contains some latent characteristics. Further, the schooling decisions are potentially affected by unobserved individual skills and tastes, which are also correlated with individual wages. Hence, to overcome this problem of sample selection bias, we estimate Equation (2) using the Heckmann Maximum Likelihood Estimation (Heckman 1974). The advantage of using this estimation over OLS can be seen

Table 9

Physical accounts for the working population between 1993 and 2001

State/union territory	*Opening stock (15–60) age cohort population in 1993*	*Additions to the stock (+)*	*Depreciation of the stock due to ageing (–)*	*Other changes in inventories due to migration, emigration, death,and so on (+/–)*	*Closing stock (15–60) age cohort population in 2001*
Andhra Pradesh	38 796 115	13 154 708	1 693 615	–4 369 823	45 887 385
Arunachal Pradesh	493 495	175 835	18 626	–46 617	604 086
Assam	12 502 705	4 755 452	474 633	–1 688 814	15 094 709
Bihar	32 207 981	18 604 984	1 337 763	+7 579 677	57 054 879
Goa	758 421	194 385	34 362	–21 293	897 151
Gujarat	24 669 610	8 114 569	1 078 913	–1 214 370	30 490 896
Haryana	9 172 872	3 498 988	335 406	–437 737	11 898 717
Himachal Pradesh	2 963 369	1 015 520	151 610	–196 504	3 630 774
Jammu and Kashmir	3 780 581	4 245 657	171 238	–2 049 956	5 805 045
Karnataka	26 294 889	8 890 906	1 116 957	–2 177 779	31 891 059
Kerala	18 073 041	4 746 318	994 481	–1 642 515	20 182 363
Madhya Pradesh	36 290 067	13 379 609	1 728 227	–3 684 065	44 257 383
Maharashtra	46 343 441	15 111 615	2 285 541	–1 964 289	57 205 226
Manipur	1 088 809	351 399	48 095	–82 332	1 309 781
Meghalaya	966 411	382 582	33 666	–86 347	1 228 980
Mizoram	402 827	143 086	15 717	–5 198	524 998
Nagaland	747 306	273 674	26 457	+171 864	1 166 387
Orissa	18 266 035	6 132 174	921 019	–1 982 005	21 495 185
Punjab	11 931 079	3 860 707	531 064	–807 720	14 453 002
Rajasthan	23 845 274	9 577 458	1 071 511	–2 485 151	29 866 070
Sikkim	236 517	89 352	9 274	+4 246	320 841
Tamil Nadu	34 551 793	9 695 039	1 904 501	–2 584 555	39 757 776
Tripura	1 552 715	572 454	63 114	–175 863	1 886 192
Uttar Pradesh	75 789 820	29 379 693	3 566 314	–7 658 094	93 945 105
West Bengal	39 881 101	13 707 075	1 819 777	–4 064 988	47 703 412
Andaman and Nicobar Islands	177 064	56 004	6 568	+5 949	232 449
Chandigarh	434 074	114 183	14 618	+59 168	592 807
Dadra Nagar Haveli	85 472	27 555	3 435	+24 204	133 796
Daman and Diu	63 939	20 365	2 549	+25 127	106 882
Delhi	6 028 740	1 802 855	225 491	+1 009 318	8 615 422
Lakshadweep	30 256	10 420	1 660	–2 886	36 130
Puducherry	511 802	142 578	24 320	–236	629 824
India	468 937 621	168 824 559	21 710 522	27 146 945	588 904 712

from the result in Tables 10a and 10b (For details please refer to Appendix 2). In this first stage, a probit estimation is used to estimate the probability of being employed (the dependent variable takes the value of 1 if employed, and takes value of 0 otherwise) and in the second stage, the actual wages are used in the regression equation. We used STATA version 8.0 for the estimation. From this, the returns to education for each age cohort for different educational levels are obtained by state. Using the regression equation, we predict the wages for the different age cohorts by the educational levels.

Results

The descriptive statistics of the variables used in the model are given in Table 2. The results of the first-stage probit analysis are given in Tables 11a and 11b, which give the marginal effects. From the Tables 11a and 11b it can be seen that as expected, males have a higher probability of being employed than females. Similarly, urban dwellers have a higher probability of being employed compared to those in a rural setting for both the years 1993 and 1998; this may explain the migration of rural people to urban areas. It is surprising to note that a person belonging to a forward caste had less probability of being employed compared to a reserved caste in 1993, while the trend reversed in 1998, perhaps due to changes in the nature of jobs available between 1993 and 1998.

An additional technical diploma or degree, captured by skill in the model, seems to significantly increase the probability of getting a job. It can be seen from tables 11a and 11b that persons with higher educational qualifications and experience have higher probability of finding employment. The results also show that the contribution of nonformal education is insigificant because it contributes only to literacy.

Education, the variable of most interest, plays a very important role in determining wages. It is seen that the amount of education received, whether at the primary, secondary, or graduate level, positively influences wages across all age cohorts and for both years. This is illustrated by the fact that most of the educational variables are positive (Tables 10a and 10b). Non-formal education is shown to influence the wages for those individuals who are in the higher age cohorts.

Tables 10a and 10b show that for all age cohorts, the returns to education are positive as one moves to higher educational levels. This shows that the investment in education gives positive returns. Similarly, experience has a positive impact on earnings except for certain age cohorts in 1993 (Table 10a). It is clear from the results that experience has diminishing returns in the sense that beyond a certain point it does not fetch additional wages. The coefficient of the technical variable (Tec_educ) shows that skills have a positive impact upon earnings. An individual with an additional technical and diploma degree can, therefore, earn more than the one who does not have this skill. The returns to skill are higher at younger age cohorts but this effect decreases gradually over the period of study. In effect, this means that returns to education are positively influenced by on-the-job investment in the form of training (captured by experience) but negatively affected by depreciation (the wearing of human capital because of ageing). The net effects will be mixed depending upon the profession one is in and also the educational qualification.

The results of the second-stage estimation also show that socio-economic factors other than education affect earnings. People in rural

Table 10a

Results of the second-stage of the Heckitt estimation for 1993

	Estimated coefficient for each age cohort by educational level for 1993								
	15-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60
Number of observations	73 102	50 564	49 600	38 321	36 508	28 000	25 386	18 545	17 164
Wald chi (2)	886	2 833	4 824	5 410	5 311	4 871	4 170	2 818	1 607
Lntwrec									
Male	0.35[a]	0.40[a]	-0.37[a]	-0.18[a]	-0.22[a]	-0.19[a]	-0.17[a]	-0.21[a]	-0.33[a]
	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)
Rural	0.02	-0.06[b]	-0.05	-0.07[b]	-0.13[a]	-0.09[b]	-0.13[a]	-0.23[a]	-0.07
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.07)	(0.08)
SC/ST	0.03	-0.01	-0.14[a]	-0.10[a]	-0.12[a]	-0.10[a]	-0.14[a]	-0.17[a]	-0.11[b]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.05)
Self-employed	0.03	-0.003	-1.33[a]	-1.22[a]	-1.14[a]	-1.34[a]	-1.52[a]	1.39[a]	-1.72[a]
	(0.03)	(0.03)	(0.05)	(0.06)	(0.07)	(0.08)	(0.09)	(0.10)	(0.13)
Agricultural labour	0.25[a]	0.21[a]	-0.94[a]	-0.91[a]	-0.91[a]	-1.04[a]	-1.21[a]	-1.19[a]	-1.42[a]
	(0.03)	(0.03)	(0.05)	(0.06)	(0.07)	(0.08)	(0.08)	(0.11)	(0.13)
Casual labour	0.22[a]	0.31[a]	-0.69[a]	-0.52[a]	-0.54[a]	-0.66[a]	-0.86[a]	-0.75[a]	-0.85[a]
	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)	(0.08)	(0.09)	(0.12)	(0.13)
Salaried employee	0.02	0.23[a]	-0.49[a]	-0.43[a]	-0.39[a]	-0.56[a]	-0.59[a]	-0.31[a]	-0.43[a]
	(0.05)	(0.04)	(0.05)	(0.06)	(0.06)	(0.08)	(0.08)	(0.10)	(0.11)
Technical degree and diploma	0.46[a]	0.26[a]	0.03	-0.01	-0.06	-0.04	-0.07	-0.03[a]	0.24[b]
	(0.16)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.11)
Non-formal education	0.11	0.08	0.20[a]	0.19[b]	0.29[a]	0.25[b]	0.20	0.59[a]	0.45[a]
	(0.08)	(0.08)	(0.07)	(0.09)	(0.10)	(0.11)	(0.14)	(0.16)	(0.13)
Below primary	0.20[a]	0.13[a]	0.09[b]	0.26[a]	0.29[a]	0.27[a]	0.31[a]	0.39[a]	0.47[a]
	(0.03)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.07)	(0.09)
Primary	0.37[a]	0.25[a]	0.27[a]	0.28[a]	0.39[a]	0.41[a]	0.42[a]	0.55[a]	0.79[a]
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.06)	(0.07)	(0.09)	(0.12)
Middle	0.63[a]	0.35[a]	0.38[a]	0.38[a]	0.55[a]	0.47[a]	0.50[a]	0.68[a]	0.90[a]
	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)	(0.08)	(0.09)	(0.11)	(0.17)
Secondary	0.81[a]	0.58[a]	0.54[a]	0.54[a]	0.75[a]	0.68[a]	0.67[a]	0.86[a]	1.21[a]
	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.09)	(0.10)	(0.13)	(0.22)
Higher secondary	1.18[a]	0.83[a]	0.62[a]	0.66[a]	0.73[a]	0.66[a]	0.62[a]	0.82[a]	1.28[a]
	(0.10)	(0.08)	(0.08)	(0.08)	(0.09)	(0.10)	(0.12)	(0.15)	(0.28)
Graduate and above	1.89[a]	1.22[a]	0.66[a]	0.67[a]	0.83[a]	0.75[a]	0.80[a]	1.05[a]	1.97[a]
	(0.18)	(0.11)	(0.10)	(0.10)	(0.11)	(0.12)	(0.14)	(0.18)	(0.35)
Experience	0.13[a]	0.08[a]	0.001	-0.03	-0.01	-0.03	-0.01	0.02	0.27[c]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.05)	(0.07)	(0.14)
(Experience)^2	-0.004[a]	-0.002[a]	-0.0002	0.001	0.0002	0.0003	0.00003	-0.00001	-0.002[c]
	(0.001)	(0.001)	(0.0005)	(0.0005)	(0.001)	(0.001)	(0.00004)	(0.001)	(0.001)
Monthly per capita expenditure	0.0003[a]	0.0003[a]	0.0003[a]	0.0002[a]	0.0004[a]	0.0004[a]	0.0003[a]	0.0002[a]	0.00003
	(0.0001)	(0.00005)	(0.00004)	(0.0001)	(0.00004)	(0.00004)	(0.00004)	(0.0001)	(0.00004)
_Cons	1.31[a]	1.78[a]	4.95[a]	5.07[a]	4.72[a]	5.28[a]	5.39[a]	4.33[a]	-1.76
	(0.12)	(0.14)	(0.22)	(0.29)	(0.42)	(0.64)	(0.93)	(1.49)	(3.49)

