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Changes in Employment Structures and Investments in Children's Education: Evidence from Rural India[*]

March 2013

Kazuya Wada[†]

Abstract

This study investigates the effects of changes in non-agricultural sectors in India on investments in children's education. By using data from the Census of India (1981, 1991, and 2001) and the India Human Development Survey 2005 (IHDS), this study seeks to capture changes in Indian economic situation for the two decades between 1981 and 2001 and examine the effects of those changes on children's educational attainments in 2005. The results of empirical analysis suggest that changes in the first and second decades have different characteristics in terms of expansion among the non-agricultural sectors. In addition, estimation results imply that the expansion of non-agricultural sectors in the 1990s have had positive effects on investments in girls' education, leading to the alleviation of gender disparity in education. However, it should be noted that such expansion may aggravate income inequality in the future because it adversely affects children from poor households.

JEL Classification Codes: O15, I25, J16

Keywords: Non-agricultural Sectors, Investments in Children's Education, Disparity

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1. Introduction

In recent decades, the world economy has been drastically globalized. Rapid changes have significantly influenced not only developed countries but also developing countries, bringing about various effects worldwide. The globalized economy has affected the economic policies of every country, increased the speed of flow of people, goods, and money, and changed industrial and employment structures, leading to changes in the importance of investments in human capital. This study examines the effects of changes in employment structure on investments in children's education in a developing country, India.

In the early 1990s, the World Bank published "The East Asian Miracle," evoking global attention toward conspicuous growth in the region. Since then, Asia has achieved a more distinctive and impressive rate of development. Although the global recessions of 1997 and 2008 caused economic stagnation in the region, the Asian economy recovered before too long, steadily resuming its growth. It would not be an exaggeration to say that Asia's economic development has been one of the most important driving forces in the global economy in recent decades.

Among the Asian countries, India has achieved significant economic growth in the globalized economy since the 1990s. According to the World Economic Outlook, its average GDP growth rate was 5.6% in the 1990s; and in the 2000s, especially after 2004, India achieved a rate of 9–11%—except in 2008 and 2009, when it was affected by the world recession. For this reason, India, like China, has received considerable attention worldwide, indicating its strong economic presence. As one of the most important reasons for India's significant economic growth, it is often pointed out that the trade liberalization in 1991 greatly influenced the Indian economy.[1] The average duty rate declined by more than half, and the percentage of goods that could be imported without a

[1] Although trade liberalization was gradually implemented in the 1980s, trade policies that had previously been extremely restrictive were drastically reformed in 1991.

license or quantitative restriction rose sharply (Topalova 2005).[2] It is inferred that changes in the economy would create upheaval in the people's lives. This study focuses, in particular, on the effects of changes in economic surroundings on investments in children's education.

As can be observed in its peculiar demographic composition, it is well known that women's status in India is quite low compared to that of men.[3] The problem of gender disparity in India also applies to educational achievements, but significant improvements have been seen in recent decades. The total literacy rate in India, which was 36% in 1981, has steadily improved, from 42% in 1991, to 55% in 2001 and 64% in 2011.[4] As seen in the right-hand column of Table 1, the ratio of the female literacy rate to that of males was quite distinctive in 1981, with the former being only half **that** of the latter. In recent decades, however, the ratio has steadily increased, suggesting gradual improvements in gender disparity vis-à-vis educational achievements.

What factors have prompted such changes in education? First, in terms of economics, the effects of an expansion of job opportunities on investments in girls' and boys' education should be pointed out, though it is true that education policy tends to play a principal role in educational improvements. Rosenzweig and Schultz (1982) demonstrate that an increase in female labor participation could increase returns to investments in girls, thus reducing excessive mortality rates among them.[5] Second, we should also focus on the effects of expansion among non-agricultural sectors. Kurosaki and Khan (2006), using Pakistani micro-level data, show that returns to education are larger in non-agricultural sectors than in agricultural ones. Third, the effects of such changes in economic situation may differ by gender. For example, Munshi and Rosenzweig (2006), who

[2] With regard to the effects of trade liberalization in India, see Krishna and Mitra (1998), Topalova (2005), and Aghion et al. (2008), among others.
[3] In developed countries, it is usually men that die earlier, so that in general, the female population tends to be larger than the male population. This is a natural pattern one observes when women and men enjoy equal levels of access to nutrition and health care. In contrast, in India, there are more men than women, reflecting a higher mortality rate among women.
[4] The figures are calculated as the ratio of the literate population to the total population.
[5] See also Kishor (1993) and Murthi, Guio, and Dreze (1995).

investigated investments in children's education in Mumbai, showed that girls who tend to be less bound by traditional institutions compared to boys have more opportunities to receive an English education. In addition, on the basis of a household survey in southern India, Oster and Millett (2010) show that the establishment of call centers in southern India to handle the concerns of customers in the United States and Europe has improved people's perception of returns to investments in English education, leading to an increase in such education among girls in particular. It is therefore expected that people believe that an expansion in non-agricultural employment will increase girls' possibility to earn more money and create a preferable situation for girls' education. In other words, an expansion among non-agricultural sectors could have a great potential to promote further development: in the Indian context, it is important to pay attention to the effects of an expansion among non-agricultural sectors in reducing gender disparity, because that disparity is so much more severe in rural areas than in urban ones.[6]