Figures in the parentheses indicate the robust standard errors.

[a]Indicates 1% significance level

[b]Indicates 5% significance level

[c]Indicates 10% significance level

Table 10b

Results of the second-stage of the Heckitt estimation for 1998

	Estimated coefficient for each age cohort by educational level for 1998								
	15-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60
Number of observations	75 728	52 255	51 399	43 579	41 529	30 827	27 033	19 131	18 380
Wald chi (2)	2 523	6 902	14 901	21 215	26 062	23 111	20 989	14 263	8 368
Lntwrec									
Male	0.36[a]	0.40[a]	0.37[a]	0.40[a]	0.40[a]	0.42[a]	0.38[a]	0.33[a]	0.36[a]
	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.05)
Rural	-0.04[b]	-0.06[a]	-0.08[a]	-0.07[a]	-0.11[a]	-0.08[a]	-0.10[a]	0.01	0.07
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.06)
SC/ST	-0.05[a]	-0.08[a]	-0.05[a]	-0.06[a]	-0.04[a]	-0.04[a]	-0.03[b]	-0.05[a]	-0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)
Self-employed	-0.03	-0.06[a]	-0.10[a]	-0.09[a]	-0.14[a]	-0.17[a]	-0.23[a]	-0.29[a]	-0.40[a]
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.06)	(0.11)
Agricultural labour	0.19[a]	0.20[a]	0.20[a]	0.19[a]	0.20[a]	0.18[a]	0.06	0.02	-0.02
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.07)	(0.11)
Casual labour	0.18[a]	0.30[a]	0.45[a]	0.51[a]	0.63[a]	0.65[a]	0.61[a]	0.65[a]	0.60[a]
	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.07)	(0.12)
Salaried employee	0.04	0.28[a]	0.43[a]	0.58[a]	0.67[a]	0.70[a]	0.68[a]	0.65[a]	0.59[a]
	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.06)	(0.09)
Technical degree and diploma	0.16[b]	0.17[a]	0.25[a]	0.23[a]	0.26[a]	0.21[a]	0.25[a]	0.20[a]	0.18[a]
	(0.07)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)
Non-formal education	0.11	0.08	0.07	0.09[c]	0.22[a]	0.08	0.15[c]	0.19[a]	0.20
	(0.08)	(0.06)	(0.06)	(0.05)	(0.06)	(0.07)	(0.08)	(0.08)	(0.16)
Below primary	0.15[a]	0.11[a]	0.12[a]	0.11[a]	0.15[a]	0.07[a]	0.25[a]	0.18[a]	0.16[a]
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)
Primary	0.23[a]	0.19[a]	0.23[a]	0.27[a]	0.22[a]	0.17[a]	0.33[a]	0.38[a]	0.09
	(0.03)	(0.03)	(0.03)	(0.03)	(0.06)	(0.04)	(0.05)	(0.06)	(0.08)
Middle	0.39[a]	0.33[a]	0.36[a]	0.38[a]	0.39[a]	0.36[a]	0.46[a]	0.49[a]	0.27[a]
	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)	(0.10)
Secondary	0.62[a]	0.52[a]	0.62[a]	0.68[a]	0.67[a]	0.60[a]	0.80[a]	0.86[a]	0.49[a]
	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.08)	(0.12)
Higher secondary	0.75[a]	0.74[a]	0.85[a]	0.89[a]	0.83[a]	0.72[a]	0.90[a]	0.99[a]	0.55[a]
	(0.07)	(0.06)	(0.05)	(0.04)	(0.06)	(0.06)	(0.07)	(0.09)	(0.14)
Graduate	1.38[a]	1.12[a]	1.22[a]	1.16[a]	1.19[a]	0.93[a]	1.15[a]	1.32[a]	0.70[a]
	(0.14)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.08)	(0.10)	(0.19)
Experience	0.09[a]	0.08[a]	0.07[a]	0.04[a]	0.04[b]	0.02	0.03	0.11[a]	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.04)	(0.07)
(Experience)^2	-0.002[a]	-0.002[a]	-0.001[a]	-0.0005[c]	-0.0006[b]	-0.0004	-0.0004	-0.0013[a]	-0.0002
	(0.0005)	(0.011)	(0.0003)	(0.0003)	(0.0001)	(0.0003)	(0.0004)	(0.0004)	(0.0007)
Monthly per capita expenditure	0.0004[a]	-0.0004[a]	0.0003[a]	0.0004	0.0002[a]	0.0003[a]	0.0003[a]	0.0003[a]	0.0002[a]
	(0.00003)	(0.00002)	(0.00004)	(0.00003)	(0.0001)	(0.00002)	(0.00002)	(0.00002)	(0.00004)
_Cons	2.09[a]	2.18[a]	2.25[a]	2.46[a]	2.65[a]	2.97[a]	2.70[a]	0.90	4.93[a]
	(0.07)	(0.10)	(0.14)	(0.18)	(0.24)	(0.35)	(0.51)	(0.77)	(1.64)

Figures in the parentheses indicate the robust standard errors

[a] Indicates 1% significance level

[b] Indicates 5% significance level

[c] Indicates 10% significance level

Table 11a

Results of the first-stage probit analysis for 1993 (marginal effects) for different age groups

	15–20	21–25	26–30	31–35	36–40	41–45	46–50	51–55	56–60
Male	0.11	0.25	0.32	0.34	0.35	0.33	0.29	0.24	0.14
	(0.002)	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)
Rural	–0.03	–0.02	–0.01	0.02	0.01	0.02	0.03	0.03	0.01
	(0.003)	(0.005)	(0.006)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.007)
SC/ST	0.01	0.03	0.05	0.06	0.07	0.07	0.07	0.05	0.02
	(0.002)	(0.004)	(0.005)	(0.006)	(0.006)	(0.008)	(0.007)	(0.008)	(0.006)
Self-employed	0.34	0.53	0.62	0.67	0.68	0.70	0.68	0.64	0.55
	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)	(0.009)	(0.010)	(0.012)	(0.014)
Agricultural labour	0.27	0.48	0.58	0.66	0.68	0.69	0.66	0.66	0.51
	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)	(0.009)	(0.011)	(0.014)	(0.018)
Casual labour	0.10	0.35	0.50	0.60	0.62	0.66	0.66	0.64	0.42
	(0.006)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.011)	(0.014)	(0.018)
Salaried employee	0.04	0.18	0.37	0.48	0.49	0.51	0.48	0.41	0.18
	(0.005)	(0.009)	(0.010)	(0.010)	(0.011)	(0.012)	(0.012)	(0.015)	(0.014)
Technical degree and diploma	0.12	0.16	0.12	0.14	0.16	0.15	0.13	0.11	–0.02
	(0.024)	(0.015)	(0.015)	(0.017)	(0.020)	(0.022)	(0.021)	(0.026)	(0.012)
Non-formal education	–0.02	–0.02	–0.01	–0.04	–0.05	–0.04	–0.02	–0.06	–0.04
	(0.008)	(0.017)	(0.017)	(0.023)	(0.022)	(0.024)	(0.024)	(0.019)	(0.010)
Below primary	0.01	0.00	0.00	–0.04	–0.04	–0.04	–0.05	–0.04	–0.05
	(0.004)	(0.008)	(0.009)	(0.010)	(0.010)	(0.012)	(0.011)	(0.011)	(0.006)
Primary	0.00	–0.01	–0.02	–0.05	–0.04	–0.06	–0.06	–0.04	–0.07
	(0.004)	(0.009)	(0.010)	(0.012)	(0.012)	(0.013)	(0.012)	(0.014)	(0.005)
Middle	0.01	0.01	0.00	–0.04	–0.05	–0.05	–0.05	–0.03	–0.09
	(0.006)	(0.012)	(0.013)	(0.016)	(0.015)	(0.017)	(0.016)	(0.017)	(0.004)
Secondary	0.03	0.02	0.06	0.02	0.01	0.03	0.03	0.04	–0.10
	(0.008)	(0.015)	(0.017)	(0.021)	(0.020)	(0.024)	(0.024)	(0.027)	(0.004)
Higher secondary	0.05	–0.02	0.11	0.05	0.07	0.07	0.08	0.06	–0.09
	(0.011)	(0.016)	(0.023)	(0.026)	(0.027)	(0.032)	(0.032)	(0.036)	(0.003)
Graduate	0.51	0.16	0.26	0.16	0.12	0.13	0.16	0.05	–0.10
	(0.045)	(0.030)	(0.032)	(0.037)	(0.036)	(0.044)	(0.046)	(0.045)	(0.004)
Experience	0.05	0.03	0.03	0.01	–0.01	0.00	0.02	–0.01	–0.13
	(0.001)	(0.003)	(0.004)	(0.007)	(0.008)	(0.012)	(0.013)	(0.016)	(0.015)
$(\text{Experience})^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Monthly per capita expenditure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	0.000	(0.000)	(0.000)	(0.000)

areas earn less than those in the urban area as shown in Tables 10a and 10b. Caste is another factor that can affect earnings potential. People belonging to the reserved castes on an average earn less than those belonging to the forward caste for all the age cohorts and in both the years. Similarly, profession affects the wages significantly; a person who is self-employed gets paid less than other professionals in both the years. This may be because the earnings are not recorded properly. An agricultural labourer, a casual labourer, and a salaried employee can expect higher wages. Gender also affects the wages significantly; the male worker on an average earns about 34%–43% more than a female worker.

Table 11b

Results of the first-stage probit analysis for 1998 (marginal effects) for different age groups

	15–20	21–25	26–30	31–35	36–40	41–45	46–50	51–55	56–60
Male	0.12	0.27	0.33	0.34	0.34	0.34	0.29	0.27	0.14
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	0.005
Rural	–0.03	–0.02	0.01	0.03	0.05	0.06	0.06	0.07	0.04
	(0.003)	(0.005)	(0.006)	(0.007)	(0.007)	(0.008)	(0.008)	(0.009)	(0.006)
SC/ST	0.01	0.03	0.05	0.05	0.06	0.05	0.06	0.06	0.03
	(0.002)	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.004)
Self-employed	0.31	0.53	0.64	0.69	0.72	0.73	0.72	0.69	0.56
	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.012)	(0.013)
Agricultural- labour	0.22	0.45	0.59	0.67	0.71	0.72	0.70	0.69	0.54
	(0.006)	(0.008)	(0.007)	(0.007)	(0.007)	(0.008)	(0.010)	(0.013)	(0.017)
Casual labour	0.09	0.33	0.52	0.62	0.68	0.71	0.72	0.73	0.55
	(0.005)	(0.009)	(0.008)	(0.008)	(0.008)	(0.009)	(0.010)	(0.012)	(0.017)
Salaried employee	0.02	0.14	0.31	0.41	0.46	0.50	0.45	0.39	0.19
	(0.004)	(0.008)	(0.010)	(0.010)	(0.010)	(0.011)	(0.013)	(0.014)	(0.012)
Technical degreeand	0.20	0.14	0.12	0.12	0.17	0.18	0.13	0.06	–0.05
diploma	(0.024)	(0.013)	(0.014)	(0.016)	(0.019)	(0.023)	(0.022)	(0.021)	(0.007)
Non-formal education	0.00	–0.03	–0.01	–0.03	–0.03	–0.02	–0.02	0.02	–0.05
	(0.010)	(0.016)	(0.020)	(0.020)	(0.019)	(0.022)	(0.021)	(0.028)	(0.009)
Below primary	0.03	–0.01	–0.01	–0.03	–0.03	–0.02	–0.05	–0.04	–0.05
	(0.005)	(0.008)	(0.009)	(0.010)	(0.010)	(0.012)	(0.010)	(0.011)	(0.006)
Primary	0.04	–0.01	–0.03	–0.05	–0.06	–0.05	–0.07	–0.06	–0.07
	(0.006)	(0.009)	(0.010)	(0.011)	(0.011)	(0.013)	(0.011)	(0.012)	(0.005)
Middle	0.07	0.00	–0.02	–0.03	–0.03	–0.04	–0.07	–0.05	–0.09
	(0.007)	(0.012)	(0.013)	(0.014)	(0.015)	(0.017)	(0.014)	(0.016)	(0.004)
Secondary	0.09	0.01	0.02	0.01	0.03	0.03	0.00	–0.01	–0.10
	(0.009)	(0.015)	(0.016)	(0.019)	(0.019)	(0.023)	(0.021)	(0.022)	(0.004)
Higher secondary	0.08	–0.02	0.03	0.05	0.08	0.08	0.05	0.03	–0.09
	(0.013)	(0.015)	(0.019)	(0.024)	(0.025)	(0.031)	(0.029)	(0.031)	(0.003)
Graduate	0.55	0.13	0.13	0.15	0.19	0.21	0.12	0.02	–0.10
	(0.040)	(0.027)	(0.028)	(0.033)	(0.035)	(0.043)	(0.042)	(0.039)	(0.004)
Experience	0.04	0.04	0.02	0.00	0.01	0.00	0.02	–0.02	–0.14
	(0.001)	(0.003)	(0.004)	(0.006)	(0.008)	(0.011)	(0.012)	(0.015)	(0.013)
$(\text{Experience})^2$	–0.001	–0.001	–0.0005	0.0001	–0.0002	–0.00002	–0.0004	0.0001	0.001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Monthly percapita expenditure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.00)	(0.00)	(0.000)	(0.000)	(0.000)

Value of total stock of human capital

The value of the stock of total human capital for each state is estimated using the present value of the lifetime labour income approach proposed by Jorgensen and Fraumeni (1989). They stated that the present value of lifetime labour income for persons of given age is just their expected current annual labour income plus the present value of the expected lifetime income in the next period (where this expectation depends on survival probabilities). Thus, on using this method, we assumed that individuals retire when they are 60 years old; so, for a 59-year-old person, the present value of lifetime labour income is just the current labour income. The lifetime labour income of a 58-year-old individual is equal to the present value of lifetime labour income of the 59-year-old plus his/her current labour income and so forth. Thus, by backward recursion, it is possible to calculate the present value of

lifetime income at each age with any particular level of education. As the future lifetime labour income depends on the probability of survival as well, we used the probability of survival for different age groups (Table 4).

However, in the work-study stage, there is a possibility of future enrollment to gain a higher level of education, leading to higher pay. Thus, individuals in this stage face two possible earning streams: one with continuous work and the other with the possibility of further study (postponing earnings). In such cases, lifetime labour income is a linear combination of the two earning streams, where the weights of each stream depend upon the probability of enrollment (Table 12) and the survival rates of the individuals. Also, since the focus of the Jorgenson and Fraumeni approach is labour force, the expected contribution of the student population, which is currently not participating in the labour force, should be weighted by the probability

Table 12

Probability of enrollment by different age groups and educational qualifications for 1993 and 1998