To capture changes in India's employment structure at the semi-macro level, this study makes use of data from the Census of India (1981, 1991, and 2001) and pays special attention to differences in labor force structure before and after 1991. In addition, data from the India Human Development Survey 2005 (IHDS), which was executed in 2005 by the National Council of Applied Economic Research of India (NCAER) and Maryland University, are employed to analyze household behavior. By using these data, this study examines the effects of changes in employment structure before and after 1991 (captured at the district level) on children's educational achievements (captured at household level).[7]

[6] As has been pointed out in previous studies, it goes without saying that agricultural sectors still have significant effects on development, and that there is plenty of room for improvement. See Ahluwalia (1978), Datt and Ravallion (1998, 2002), Kijima and Lanjouw (2005), and Lanjouw and Murgai (2009), among others.

[7] Of course, as many previous studies point out, individual characteristics—in particular, those of the mother—are quite important factors. In considering individual and household characteristics, therefore, this study examines semi-macro-level changes in economic surroundings, as will be explained later in this paper.

The remainder of this paper is organized as follows. Section 2 describes the data used herein. After the theoretical and empirical models used in the analyses are presented in Section 3, Section 4 details the estimation results. Section 5 provides concluding remarks.

2. Data and Outlook

2.1 District-Level Data from the 1981, 1991, and 2001 Censuses

To capture recent expansion among non-agricultural sectors at the district level, the data derived from the three aforementioned Indian censuses are examined. District-level data from the three censuses are modified, based on the 1981 census districts; this leads to total 368 districts within the sample.[8]

Labor forces in the Censuses are roughly categorized into two groups: "main workers" and "marginal workers." The former is a worker who engages in any economically productive work for 183 days or more in the year preceding the survey, and the latter otherwise. This study focuses on main workers, because it is sound to expect returns to investments in education to be strongly and primarily affected by the employment situation of main workers, rather than that of all workers, including marginal workers.

The three censuses captured data on the industrial categories of workers on the basis of the national industrial classification.[9] Among the main workers, cultivators, agricultural laborers, and those who engage in livestock etc. are classified as "agricultural workers" in this study, while the others are "non-agricultural workers." This study examines the effects of changes in the ratio of non-agricultural workers to all main workers on investments in children's education.

[8] The 1991 and 2001 data are modified so as to align with the district borders in the 1981 Census map. Jammu & Kashmir and Assam are excluded, as their data were only partial.

[9] The 1981 and 1991 Censuses have 10 categories: cultivators, agricultural laborers, livestock etc., mining and quarrying, household industry, other than household industry, constructions, trade and commerce, transport etc., and other services. "Livestock etc." is, precisely, "livestock, forestry, fishing, hunting and plantations, orchards, and allied activities," and "transport etc." is "transport, storage, and communications." The 2001 Census provides for 13 categories.

Let us examine the ratios of main workers to the total population (hereafter the "labor force participation rate"). The male labor force participation rate was 52% in 1981, 51% in 1991, and 46% in 2001; on the other hand, the female labor force participation rate was 14% in 1981, 16% in 1991, and 15% in 2001. These figures suggest that although both the female and male labor force populations increased, the total population had also expanded, so that the labor force participation rate actually decreased, especially in the second decade.[10] Next, let us closely examine non-agricultural workers. The number of female non-agricultural workers was about 8 million in 1981, 12 million in 1991, and 20 million in 2001, while the number of male non-agricultural workers was 61 million in 1981, 80 million in 1991, and 109 million in 2001. The proportion of female non-agricultural workers to female main workers was 19% in 1981, 19% in 1991, and 29% in 2001; as for males, those numbers were 34%, 37%, and 47%, respectively. The growth rates of female non-agricultural workers were 44% in the former decade and 71% in the latter, while those of male non-agricultural workers were 33% and 36%, respectively. These figures imply that, for both genders, the magnitude of change in the latter decade exceeded that in the former.

In addition, regional patterns of difference in the proportion of non-agricultural workers to total main workers at the district level are shown in Figures 1 and 2, by period and by gender. They seemingly show not only that the amount of change in the latter decade is larger than that in the former, but also that regional patterns differ greatly between the two decades. Table 2 shows the proportion of non-agricultural workers in each census; the means of the differences between the two decades at the district level; and the results of statistical tests of mean difference to evaluate whether differences between the two decades are the same. In addition, Table 3 presents the correlation of the

[10] The total male population was about 341 million in 1981, 422 million in 1991, and 505 million in 2001; the total female population in those years, meanwhile, was 318 million, 391 million, and 470 million, respectively. On the other hand, the male labor force population was 175 million, 215 million, and 230 million, and female labor force population was 45 million, 62 million, and 70 million, respectively.

differences between the two periods, to examine whether or not regional patterns differed. They show not only that changes in the proportion of non-agricultural workers differed between the two decades for both genders (t-value: -24.5 for men, -14.0 for women), but also that regions where huge changes occurred are completely different between the two decades, for both genders (correlation: 0.18 for men, 0.17 for women). These results imply that economic changes in India in the former decade and those in the latter were quite different, in terms of changes in the proportion of non-agricultural workers. These simple statistical tests imply that the mean and regional patterns are quite different between the two decades.