State/union territory	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Graduate and above*	*Technical degree and diploma*
Andhra Pradesh	0.70	0.41	0.30	0.18	0.09	0.007
Arunachal Pradesh	0.60	0.29	0.08	0.05	0.20	0.006
Assam	0.72	0.43	0.34	0.10	0.25	0.001
Bihar	0.41	0.33	0.20	0.09	0.16	0.003
Goa	0.94	0.62	0.48	0.24	0.11	0.008
Gujarat	0.78	0.52	0.29	0.12	0.10	0.009
Haryana	0.78	0.52	0.20	0.14	0.13	0.005
Himachal Pradesh	0.85	0.54	0.38	0.23	0.20	0.004
Jammu and Kashmir	0.67	0.53	0.27	0.09	0.26	0.001
Karnataka	0.73	0.50	0.33	0.20	0.10	0.009
Kerala	0.91	0.76	0.60	0.34	0.12	0.014
Madhya Pradesh	0.63	0.35	0.14	0.10	0.14	0.001
Maharashtra	0.85	0.55	0.38	0.24	0.16	0.008
Manipur	0.60	0.43	0.14	0.12	0.44	0.002
Meghalaya	0.67	0.25	0.17	0.02	0.19	0.001
Mizoram	0.69	0.39	0.14	0.04	0.18	0.001
Nagaland	0.70	0.40	0.22	0.06	0.40	0.002
Orissa	0.61	0.45	0.33	0.17	0.13	0.004
Punjab	0.81	0.29	0.33	0.19	0.13	0.005
Rajasthan	0.55	0.35	0.20	0.13	0.14	0.001
Sikkim	0.77	0.33	0.20	0.06	0.16	0.001
Tamil Nadu	0.84	0.61	0.36	0.19	0.07	0.009
Tripura	0.80	0.40	0.09	0.04	0.22	0.002
Uttar Pradesh	0.59	0.33	0.19	0.12	0.12	0.001
West Bengal	0.66	0.33	0.15	0.07	0.13	0.001
Andaman and Nicobar Islands	0.92	0.73	0.31	0.16	0.20	0.011
Chandigarh	0.83	0.45	0.55	0.35	0.24	0.006
Dadra Nagar Haveli	0.76	0.55	0.63	0.01	0.14	0.017
Daman and Diu	1.00	0.57	0.32	0.12	0.07	0.008
Delhi	0.79	0.70	0.45	0.30	0.26	0.002
Lakshadweep	0.95	0.69	0.19	0.01	0.08	0.003
Puducherry	0.77	0.84	0.82	0.14	0.09	0.01

that these students will enter the labour force and be employed upon graduation. In this study, we assumed that the potential working life is from ages 15 to 60, a work-study phase occurs from the ages 15–25, and the work-only phase occurs from age 25.

Figures 1 and 2 give the incremental wages for different educational levels for the years 1993 and 2001. These figures show that the wages increase as one moves from one age cohort to another. The wages of a person belonging to a higher educational level are greater in comparison to a person with a lower educational level. The differences in wages among illiterate persons, those with non-formal education, and those with a below-primary level of education are minimal. Hence, the curve will be more or less the same for the three educational groups. Figures 1 and 2 make it clear that initially lifetime income tends to increase at an increasing rate till about ages 35–40, after which it increases at a decreasing rate. The point at which the curve peaks down is different across different educational qualifications, and the curve peaks down at later stages for individuals with higher educational qualifications. This is because the time devoted to further education postpones the reaping of higher returns until later in life. Lifetime income profiles are flatter for 'unqualified' and 'skilled' people than for the university educated people, reflecting what was observed earlier about the annual income profiles. These figures, reported in Tables 13a and 13b, are the weighted averages of the lifetime income profiles for 1993 and 2001, respectively, where the weights are the number of people at each year of age. Table 14 gives the value of human capital accumulation in the base scenario (4% discount rate and 6% increase in income) at different educational levels between 1993 and 2001. While the total human capital increases by two and a half times between 1993 and 2001, university degree holders, a group that increased by 64% in the last eight years, contributes to only about 17% of this human capital accumulation. Similarly, in all the states, the human capital accumulation is positive for all the educational levels in absolute terms. This growth is primarily due to the larger size of the labour force, since the expected annual labour income in 2001 is marginally higher than that in 1991. Human capital accumulation is highest in the secondary level (23%).

Monetary accounts for human capital

The next step is to develop an integrated stock-flow accounting system in which changes in the stock of human capital can be fully explained by investments in education and other flows in human capital. For this, we multiply the physical accounts (Table 9) with the per capita lifetime labour income to get the value of human capital for 1993 and 2001. We multiplied the opening stocks of human capital with the mean wage across all educational groups and age cohorts of 1993, and the closing stocks with the mean wage across all

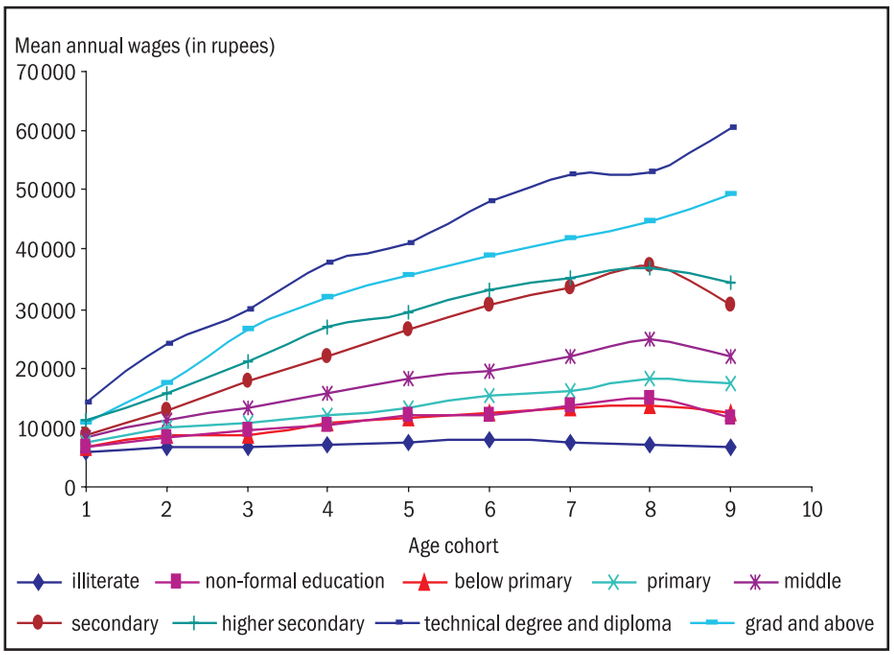


Figure 1

Mean annual wages of persons of different educational levels by age cohort for 1993

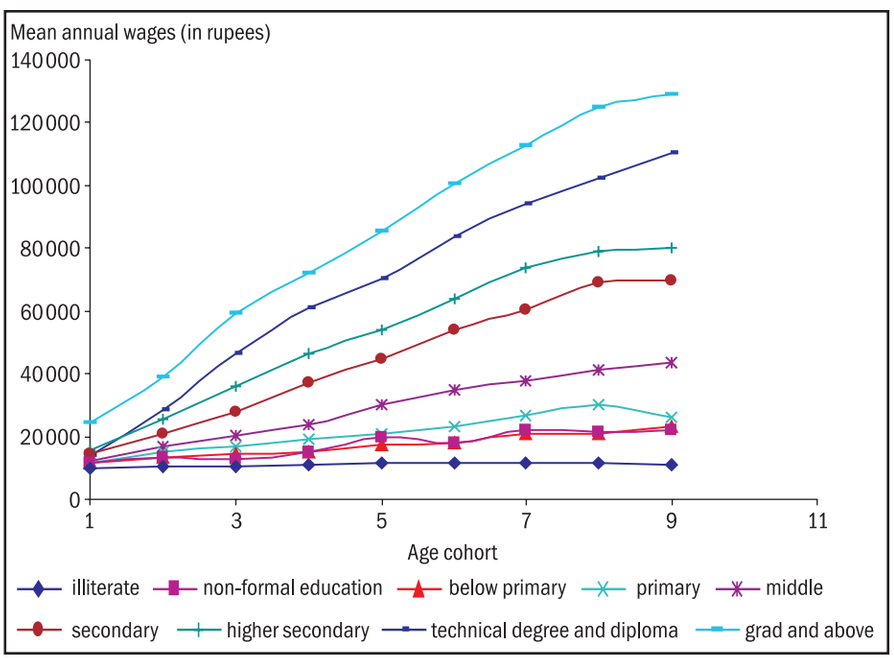


Figure 2

Mean annual wages of persons of different educational levels by age cohort for 1998

educational groups and age cohorts of 2001 (Tables 13a and 13b). The difference between the value of the opening stock and the closing stock is because of the investments in education, depreciation, and on-the-job training captured by experience, changes in inventories, and revaluation. Depreciation and on-the-job training are implicitly captured in the Mincerian specification estimation of predicted wages. The depreciation of the stock is also captured by the physical accounts. Investment in education is estimated through the number of persons who obtain higher educational qualifications

Table 13a

Lifetime income profiles by different educational groups for different states for 1993 (weighted by age cohorts) (in thousands of rupees)