Let us now consider the extent to which people responded to these changes in economic surroundings.

2.2 Household Data from the IHDS

The IHDS was executed in 2005 by NCAER and Maryland University.[11] The IHDS was administered to a nationally representative sample of 41,554 households located in 384 of 593 districts identified in the 2001 census, across all states and union territories of India, with the exception of Andaman Nicobar and Lakshadweep (Desai et al. 2009). In addition to household characteristics, a considerable amount of information on individual members and villages is contained in the IHDS. This study makes use of information relating to individual, household, and village characteristics.

Before embarking on a description of the IHDS, some important points should be considered. The IHDS data used in this study consist mainly of four datasets: household, individual, non-resident, and birth-history data. The individual dataset contains only residents of the household. Non-resident members—for example, children who are away in order to study—can be captured by

[11] IHDS data can be obtained from http://www.ihds.umd.edu/.

using the non-resident dataset. However, those who left their native home owing to marriage are ignored when only the individual dataset is used. Therefore, for analyses of children's education in a later section, the birth-history dataset is mainly used and supplemented by the household, individual, and non-resident datasets. It should be noted that the birth-history dataset does not contain information on all the households that can be observed in the household dataset: about 30,000 households are represented in the birth-history dataset, while there are about 40,000 in the household dataset.

Table 4 shows the means of schooling years for each generation, calculated as per the individual dataset. The younger the generation is, the greater the number of schooling years, suggesting that the Indian environment for education has steadily improved in recent decades. Table 5 details the proportions of people aged 21–25 who graduated from elementary school (eight years) or more, graduated from secondary school (10 years) or more, and graduated from senior secondary (12 years) or more; these figures are calculated by using the individual dataset. Some features appear to be obvious. First, educational achievement is much higher in urban areas than in rural ones. Second, the lower the aggregate education level is, the larger the difference between the genders. However, it should be noted that the female–male ratio values are generally similar across all levels. Third, gender disparity in education is greater in rural areas than in urban ones. Although Tables 1 and 4 show that the educational environment has steadily improved, educational attainments in rural areas cannot necessarily be viewed with optimism: there is still plenty of room to mitigate gender disparity.

Education is expected to increase one's future income. To what extent does schooling actually contribute to increases in one's income? Here, returns to investments in education are estimated through the use of the following procedure.[12] (1) A labor allocation model is examined by

[12] The method of Kurosaki and Khan (2006) is applied to the estimation, although there are some

using a multinomial logit model with five occupation categories: household work, non-agricultural wage employee, agricultural wage employee, non-agricultural self-employed, and agricultural self-employed. (2) Using the fitted probabilities calculated from the first step, the Mincer equation or a Cobb–Douglas production function is estimated. Table 6 presents returns to investments in education, estimated mainly from the household dataset and by using data relating to male workers.[13] The figures in the right-hand column are calculated by dividing the coefficients of the dummy variables for the three education levels by schooling years, indicating annual rates of return to schooling years. In general, the returns to education for non-agriculture are much larger than those for agriculture. For example, the annual rate of returns to education at the secondary level is 1.5% for agricultural self-employed, while it is 2.3% for non-agricultural self-employed. In addition, it should be noted that the higher the educational attainment, the higher the return: the annual rates of return to a schooling year for non-agricultural wage employees are 1.4% for primary, 2.1% for secondary, and 3.0% for senior secondary. As mentioned, the proportion of non-agricultural workers greatly expanded in the 1990s. Then, how did such a change at the district level influence people's investments in children's education?

This study pays particular attention to the effects of expansion among non-agricultural sectors, since about 70% of Indians live in rural areas and continue to experience serious problems, for example poverty and gender disparity. For these reasons, our empirical analyses focus on those who live in rural areas. In the next section, theoretical and empirical models by which to analyze investments in education are provided.

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data-based differences. For example, Kurosaki and Khan (2006) used panel data and employed the data of a relatively small area, etc.

[13] Owing to space constraints, the result of the first-stage estimation is not reported. All the estimation results can be obtained from the author upon request.