State/union territory	*Illiterate*	*Non-formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Technical degree and diploma*	*Graduate and above*	*Weighted lifetime labour income*
Andhra Pradesh	239.68	369.33	404.68	505.30	794.59	922.51	992.37	1046.19	1115.50	453.30
Arunachal Pradesh	267.62	392.83	495.40	572.81	703.02	875.56	920.70	997.54	1087.35	455.92
Assam	223.56	289.33	305.73	389.37	609.19	724.65	809.87	762.02	883.77	409.95
Bihar	207.16	319.66	343.94	451.66	577.77	732.40	843.55	867.54	1015.15	415.27
Goa	217.25	385.08	366.08	558.34	858.63	897.06	1072.70	935.51	1079.74	663.20
Gujarat	256.99	368.47	404.16	531.94	777.45	877.34	1025.50	1071.72	1100.94	534.01
Haryana	289.12	468.40	544.45	675.51	795.72	906.77	1152.79	898.44	1190.78	599.83
Himachal Pradesh	227.19	337.42	422.47	617.36	843.02	882.17	1090.87	908.01	1106.38	587.53
Jammu and Kashmir	296.71	369.81	541.15	627.91	783.51	867.78	1057.10	934.97	1059.98	578.13
Karnataka	253.33	449.47	406.32	531.99	786.95	903.73	1054.44	991.12	1110.98	529.14
Kerala	175.46	244.73	280.87	458.72	892.42	1105.67	1283.98	1079.45	1429.22	768.12
Madhya Pradesh	225.88	331.07	363.60	523.83	676.92	824.96	868.67	912.86	1035.37	416.87
Maharashtra	229.80	386.96	407.24	531.99	823.41	930.64	1072.65	1078.49	1182.60	601.46
Manipur	224.92	323.09	403.80	511.99	630.91	770.83	870.05	882.32	891.88	500.98
Meghalaya	255.19	381.04	423.83	510.62	665.88	704.70	890.04	976.49	993.59	435.31
Mizoram	285.33	377.62	348.70	497.79	681.03	781.59	920.77	806.93	967.69	529.27
Nagaland	319.93	382.11	485.78	606.35	756.29	825.12	978.02	918.37	1050.69	572.31
Orissa	224.01	289.32	328.84	456.76	688.61	822.43	966.26	842.82	1084.81	418.06
Punjab	274.52	440.75	508.38	606.36	775.62	901.96	1123.28	898.83	1154.07	598.02
Rajasthan	269.35	342.34	464.57	623.72	784.39	883.83	1033.22	900.37	1163.30	474.49
Sikkim	268.96	342.13	478.09	557.04	739.33	847.55	954.57	936.58	1119.48	506.98
Tamil Nadu	222.99	374.72	401.63	510.43	708.21	833.93	1007.70	1064.51	1163.31	514.22
Tripura	237.48	269.79	374.05	486.27	621.63	822.44	877.82	840.60	1136.20	456.40
Uttar Pradesh	265.71	376.34	436.36	532.54	701.90	867.58	887.64	1002.24	1095.31	463.16
West Bengal	264.17	377.98	413.91	512.89	658.08	812.88	891.85	885.48	1061.45	492.10
Andaman and Nicobar Islands	276.36	424.95	459.93	667.99	927.15	1097.60	1463.14	1180.47	1529.02	736.99
Chandigarh	337.34	417.22	580.50	647.11	954.05	1011.29	1305.84	886.94	1133.53	854.61
Dadra Nagar Haveli	263.95	353.98	423.40	513.94	753.82	807.28	1055.18	1036.70	1199.71	442.69
Daman and Diu	245.38	426.10	389.62	504.84	819.79	892.76	1073.87	934.64	1116.06	582.61
Delhi	369.63	508.39	607.26	691.36	946.17	1001.83	1078.95	990.97	1143.52	832.33
Lakshadweep	169.51	214.41	436.13	570.85	757.24	811.75	819.66	847.43	1122.01	564.20
Puducherry	229.67	402.37	424.68	594.86	772.25	821.98	999.91	1105.50	1120.95	630.59

during the accounting period, which is measured by additions to lifetime labour incomes due to higher educational qualifications. The changes in inventories are captured through the changes in the working-age population, which has reached the potential working age during the accounting period. The additions, depreciation, and other volume changes are also valued using the mean wages of 2001.

Human capital may also change between the two accounting periods because of revaluation (difference in lifetime labour incomes between the beginning and end of the accounting period). Hence, the term revaluation captures the changes in the value of human capital stock due to this price change. Table 15 provides the monetary

Table 13b

Lifetime income profiles by different educational groups for different states for 2001 (weighted by age cohorts) (in thousands of rupees)

State/union territory	*Illiterate*	*Non-formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Technical degree and diploma*	*Graduate and above*	*Weighted lifetime labour income*
Andhra Pradesh	469.44	778.49	905.02	1247.99	2084.55	2584.92	2874.08	3335.68	4049.50	1382.54
Arunachal Pradesh	609.76	681.78	1101.56	1394.57	1724.09	2433.23	2898.13	3006.69	3777.15	1342.14
Assam	472.07	549.83	673.80	983.63	1488.32	1806.15	2130.15	2474.65	2686.11	1082.66
Bihar	427.92	740.00	844.68	1005.06	1477.43	1905.90	2405.87	2708.56	3365.75	1002.38
Goa	539.70	847.98	905.90	1306.31	2129.42	2539.55	2916.08	3796.77	3471.44	1994.34
Gujarat	506.47	730.51	872.12	1236.65	1884.65	2381.01	2847.75	2990.04	3350.61	1464.12
Haryana	645.87	932.24	1303.26	1587.78	2032.78	2508.09	3115.19	2752.04	3851.51	1752.12
Himachal Pradesh	551.98	820.39	984.13	1336.87	2409.17	2875.76	3664.03	3053.90	4215.23	2011.37
Jammu and Kashmir	747.88	933.41	1492.96	1635.96	2156.71	2526.01	3183.67	3549.56	3519.08	1621.31
Karnataka	446.88	624.69	893.90	1136.26	2058.02	2373.04	2557.93	3627.89	3524.05	1428.26
Kerala	338.83	886.82	598.06	1091.42	2115.55	2602.87	2997.48	3381.41	4045.45	1991.35
Madhya Pradesh	415.40	618.28	725.86	1109.77	1619.72	2114.20	2573.64	2979.46	3388.57	1144.20
Maharashtra	478.52	969.94	898.79	1338.91	2322.76	2661.41	3101.45	3659.37	3790.64	1823.21
Manipur	499.85	663.19	904.26	1435.18	1743.57	2196.14	2585.08	2537.53	2552.13	1570.40
Meghalaya	616.80	785.50	986.65	1490.77	1829.06	2106.59	2735.57	2895.14	3137.90	1292.60
Mizoram	891.37	732.77	723.97	1423.72	1773.37	2235.71	2816.39	3029.42	3468.23	1541.67
Nagaland	918.13	958.36	1414.94	1626.33	2155.30	2444.54	3286.90	3111.20	3802.87	1813.03
Orissa	396.73	500.03	676.55	979.63	1789.92	2214.26	2786.10	2646.37	3427.45	1177.79
Punjab	595.37	800.23	1233.07	1386.19	1925.99	2407.36	2819.15	3206.18	3132.84	1678.53
Rajasthan	584.98	983.40	1073.83	1457.86	1845.57	2340.06	2896.53	2978.38	3291.90	1308.94
Sikkim	520.99	791.51	1073.07	1552.63	1875.86	2059.28	2432.81	3787.34	3145.25	1380.32
Tamil Nadu	378.93	803.11	791.47	1035.94	1642.80	2059.54	2522.84	3357.67	3369.64	1295.76
Tripura	563.33	845.83	888.31	1127.05	1677.81	2220.10	2587.92	4437.41	3288.49	1284.60
Uttar Pradesh	546.70	837.30	1041.93	1155.29	1646.44	2288.11	2555.97	2637.49	3242.54	1243.75
West Bengal	534.53	722.74	857.66	1205.81	1472.50	2118.72	2589.58	2851.55	3282.55	1247.74
Andaman and Nicobar Islands	589.24	823.53	1044.37	1557.15	2388.88	2927.59	2870.50	3515.57	4606.99	2022.88
Chandigarh	1053.77	1099.69	1774.50	1981.03	2613.31	2737.56	3502.42	5054.09	3022.87	2469.37
Dadra Nagar Haveli	678.23	936.93	1056.53	1507.69	2015.04	2212.90	2915.06	4012.39	4295.29	1555.06
Daman and Diu	684.34	956.82	1057.70	1612.67	2068.51	2548.86	2927.18	3983.75	3908.71	1913.34
Delhi	966.55	1260.32	1717.89	2174.46	2941.80	3218.85	3370.82	3459.80	4523.07	2821.53
Lakshadweep	420.71	558.56	889.92	1551.37	2252.57	2630.62	2686.79	3246.23	3954.53	1717.43
Puducherry	360.31	703.41	754.63	1011.48	1710.10	2063.05	2666.96	3682.12	3985.03	1729.05

accounts that give information on the opening stocks, closing stocks, and changes in stocks due to depreciation, changes in inventories, and revaluation for the two different accounting periods. It can be seen from Table 15 that in all the states, the gross human capital formation is positive.

However, as the estimates of human capital are sensitive to the choice of discount rates and income growth rates, we carried out a sensitivity analysis to examine how the estimates can vary for different choices of these rates. We carried out the analysis with discount rates of 4%, 10%, and 15%, keeping the growth rate constant at 6%. The income growth rates by state were captured based on the annu-

alized state domestic product growth rates in the period 1993–2001, keeping the discount rate constant at 4%. The results of the analysis are captured in Figure 3. The value of human capital accumulation is different for different scenarios but it is consistent. It can be seen that almost for all the north-eastern states, Andaman and Nicobar Islands, and Lakshadweep, the value of human capital accumulation is quite low in all the scenarios, whereas for the states of West Bengal, Maharashtra, Delhi, Bihar, Karnataka, Gujarat, and Kerala, the value is high in all the scenarios.