3. Model and Empirical Strategy

3.1 Maximization Problem

This section describes how households maximize their utility under their expected returns to investments in children's education, and how changes in economic surroundings impact their expectations. In addition, an estimation strategy is outlines based on the model. First, for simplicity, let us assume the parents' two-period maximization problem, as follows:

$$\max_{S} \quad Y_1 + w_c T - (p + w_c S) + \frac{1}{1+\delta}\Big(Y_2 + E\big(I(S)\big)\Big).$$

Subscriptions are for each period. *Y* is parents' income, w_c shows the expected wage of child labor, *T* indicates time endowment of children, *S* is the amount of schooling, and *p* is the price of schooling, for the first period. δ is the subjective discount rate for parents. Parents also expect children's income for the second period, $E\big(I(S)\big)$, which is a function of schooling in the first period ($I'(S) > 0$ and $I''(S) < 0$ are assumed). In other words, it is presumed that changes in economic conditions will impact parents' expectations vis-à-vis children's earnings in the second period. Assuming the inner solution, the first-order condition for this maximization problem provides the following:

$$\frac{E[I'(S)]}{1+\delta} = p + w_c. \qquad (1)$$

Here, p is tuition and w_c is the income that children could earn if they worked instead of being schooled. In other words, the latter indicates the opportunity costs for a unit of schooling that

children's education imposes on the household in the first period. Therefore, it is believed that $(p + w_c)$ on the right-hand side reflects the total cost of children's additional education. $E(I'(S))$ is additional expected income in the second period for an additional unit of education in the first period. Equation (1) demonstrates that parents make investments in children's education to the extent that the additional expected return to education in the second period, which is divided by the subjective discount rate, is equal to the total costs of children's additional education in the first period. In other words, parents decide upon their investments by considering the total costs of children's additional education in the first period and the expected income in the second period. Assuming the corner solution, however, it should be noted that parents make no investment ($S = 0$) if $\frac{E[I\prime(S)]}{1+\delta} < w_c + p$.

3.2 Influence Channels for Expected Income

How, then, do changes in economic surroundings affect people's expected incomes? Let us assume that people form their expectations by observing wage distribution: a standard normal distribution of wage for men and a left-truncated distribution for women. The seeming mean (truncated mean) of wage for women is greater than the true mean, on account of the left truncation, while that for men accords with the true mean. Assume that $x \sim N(\mu, \sigma)$, ϕ a standard normal pdf, Φ the cdf, and $\frac{a-\mu}{\sigma}$ a truncation point. In this case, Δ, the difference between the true and the seeming mean, is $\sigma \cdot \phi\left(\frac{a-\mu}{\sigma}\right) / \left(1 - \Phi\left(\frac{a-\mu}{\sigma}\right)\right)$.

Wage distribution changes can be induced through two channels: one is a shift of the mean of the wage distribution, and the other is a change in the variance. When the economy is animated, the distribution is expected to move rightward. In addition, such an economic change may make the variance large, because the vocational choices in India are essentially limited.

At first, suppose *s*, a rightward shift of the wage distribution with the variance invariant, which is caused by a change in the economic surroundings, particularly increases in the proportion of non-agricultural workers, that affects both genders alike. For men, there is no truncation in the distribution, so that the new mean is larger than the old one by *s*. For women, on the other hand, the width of the shift of the seeming mean is less than *s*, because there the distribution is left-truncated, so that the difference between the new true mean and the new seeming mean is less than $\sigma \cdot \phi\left(\frac{a-\mu}{\sigma}\right) / \left(1-\Phi\left(\frac{a-\mu}{\sigma}\right)\right)$.[14] That is, the shift in the seeming mean for women is not as large as that in the true mean. In other words, when changes in the economic surroundings have the same effects on the wage distribution of both genders, the shift of the mean that can be observed is smaller for women than for men.

Next, let us assume that the variance changes with the mean invariant. Most of the female main workers are engaged in agricultural sectors, so even subtle changes in an employment structure may result in an increase in variance. The seeming mean, however, does not always become large when the variance increases, because $\sigma \cdot \phi\left(\frac{a-\mu}{\sigma}\right) / \left(1-\Phi\left(\frac{a-\mu}{\sigma}\right)\right)$ depends not only on σ but also on a. If the variance increases from σ_0 to σ_1 ($\sigma_1 > \sigma_0$), the difference between the new true mean and the new seeming mean is $\sigma_1 \cdot \phi\left(\frac{a-\mu}{\sigma_1}\right) / \left(1-\Phi\left(\frac{a-\mu}{\sigma_1}\right)\right)$. In this case, it is impossible to determine the sign of $\sigma_1 \cdot \phi\left(\frac{a-\mu}{\sigma_1}\right) / \left(1-\Phi\left(\frac{a-\mu}{\sigma_1}\right)\right) - \sigma_0 \cdot \phi\left(\frac{a-\mu}{\sigma_0}\right) / \left(1-\Phi\left(\frac{a-\mu}{\sigma_0}\right)\right)$, because $\sigma \cdot \phi\left(\frac{a-\mu}{\sigma}\right) / \left(1-\Phi\left(\frac{a-\mu}{\sigma}\right)\right)$ is a function of a and σ, as mentioned earlier. This is depicted in Figure 3. Nevertheless, as shown in that figure, $\sigma \cdot \phi\left(\frac{a-\mu}{\sigma}\right) / \left(1-\Phi\left(\frac{a-\mu}{\sigma}\right)\right)$ increases as the

[14] Provided only the mean shifts by *s* with the variance invariant, the difference between the true and new seeming is $\sigma \cdot \phi\left(\frac{a-\mu-s}{\sigma}\right) / \left(1-\Phi\left(\frac{a-\mu-s}{\sigma}\right)\right)$. $\phi\left(\frac{a-\mu-s}{\sigma}\right) / \left(1-\Phi\left(\frac{a-\mu-s}{\sigma}\right)\right) - \phi\left(\frac{a-\mu}{\sigma}\right) / \left(1-\Phi\left(\frac{a-\mu}{\sigma}\right)\right)$ is less than zero since $\phi(\cdot)/(1-\Phi(\cdot))$ is monotonically increasing with the truncation point *a*, as shown in Bagnoli and Bergstrom (2005). This suggests that the seeming mean does not shift by *s*.

variance begins to increase at first, save for some cases where the truncation point is near the true mean.

Wages can be significantly affected when the economy is brisk or the employment structure changes. Therefore, it is believed that some factors—like changes in the labor force participation rate or in the proportion of non-agricultural workers—can bring about changes in wage distribution: an increase in the true mean and a decrease in the variance. Increases in the proportion of non-agricultural workers, on which this paper especially focuses, would attract people to the non-agricultural sectors, because incomes within the non-agricultural sectors are larger than those in the agricultural sectors. The problem here is the extent to which people evaluate the importance of education and make investments in their children's education. As shown above, education has significant effects on earnings, especially among those who engage in non-agricultural sectors. However, it is theoretically unpredictable whether or not people will invest in their children's education under such circumstances—because, as already mentioned, it is seldom clear whether the current expected income or the future expected income will be larger.

In the Indian context, it should be noted that the impacts of economic shocks that cause changes in the wage distribution may differ between the genders. First, the practice of dowry is persistent in India, and therefore, it is a heavy financial burden for parents to have girl children. As some studies point out, it is possible that the burden of dowry could be reduced by the promotion of female labor participation, because that makes women economically valuable (Bardhan 1974; Rosenzweig and Schultz 1982). Therefore, the impacts of changes in economic surroundings may be preferable—for women, in particular—if changes in economic surroundings are such that they allow women to have more opportunities to earn money outside their home. Increases in employment within the non-agricultural sectors would increase expected incomes among women, bring about a large shift in the distribution for women, and lead to greater investments in girls' education. Second,

as Munshi and Rosenzweig (2006) show, the extent to which girls are bound by traditional institutions is smaller than that for boys, so that compared to boys, girls can make their vocational choices relatively freely and receive more English education, in response to changes in the economic surroundings in the 1990s.

According to the Census of India, the proportion of female main workers who engaged in agricultural sectors was 81% in 1981, 81% in 1991, and 71% in 2001, indicating that a considerable number of women have had little choice but to work in agricultural sectors, despite the non-agricultural sectors having expanded. Therefore, current wages among girls may not be overly large. To put it another way, the future expected income for girls that is promoted by education could be relatively large. Nonetheless, it is still theoretically unclear whether future additional expected income would exceed the current total cost of additional education, in case of both girls and boys. Empirical analyses need to be undertaken to address this question.

3.3 Empirical Strategy

From the theoretical model presented above, the "baseline model" is obtained as an empirical reduced form:

$$S_{ijkl} = S\left(X_{ijkl}, X_{jkl}, Z_{kl}, Z_l\right) + \varepsilon_{ijkl}, \qquad (2)$$

where S_{ijkl} denotes educational achievements of child i of household j in village k, within district l, and X_{ijkl} and X_{jkl} are vectors of child and household characteristics, respectively. Z_{kl} is a vector that represents characteristics of village k, and Z_l shows characteristics of district l in which household j lives. ε_{ijkl} is an error term with the expected value of zero. Children's characteristic is their age and household characteristics include parents' age and schooling years, household wealth, composition

of household members, and caste/religion. Village characteristics are the numbers of primary, secondary, senior secondary schools, and colleges present. District characteristics include some variables that relate to the educational and economic conditions of a district: literacy rate, labor force participation rate, and proportion of main workers who engage in non-agricultural sectors. As mentioned, it is the changes in the economic surroundings of a region, which is included in Z_l, that this study particularly focuses on. $\left(N_{t+1}^{l} - N_{t}^{l}\right)$, which shows the difference in the proportion of non-agricultural workers in district l for a decade, is employed as an important factor that would influences wage distribution. In addition, to control for the effects of the educational surroundings of each district, literacy rates at the district level are used. Only the 2001 literacy rate is introduced in the empirical analysis, because literacy rates and increments thereof are closely correlated among 1981, 1991, and 2001.[15]

In particular, this study focuses on the coefficient of $\left(N_{2001}^{l} - N_{1991}^{l}\right)$. As explained in the next section, this model is applied to children aged 14–21 in 2005, since they began to study in the 1990s and the 2000s—that is, this empirical model examines the extent to which outcomes of investments in children's education, made by parents who observed changes in economic conditions between 1991 and 2001, would emerge. Further, $\left(N_{1991}^{l} - N_{1981}^{l}\right)$ is used to control for the trend in the 1980s.[16]