Comparison with the national accounting Indicators

As the main objective of our work is to link the analysis with the national accounts, in this section, we try to interpret the results in the light of various national income indicators. Table 16 compares the human and physical capital stocks for India. From the table it can be seen that the value of the economically effective human capital stock is greater than that of the physical capital stock in India except for Meghalaya and Sikkim. In some states like Assam, Bihar, West Bengal, and Jammu and Kashmir, the human capital formation is more than six times the gross fixed capital formation. At an all-India level, the value of human capital formation is 5.1 times higher than the gross fixed capital formation. In Table 16, we have reported separately the expenditures incurred on education. In reality, these expenditures need to be treated not as consumption but as investment. The investment in education yields returns in the form of human capital, which is positive for all the states. The human capital formation is highest for Uttar Pradesh, Maharashtra, Andhra Pradesh, West Bengal, Bihar, Madhya Pradesh, and so on, and lowest in the states of Meghalaya, Mizoram Arunachal Pradesh, Sikkim, and so on in absolute terms because of the higher labour force in these states. Even under different scenarios (Figure 3), in the north-eastern states, Lakshadweep, and Andaman and Nicobar Islands, the human capital accumulation is negligible, but in comparison to the amount of expenditure allocated to education, the returns are greater than 1. However, if we adjust for the population totals, the smaller states and union territories like Delhi, Chandigarh, Goa, and Kerala top the list in human capital accumulation. Similar to physical capital accumulation, which is considered an asset and is added to the respective state domestic products, human capital accumulation should be treated as an asset and be added to the GSDP. The GSDP adjusted for human capital (HSDP [human state domestic product]) is greater than GSDP in all the cases with the states of Bihar, Jammu and Kashmir, and Nagaland having ratios of over 2.5. Thus, a rupee spent in these states has a higher impact. In terms of the human capital stock, Delhi, Chandigarh, Andaman and Nicobar Islands, Himachal Pradesh, Goa, and Kerala have the highest wealth per capita and the states of Bihar, Assam, Madhya Pradesh, Orissa, and Uttar Pradesh have the lowest wealth per capita.

Table 14

Human capital accumulation between 1993 and 2001 (in Rs million)

State/union territory	*Illiterate*	*Non-formal education*	*Below primary*	*Primary*	*Middle*	*Secondary*	*Higher secondary*	*Technical degree and diploma*	*Graduate and above*	*Total human capital*
Andhra Pradesh	3 946 185	873 171	2 047 447	6 687 317	3 638 617	11 067 132	7 233 096	1 130 518	9 231 393	45 854 876
Arunachal Pradesh	89 202	4 253	38 350	85 886	84 444	120 627	77 484	5 692	79 833	585 771
Assam	1 312 289	103 811	924 940	1 145 143	1 894 138	3 105 113	1 292 408	36 528	1 402 527	11 216 898
Bihar	9 524 198	909 726	1 747 678	5 424 532	4 011 298	9 077 066	5 321 465	206 338	7 593 286	43 815 587
Goa	41 413	8 914	56 451	86 699	146 342	254 088	384 457	39 175	268 703	1 286 242
Gujarat	2 370 366	141 924	2 176 072	3 595 974	4 814 622	7 058 015	5 587 479	918 084	4 805 886	31 468 422
Haryana	1 356 969	104 809	378 897	2 170 947	2 470 671	4 174 054	2 028 361	225 413	2 435 656	15 345 778
Himachal Pradesh	208 289	34 982	126 560	546 535	1 014 735	1 859 560	918 444	88 831	763 824	5 561 761
Jammu and Kashmir	1 457 588	119 430	117 181	561 759	1 484 541	1 733 492	831 870	23 808	896 422	7 226 092
Karnataka	2 041 820	211 946	1 672 089	3 830 716	3 656 506	8 805 851	3 930 754	1 352 371	6 133 048	31 635 101
Kerala	187 146	105 854	808 646	2 112 684	6 171 175	7 682 281	3 411 387	1 499 317	4 329 507	26 307 998
Madhya Pradesh	2 448 870	1 063 387	2 308 297	5 300 322	6 607 257	6 272 397	4 664 440	242 080	6 604 200	35 511 249
Maharashtra	2 543 112	901 061	4 493 639	8 684 338	11 095 132	20 504 937	12 571 983	1 136 276	14 493 022	76 423 500
Manipur	79 464	10 645	29 495	156 533	299 796	368 437	274 694	3 470	288 876	1 511 410
Meghalaya	146 286	21 416	172 473	203 905	151 163	229 303	118 138	1 749	123 460	1 167 893
Mizoram	26 330	7 324	50 642	136 040	137 976	100 099	60 019	1 522	76 218	596 169
Nagaland	255 887	19 590	67 191	234 018	290 133	378 463	248 840	5 113	187 769	1 687 006
Orissa	1 152 905	98 050	992 923	2 621 171	2 288 261	4 596 759	2 352 708	282 735	3 294 892	17 680 403
Punjab	1 209 152	113 357	335 949	2 089 261	2 767 500	5 476 521	2 616 133	345 911	2 170 978	17 124 762
Rajasthan	3 520 454	1 339 731	2 346 042	4 522 216	4 808 223	5 270 247	2 307 907	71 102	3 592 548	27 778 470
Sikkim	23 005	3 188	37 696	76 379	57 017	51 805	35 496	2 319	36 050	322 955
Tamil Nadu	1 082 556	2 677 671	874 042	4 267 381	5 740 204	7 882 468	4 716 767	1 241 221	5 267 044	33 749 354
Tripura	143 292	16 286	158 099	363 542	417 117	269 585	93 996	11 061	241 365	1 714 344
Uttar Pradesh	12 605 926	1 499 497	2 545 205	8 749 109	14 585 901	15 838 882	12 346 596	193 508	13 376 809	8 174 1435
West Bengal	3 939 348	356 707	4 968 208	5 611 339	5 994 716	7 065 173	4 303 854	178 919	7 477 434	39 895 698
Andaman and Nicobar Islands	11 892	1 113	14 037	50 487	91 352	71 946	36 805	6 906	55 184	339 723
Chandigarh	83 868	4 997	20 148	101 438	142 967	235 661	183 895	38 845	281 074	1 092 892
Dadra Nagar Haveli	26 513	964	8 103	17 520	22 426	27 446	27 265	9 300	30 687	170 224
Daman and Diu	11 272	322	9 495	20 174	29 775	31 358	38 178	5 505	21 172	167 251
Delhi	1 052 413	85 194	382 993	1 927 065	2 818 185	4 059 978	2 628 725	111 493	6 224 770	19 290 815
Lakshadweep	752	673	3 619	8 955	13 733	10 975	1386	1 869	3 020	44 980
Puducherry	10 198	4 998	8 365	52 516	132 733	174 671	112 026	47 274	223 478	766 260
India	52 908 961	10 844 991	29 920 973	71 441 903	87 878 657	133 854 390	80 757 057	9 464 253	102 010 134	579 081 320

Table 15

Monetary accounts for human capital for the period 1993–2001 (in Rs million)

State/union territory	*Opening stock*	*Additions*	*Depreciation*	*Other changes*	*Revaluation*	*Closing Stock*	*Gross human capital formation over nine-year period*
Andhra Pradesh	17 586 308	18 186 921	2 341 493	-6 041 459	36 050 905	63 441 184	9 803 970
Arunachal Pradesh	224 995	235 994	24 999	-62 566	437 343	810 766	148 429
Assam	5 125 510	5 148 528	513 865	-1 828 408	8 410 644	16 342 408	2 806 254
Bihar	13 375 132	18 649 280	1 340 948	7 597 723	18 909 532	5 719 0718	24 906 055
Goa	502 982	387 670	68 529	-42 465	1 009 567	1 789 224	276 676
Gujarat	13 173 885	11 880 697	1 579 657	-1 777 982	22 945 365	44 642 307	8 523 057
Haryana	5 502 147	6 130 630	587 669	-766 966	10 569 782	20 847 925	4 775 995
Himachal Pradesh	1 741 070	2 042 586	304 945	-395 242	4 219 362	7 302 831	1 342 399
Jammu and Kashmir	2 185 674	6 883 518	277 629	-3 323 610	3 943 813	9 411 766	3 282 279
Karnataka	13 913 587	12 698 516	1 595 304	-3 110 432	23 642 322	45 548 688	7 992 780
Kerala	13 882 251	9 451 604	1 980 365	-3 270 830	22 107 590	40 190 248	4 200 409
Madhya Pradesh	15 128 184	15 308 990	1 977 443	-4 215 319	26 395 022	50 639 434	9 116 228
Maharashtra	27 873 741	27 551 675	4 167 025	-3 581 315	56 620 166	104 297 241	19 803 335
Manipur	545 474	551 839	75 529	-129 294	1 164 396	2 056 884	347 015
Meghalaya	420 684	494 524	43 516	-111 612	828 496	1 588 577	339 396
Mizoram	213 202	220 591	24 231	-8 014	407 822	809 372	188 346
Nagaland	427 691	496 180	47 967	311 595	927 198	2 114 697	759 808
Orissa	7 636 340	7 222 393	1 084 764	-2 334 379	13 877 153	25 316 743	3 803 250
Punjab	7 135 043	6 480 314	891 407	-1 355 783	12 891 638	24 259 805	4 233 124
Rajasthan	11 314 455	12 536 329	1 402 545	-3 252 916	19 897 603	39 092 925	7 880 868
Sikkim	119 910	123 335	12 801	5 861	206 561	442 865	116 395
Tamil Nadu	17 767 341	12 562 483	2 467 784	-3 348 973	27 003 628	51 516 694	6 745 725
Tripura	708 655	735 374	81 076	-225 913	1 285 960	2 422 999	428 384
Uttar Pradesh	35 103 132	36 541 101	4 435 616	-9 524 782	59 160 733	116 844 567	22 580 702
West Bengal	19 625 545	17 102 805	2 270 600	-5 072 030	30 135 522	59 521 243	9 760 175
Andaman and Nicobar Islands	130 494	113 290	13 287	12 034	227 686	470 217	112 038
Chandigarh	370 965	281 960	36 098	146 107	700 923	1 463 857	391 970
Dadra Nagar Haveli	37 837	42 849	5 341	37 639	95 077	208 061	75 147
Daman and Diu	37 251	38 965	4 877	48 077	85 085	204 502	82 165
Delhi	5 017 893	5 086 816	636 230	2 847 825	11 992 404	24 308 708	7 298 412
Lakshadweep	17 070	17 895	2 850	-4 956	34 892	62 051	10 088
Puducherry	322 736	246 525	42 050	-408	562 194	1 088 997	204 067
India	237 167 183	235 452 175	30 338 440	-42 778 796	416 746 385	816 248 503	162 334 940