In this baseline empirical model, it is assumed that all the people in a district are homogeneously affected by changes in the proportion of main workers who engage in non-agricultural sectors. However, it remains to be seen whether they have the same expectations in practice. Obviously, from the theoretical model in the previous section, the expected income in the second period is attenuated by the subjective discount rate, suggesting that if the subjective discount

[15] To save space, the estimation results of most of these variables are not reported.
[16] Some parents may have been affected by observations during the 1980s, so this term, in other words, controls for such effects.

rate is much higher, parents would make no investments in their children's education ($S = 0$ if $\frac{E[I'(S)]}{1+\delta} < w_c + p$). In other words, poorer households would invest less in their children's education. In addition, there would be some effects pertaining to the socioeconomic classes to which people belong.[17] Hence, this study takes into consideration the heterogeneity of effects of changes in economic surroundings in order to allow people's expectations to vary with household wealth (hereafter, the "wealth effect model"). Empirically, based on the quintile of the wealth index that is calculated through a principal component analysis (PCA) of household assets, it is examined whether the effects of changes differ from class to class.[18]

As mentioned in the previous section, district-level data from the census and household data from the IHDS are used herein. Differences in the proportion of non-agricultural workers at the district level in the first decade (1991–2001) are derived from the census, as a proxy of the changes in the economic surroundings that are assumed to affect wage distribution. The IHDS is employed to examine household behavior. The results of the empirical analyses in the following section demonstrate the effects of semi-macro-level changes in employment structures in the 1990s on households' investments in children's education in 2005.

4. Estimation Results

As mentioned in the previous section, empirical analyses focus on children aged 14–21 in rural areas. The data for children aged 14–15 are employed for analyses of "elementary or more." The data for children aged 16–18 and those for children aged 19–21 are employed for analyses of "secondary or more" and "senior secondary or more," respectively. As for "secondary or more," children who left

[17] See also Jensen (2010).
[18] Following Filmer and Pritchett (2001), PCA of household assets is applied to IHDS. The number of household assets used in PCA is 33, including motorbikes, color TVs, and mobile phone, *inter alia*.

their native homes are considered to have at least "completed elementary." With regard to "senior secondary or more," children who left their native homes are considered to have at least "completed secondary."[19] The three indices each take a value of 1 when a child completes the related education level, so that probit regression is applied. Household characteristics are shown in Table 7.[20]

Before explaining the results of the empirical analyses, let us examine Table 8, which describes differences in educational attainment in terms of household wealth, which is broken out across five classes or quintiles. The first quintile is the poorest and the fifth quintile is the richest. As expected, household wealth strongly affects children's educational attainment. The focus of this study, however, is not on that, but on the extent to which people's investments in children's education is affected by changes in economic surroundings, especially through household wealth.

Tables 9 and 10 provide the estimation results based on the "baseline model." To save space, the results for the variables other than those on which this study particularly focuses are not reported.[21] Table 9, which assumes that all households are homogenously affected, shows that for each education level, differences in the proportion of main workers who engage in non-agricultural sectors between 1991 and 2001 have almost no significant effects on either gender, other than that the effect on boys for "senior secondary or more" is significantly negative. This result suggests that a number of households evaluate the additional expected income of boys in the future not to be sufficiently large to make up for the current total costs of additional education.

On the other hand, Table 10 estimated by the "wealth effect model," which takes into account the possibility that household behavior will vary based on the subjective discount rate,

[19] If children live in their native homes, or if they live separately in other places for study or money transfer, their educational attainments can be traced. However, if children have left their native home, for example because of marriage, their educational attainments cannot be captured.

[20] For convenience, Table 7 shows only some of the variables used in the estimation of elementary level and omits many of variables to save space.

[21] As noted in the previous sections, this study focuses on the effects of changes at the district level, so the results of individual and household variables are not reported. All of the estimation results are available from the author on request.

indicates some different pictures: the effects of changes in employment structures differ from class to class. As for the elementary level, the poorest households invest significantly less in girls' education, while the effects on boys are not significant. With regard to the secondary level, the effect on both girls and boys from the poorest households is significantly negative, but the effect on girls from the third quintile is significantly positive. There are no other significant effects. These imply that changes in the employment structures in the 1990s brought about preferable effects with regard to middle-class girls' education, while children from the poorest households were negatively affected.

As for the senior secondary level, the effect of changes in employment structures provides a quite different picture, showing no significant effect on girls, and significant negative effects on boys from relatively poor households. The negative effect is large, especially on boys from the poorest households: a 10-percentage-point increase in the proportion of male main workers who engage in non-agricultural sectors brings about a 20% decrease in the possibility of attaining "senior secondary or more"; it even brings about a 5% decrease among boys from third-quintile households. These results suggest that parents from all households other than the relatively rich ones perceive that the current income—obtained if parents send boys to the labor markets sooner—to be relatively more attractive than the future expected income that could be obtained by having their children complete senior secondary education.