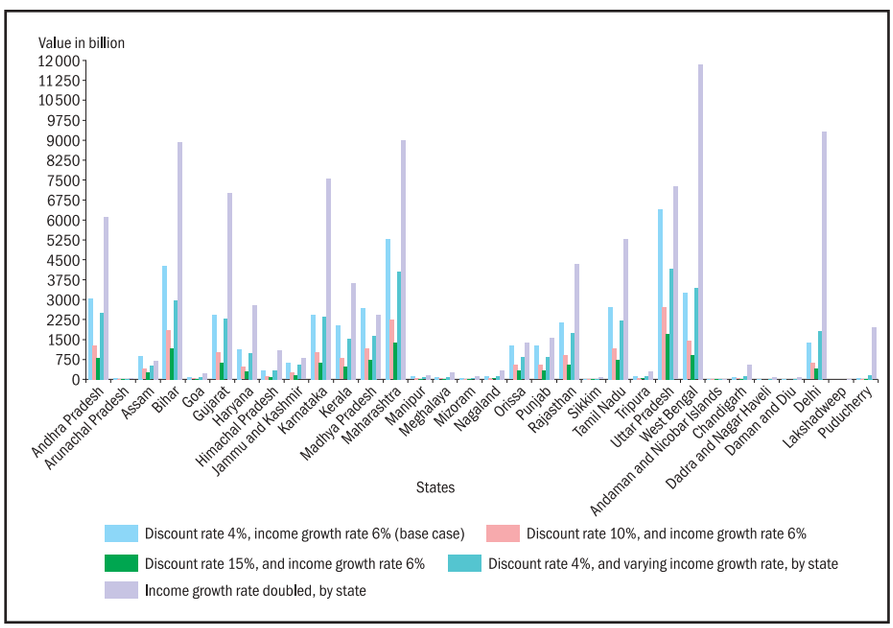


Figure 3

Annual human capital accumulation under different scenario

Table 16

Comparison with the national accounting indicators for 2002/03 (in Rs million)

State/union territory	GSDP	NSDP	GFCF in 1999/2000	Value of human capital in 1993 after taking account of revaluation	Value of human capital in 2001	GHCF extrapolated for 2002/03	Expenditure allocated to education	Gross annual educational HCF extrapolated for 2002/03	AHSDP	AHSDP/GSDP	HCF/GFCF	GFCF/GSDP	Per capita human in capital 1993	Per capita human capital in 2001	Per capita human capital accumulation
Andhra Pradesh	1 607 684	1 439 754	278 156	53 637 213	63 441 184	336 259	49 858.1	1 058 084	2 665 768	1.66	3.15	0.21	0.45	1.38	0.15
Arunachal Pradesh	19 450.5	17 395.1	10 101	662 337.5	810 766	11 384	1 754.9	15 545	34 995	1.8	1.37	0.59	0.46	1.34	0.14
Assam	354 314.2	317 208	25 403	13 536 154	16 342 408	29 035	30 396.4	297 470	651 785	1.84	10.25	0.08	0.41	1.08	0.11
Bihar	897 150.2	787 033	131 813	32 284 664	57 190 718	147 307	51 812.8	1 887 673	2 784 823	3.1	12.81	0.16	0.42	1	0.07
Goa	77 711	67 356	18 952	1 512 548.4	1 789 224	21 870	2 881.3	29 857	107 568	1.38	1.37	0.28	0.66	1.99	0.21
Gujarat	1 382 850	1 144 047	473 506	36 119 250	44 642 307	532 552	41 987.8	885 113	2 267 963	1.64	1.66	0.39	0.53	1.46	0.15
Haryana	658 372	579 374	142 723	16 071 930	20 847 925	176 526	18 688.1	475 448	1 133 820	1.72	2.69	0.27	0.6	1.75	0.17
Himachal Pradesh	159 460	142 024	78 305	5 960 431.7	7 302 831	95 684	10 024.6	140 477	299 937	1.88	1.47	0.6	0.59	2.01	0.21
Jammu and Kashmir	147 495	128 052	30 389	6 129 486.8	9 411 766	34 568	11 189	281 916	429 411	2.91	8.16	0.23	0.58	1.62	0.13
Karnataka	1 139 292	1 004 063	305 596	37 555 909	45 548 688	338 775	40 582.7	843 888	1 983 180	1.74	2.49	0.3	0.53	1.43	0.15
Kerala	761 819	696 021	135 971	35 989 840	40 190 248	157 363	32 893.1	476 709	1 238 528	1.63	3.03	0.21	0.77	1.99	0.22
Madhya Pradesh	1 132 756	974 607	210 791	41 523 206	50 639 434	232 010	62 279.6	957 860	2 090 616	1.85	4.13	0.2	0.42	1.14	0.12
Maharashtra	2 951 911	2 632 253	691 635	84 493 907	104 297 241	759 033	92 755.6	2 058 884	5 010 795	1.7	2.71	0.26	0.6	1.82	0.18
Manipur	35 312	32 047.8	15 196	1 709 869.9	2 056 884	18 174	2 738.6	36 901	72 213	2.05	2.03	0.51	0.5	1.57	0.16
Meghalaya	43 429	38 422.7	54 597	1 249 180.3	1 588 577	65 995	2 556.5	34 378	77 807	1.79	0.52	1.52	0.44	1.29	0.13
Mizoram	17 687.2	16 346.1	4 256	621 024.7	809 372	5 812	1 926.9	18 673	36 360	2.06	3.21	0.33	0.53	1.54	0.15
Nagaland	36 793.6	34 272	7 035	1 354 889.4	2 114 697	11 427	2 193.4	64 334	101 127	2.75	5.63	0.31	0.57	1.81	0.15
Orissa	446 844.5	387 373	69 161	21 513 493	25 316 743	75 918	20 774.2	412 292	859 137	1.92	5.43	0.17	0.42	1.18	0.13
Punjab	707 508.7	629 677.5	101 211	20 026 681	24 259 805	116 341	24 762.9	447 407	1 154 915	1.63	3.85	0.16	0.6	1.68	0.17
Rajasthan	873 717.5	768 878	172 249	31 212 058	39 092 925	194 068	38 620	808 966	1 682 683	1.93	4.17	0.22	0.47	1.31	0.13
Sikkim	11 527.3	10 386.5	11 679	326 470.7	442 865	15 836	1 392.5	11 142	22 669	1.97	0.7	1.37	0.51	1.38	0.13
Tamil Nadu	1 53 7 287	1 367 809	322 310	44 770 969	51 516 694	365 668	55 867	745 772	2 283 059	1.49	2.04	0.24	0.51	1.3	0.14
Tripura	60 616.9	56 603.4	7 620	1 994 615.6	2 422 999	10 165	4 923.7	45 166	105 783	1.75	4.44	0.17	0.46	1.28	0.13
Uttar Pradesh	1 796 015	1 568 625	332 955	94 263 865	116 844 567	402 598	77 544.2	2 339 064	4 135 079	2.3	5.81	0.22	0.46	1.24	0.13
West Bengal	1 671 371	1 537 807	140 015	49 761 068	59 521 243	172 759	60 355.2	1 043 057	2 714 428	1.62	6.04	0.1	0.49	1.25	0.13
Andaman and Nicobar islands	11 563.9	10 407.51	4 313	358 179.2	470 217	4 709	956.8	11 037	22 601	1.95	2.34	0.41	0.74	2.02	0.19
Chandigarh	53 710	50 790	9 001	1 071 888.4	1 463 857	10 866	1 873.9	37 302	91 012	1.69	3.43	0.2	0.85	2.47	0.23
Delhi	744 740	687 470	8 128 824	17 010 297	208 061	148 458	13 488.4	667 528	1 412 268	1.9	4.5	0.2	0.44	1.56	0.25
Puducherry	42 660	38 280	208 915	884 930.4	204 502	11 257	1 639.8	21 273	63 933	1.5	1.89	0.26	0.58	1.91	0.18
India	1 938 1049	17 164 383	12 122 678	653 606 357	790 788 748	4 502 417	758 718	16 153 216	35 534 263	1.83	5.13	0.16	0.51	1.39	0.14