In summary, including the effects that hold no significance, the results indicate that many positive signs can be seen for girls while many negative signs are for boys. In addition, positive significant signs are observed only for girls. Put another way, changes in economic surroundings attract boys to the current labor markets, while girls are more likely to be expected to earn money in the future. In terms of the theoretical model, this means that it is in some cases with girls that the future additional expected income which is attenuated by the subjective discount rate will be larger than the current total cost of additional education, and in some cases with boys otherwise. Since the

subjective discount rate of poor households is generally large, poverty likely impinges investments in children's education, both directly and indirectly.

The results suggest that changes in India's economic surroundings in the 1990s have possibly ameliorated, at least in part, gender disparity in education in rural India. However, it should be especially noted that children from the poorest households are adversely affected by these changes. That is, they are likely to be left behind, compared to children from relatively affluent households, implying that income inequality could persist or even grow in the near future, on account of uneven investments in children's education. To put it briefly, the results suggest that changes in the Indian economic surroundings in the 1990s have possibly had positive effects in terms of reducing gender disparity in education, but are likely to have negative effects on income disparity in the future.

5. Conclusion

The aim of this study was to examine the effects of the changes in Indian economic conditions in the 1990s—which are believed to have been mainly generated by the 1991 economic reforms—on household welfare in the mid-2000s. Based on this objective, the analysis focused on children's educational achievements as an outcome of changes in economic conditions. As for those changes themselves, data pertaining to the proportion of main workers who engage in non-agricultural sectors were drawn from the Census of India, while India Human Development Survey 2005 were used to examine household behavior. The results of the analysis can be summarized as follows.

In terms of changes in the proportion of non-agricultural workers, the economic surroundings of the 1980s and the 1990s were very different. From viewpoints of both increment and

regional characteristics, they were completely different. The empirical analysis shows that these changes had great effects on people's investments in their children's education. The results estimated through the baseline model showed that boys were negatively affected by those changes, at the senior secondary level of education. On the other hand, the results estimated by the wealth effect model suggested a different picture: it is possible that some girls were positively affected, while many boys were negatively affected. Theoretically, the additional expected return to education—which is attenuated by the subjective discount rate—surpasses the total costs of additional education for girls in some cases, while for boys in the many cases it falls below the total cost. These findings imply that gender disparity could be reduced by certain changes in economic surroundings. However, it should be noted that household behavior differs by the level of affluence, and children from poorer households tend to be negatively affected, furthermore implying that inequalities in wealth could persist or be exacerbated in the future.

Finally, a limitation of this paper should be mentioned. One possible problem relates to the extent to which the variable "proportion of non-agricultural workers," which is calculated based on "main workers," can accurately capture the changes in economic surroundings that could affect people's investments in their children's education. For example, it might be more appropriate to consider specific industrial categories, such as the information technology industry. In addition, it should be noted that "proportion of non-agricultural workers" at the district level could possibly capture something other than the effects on which this study has focused. These issues are left for future studies.

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Table 1 Literacy rates in India

	Literacy Rate (%)			
Year	Total	Female	Male	Female/Male
1981	36.1	24.8	46.7	0.53
1991	42.3	31.8	52.1	0.61
2001	55.2	45.7	64.0	0.71
2011	64.3	57.0	71.2	0.80

Note: Figures are calculated based on proportions of literate people to the total population.

Table 2 Changes in proportions of non-agricultural workers in India

Proportion of non-agricultural workers	Obs.	mean	std
Male (1981)	368	0.348	(0.184)
Male (1991)	368	0.377	(0.187)
Male (2001)	368	0.473	(0.192)
Female (1981)	368	0.275	(0.247)
Female (1991)	368	0.266	(0.248)
Female (2001)	368	0.335	(0.235)

Difference in proportion of non-agricultural workers	Obs.	mean	std
A. Male (1981–91)	368	0.029	(0.027)
B. Male (2001–1991)	368	0.095	(0.049)
C. Female (1981–91)	368	-0.009	(0.058)
D. Female (2001–1991)	368	0.069	(0.101)

H_0: mean (A) = mean (B)	t = -24.527
H_0: mean (C) = mean (D)	t = -13.957

Table 3 Correlation of differences between 1981–91 and 1991–2001

	A	B	C	D
A. Male (1981–91)	1.000			
B. Male (2001–1991)	0.172	1.000		
C. Female (1981–91)	0.374	0.087	1.000	
D. Female (2001–1991)	0.046	0.251	0.182	1.000

Table 4 Average schooling years, by generation, in India

	Total		Urban		Rural	
Age	Male	Female	Male	Female	Male	Female
46-50	6.12	3.09	8.56	5.59	4.72	1.83
41-45	6.32	3.63	8.65	5.84	4.95	2.27
36-40	6.64	3.87	8.75	6.26	5.42	2.54
31-35	7.42	4.62	9.07	7.04	6.46	3.27
26-30	7.98	5.57	9.37	7.86	7.19	4.24
21-25	8.38	6.70	9.65	8.81	7.67	5.45

Note: The figures are calculated by using individual-level data.