GFCF – gross fixed capital formation; GHCF – gross human capital formation; AHSDP – adjusted GSDP for human capital; NSDP– net state domestic product; GSDP– gross state domestic product; HCF – Human capital formation

Conclusions

The paper suggests an accounting framework to measure human capital formation in India. It also presents preliminary estimates of the relative contribution of education and training to human capital formation in India. The model chosen considers the value of depreciation due to ageing and other accumulations due to investments in human capital. The method is mainly based on the Mincerian specification and the Jorgenson and Fraumeni approach. The value of human capital stock depends not only on the number of people educated but also on skilled training, quality of education, and so on. The results show that in almost all states, the returns to education are positive and human capital accumulation though significant, is not very high in some states. However, the accumulation of human capital is not uniform across all the states. It can be seen that the states with more employment opportunities have a potentially higher human capital accumulation. This also reflects the need for more decentralized development.

This study has some limitations. As the role of non-market activities was not considered, the value of human capital may have been underestimated. In addition, this paper is based on the NSSO survey that, though representative, does not include the topmost layer of society, that is people working with MNCs (multinational companies) or in other private professions drawing hefty pay-packets. Therefore, the returns may be much higher than those obtained in this paper. However, these people comprise roughly only 1% of society and our estimates will be more grounded in reality if we ignore this 'creamy layer', which may give a skewed picture of Indian society.

Appendix 1

Details of NSSO sampling technique

The sample of households is drawn based on the two-stage stratified random sampling procedure. The first-stage units are the census villages, and the villages and urban blocks are selected in the form of two or more independent sub-samples. The survey provides information on the activity status and days worked, as well as individual characteristics such as age, educational level, region of residence, and so on. Household information about the area of landholding and the ownership of homestead is also available.

Appendix 2

Heckman maximum likelihood estimation method

The estimated ρ (rho) indicates whether the Heckman model is relevant or not. If ρ is significantly different from zero, we may reject the null hypothesis of no correlation between the two error terms in the selection and outcome equation. However, the Wald test statistic indicates that is statistically significant at 5% for the entire age cohort for both the years 1993 and 1998 (except for the age cohort 15–20 and 26–30 for 1998). This indicates that there is a sample selection bias in estimating the OLS, and we need to take into account the latent information that is captured by the inverse Mills ratio (variable λ [lambda]) obtained from the first-stage probit estimation. For all the age cohorts for 1993 and 1998, the estimates of λ are statistically different from zero at 5% level, indicating that wages are positively influenced by some unobserved factors like parental characteristics, ability measures, quality of schooling, and so on.

References

Aulin-Ahmavaraa P. 2004. **Moving human capital inside the production boundary**. *Review of Income and Wealth* **50**(2): 213–228

Barro R J and Lee JW. 1993. **International comparisons of educational attainment**. *Journal of Monetary Economics* **32**(3): 363–394

Barro R J and Lee JW. 1996. **International measures of schooling years and schooling quality**. *American Economic Review (Paper and Proceedings)* **86**(2): 218–223

Barro R J and Lee JW. 2001. **International data on educational attainment: updates and implications**. *Oxford Economics Papers* **53**(3): 541–563

Becker G S. 1966. **Human capital: a theoretical and empirical analysis, with special reference to education** [General Series, Number 80]. NewYork: National Bureau of Economic Research

Duraisamy P. 2000. **Changes in returns to education in India, 1983–94: by gender, age-cohort and location** [Centre Discussion Paper No. 815].Yale University: Economic Growth Centre

Engel E. 1883. ***Der Werth des Menschen***. Berlin:Verlag von Leonhard Simion

Hamilton K and Clemens M. 1999. **Genuine savings rates in developing countries**. *The World Bank Economic Review* **13**(2): 333–356

Heckman J. 1974. **Sample selection bias as a specification error**. *Econometrica* **471**

Institute of Applied Manpower Research. 2002. ***Manpower Profile India: Yearbook 2002***, 10th edn. New Delhi: Institute of Applied Manpower Research. 320 pp.

Jorgenson DW and Fraumeni B M. 1989. **The accumulation of human and non-human capital, 1948–1984**. In *The Measurement of Savings, Investment and Wealth*. pp. 227–282, edited by R E Lipsey and H S Tice Chicago, IL: The University of Chicago Press

Jorgenson DW and Fraumeni B M. 1992. **The output of the education sector**. In *Output Measurement in the Services Sector*, pp. 303–338, edited by Z Griliches. Chicago, IL: The University of Chicago Press

Kunte A, Hamilton K, Dixon J, Clemens M. 1998. ***Estimating National Wealth: methodology and results*** [Environment Paper No. 57].Washington, DC:World Bank

Le T, Gibson J, and Oxley L. 2006. **A forward looking measure of the stock of human capital in New Zealand**. Machester school, Vol. 74 No.5, pp 593-609

Lee JW and Barro R J 2001. **Schooling quality in a cross-section of countries**. *Economica* **68**(272): 465–488

Mincer J. 1958. **Investment in human capital and personal income distribution**. *Journal of Political Economy* **66**(4): 281–302

Mincer J 1974. ***Schooling, Experience, and Earnings***. NewYork: National Bureau of Economic Research

OECD (Organization for Economic Cooperation and Development). 1998. ***Human Capital Investment – an international comparison***. Paris: Centre for Educational Research and Innovation, OECD

Schultz, TW. 1961. **Investment in human capital**. *The American Economic Review* **1**(2): 1–17

Sharma D and Ram R. 1974. **Suggestions for treatment of human capital in national accounts — with special illustrations from the Indian data**. *Review of Income and Wealth* **20**: 501–514

Smith A. 1937. **The Wealth of Nations**. NewYork: Modern Library. pp. 1001, 299–366

Wei H. 2001. **Measuring the stock of human capital for Australia: a lifetime labour income approach** [Paper prepared for the methodology advisory committee] Australian Bureau of Statistics.

Wößmann L. 2003. **Specifying human capital**. *Journal of Economic Surveys* **17**(3): 239-270

Bibliography

Alfred M. 1959. ***Principle of Economics***. NewYork: Macmillan Company. pp. 469–470,705–706

OECD (Organization for Economic Cooperation and Development). 2001. ***The Well-being of Nations: the role of human and social capital***. Paris: OECD

TheodoreW S. 1961. ***Investment in human capital***. *American Economic Review*: 1-17

Treadgold M. 2000. **Early estimate of the value of Australia's stock of human capital**. *History of Economics Review* **32**: 46–57

Weisbrod B A 1961. **The valuation of human capital**. *Journal of Political Economy* **69**(5): 425–436

Green Accounting for Indian States and Union Territories Project

In common with most developing nations, India faces many trade-offs in its attempt to improve the living standards of its people. The trade-offs emerge in various arenas, and several mechanisms for decision-making (including political institutions) have been developed to help choose between competing alternatives. Unfortunately, most of these decision mechanisms do not take into account intergenerational choices, i.e. trade-offs between the needs of the present and the future generations. In our view, it is urgently necessary to develop a mechanism to do this because many of the choices we make today could severely affect the welfare of our children tomorrow.

Therefore, we propose to build a framework of national accounts that presents genuine net additions to national wealth. This system of environmentally-adjusted national income accounts will not only account for the depletion of natural resources and the costs of pollution but also reward additions to the stock of human capital.

The Green Accounting for Indian States and Union Territories Project (GAISP) aims to set up economic models for preparing annual estimates of 'genuine savings', i.e. true 'value addition', at both state and national levels. The publication of the results will enable policy-makers and the public to engage in a debate on the sustainability of growth as well as make cross-state comparisons. It is hoped that a policy consequence of the project is gradual increases in budgetary allocations for improvements in education, public health, and environmental conservation, all of which are key elements needed to secure India's long-term future.

Monograph 5

This study is part of a larger exercise to build an empirically based framework that would enable policy-makers and the public at large to make informed trade-offs between competing development goals. Whilst our other monographs have covered aspects of natural capital depletion, for example the value of forest services, this monograph is focused on the creation of human capital through education. Human capital is one of the most important assets of a country and a key determinant of a country's economic performance. We argue that the cost of education should be viewed as investment as it generates streams of future income. This monograph attempts to estimate the monetary value of this human capital accumulation as a proportion of gross domestic product at the national and state levels. Our findings suggest that human capital accumulation is not only very large, but in some states, many times larger than physical fixed capital formation. Indeed, the country may be having better success in human capital formation that was previously recognized. Of course, the authors recognize the limitations of this study, given data and methodological constraints.

For further details, log on to

www.gistindia.org