Table 5 Educational achievement in India

	Educational achievement (%)					
	Total		Urban		Rural	
Educational achievement	Male	Female	Male	Female	Male	Female
Completed elementary or more	65.02	50.46	75.30	67.85	59.32	40.12
Completed secondary or more	43.80	34.42	56.15	51.26	36.95	24.41
Completed senior secondary or more	28.23	21.72	40.02	36.04	21.69	13.21

Note: Figures are calculated by using individual-level data for people aged 21–25 years.

Table 6 Returns to investment for schooling in India

Self-employment (agriculture)	Coef.	t-value	Returns to schooling (annual rate)
Share of family labor with the following education			
primary	-0.0116	(-0.2)	
secondary	0.1466	(2.28)**	0.015
senior secondary	0.2987	(5.16)***	0.025
Self-employment (non-agriculture)			
primary	0.0481	(0.86)	
secondary	0.2286	(4.54)***	0.023
senior secondary	0.5596	(14.07)***	0.047
Agricultural employment			
primary	0.0125	(0.73)	
secondary	0.0265	(1.23)	
senior secondary	-0.0663	(-2.17)**	
Non-agricultural employment			
primary	0.0691	(3.08)***	0.014
secondary	0.2061	(9.88)***	0.021
senior secondary	0.3586	(23.51)***	0.030

Note: Estimated by using the method of Kurosaki and Khan (2006).

Table 7 Household characteristics of sample

	Mean	Std	Min	Max
Mother's age	37.7877	4.5004	24	50
Mother's schooling years	2.0599	3.4031	0	15
Father's age	42.8716	5.5461	27	95
Father's schooling years	4.6265	4.4889	-4	15
Wealth Index	-1.1548	2.0653	-3.9894	9.9708
Number of children	2.3122	1.6649	0	17
Number of adults	2.6067	1.1389	1	14
Caste/religion: High caste	0.1365			
Caste/religion: OBC	0.3580			
Caste/religion: Dalit	0.2391			
Caste/religion: Adivasi	0.1004			
Caste/religion: Muslim	0.1002			
Caste/religion: Sikh	0.0149			
Caste/religion: Christian	0.0139			

NOB: 5039

Note: For convenience and to save space, this table shows only some of the household characteristics employed in elementary-level analysis.

Table 8 Educational Achievement in India, by household wealth

Educational achievement (%)	Wealth Quintile	Male	Female
Completed elementary or more	1	21.49	14.83
	2	36.41	28.38
	3	50.85	41.57
	4	60.07	59.15
	5	73.99	71.31
	Total	43.04	37.02
Completed secondary or more	1	6.38	3.64
	2	13.80	8.35
	3	27.69	23.02
	4	38.61	31.49
	5	58.27	56.61
	Total	24.39	19.76
Completed senior secondary or more	1	4.18	1.67
	2	7.77	3.91
	3	20.66	8.40
	4	25.40	19.81
	5	48.58	35.52
	Total	18.65	11.28

Note: The first and fifth quintiles represent the poorest and the richest households, respectively.

Table 9 Estimation result 1 (baseline model)

	Elementary or more				Secondary or more				Senior secondary or more			
	Girl		Boy		Girl		Boy		Girl		Boy	
	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value
Female literacy rate in 2001	0.004	(3.82)***	0.003	(1.66)*	0.001	(1.35)	-0.001	(-0.92)	0.001	(1.24)	0.004	(2.54)**
Laborforce participation rate in 1981	0.139	(0.71)	0.112	(0.39)	-0.001	(0)	0.176	(0.74)	-0.016	(-0.12)	0.210	(0.74)
Difference in laborforce participation rate between 1981 and 1991	0.535	(2)**	1.354	(2.09)**	-0.012	(-0.05)	0.953	(1.88)*	-0.448	(-1.75)*	0.789	(1.33)
Difference in laborforce participation rate between 1991 and 2001	0.063	(0.2)	0.183	(0.55)	0.055	(0.26)	-0.446	(-1.58)	0.103	(0.49)	-0.354	(-1.17)
Proportion of main workers who engaged in non-agriculture in 1981	-0.015	(-0.2)	0.078	(0.72)	-0.0435	(-0.85)	0.0629	(0.77)	-0.017	(-0.34)	-0.0031	(-0.03)
Difference in proportion of main workers who engaged in non-agricultue between 1981 and 1991	-0.342	(-1.71)*	-0.001	(0)	0.0443	(0.3)	0.1974	(0.62)	-0.0299	(-0.2)	-0.6163	(-1.75)*
Difference in proportion of main workers who engaged in non-agricultue between 1991 and 2001	-0.056	(-0.38)	-0.099	(-0.42)	0.1085	(1.01)	-0.2402	(-1.27)	0.0859	(0.78)	-0.4204	(-1.9)*
NOB	2430		2609		3206		3325		2139		2231	
Log-likelihood	-1197.444		-1382.902		-1158.783		-1410.858		-535.809		-823.738	

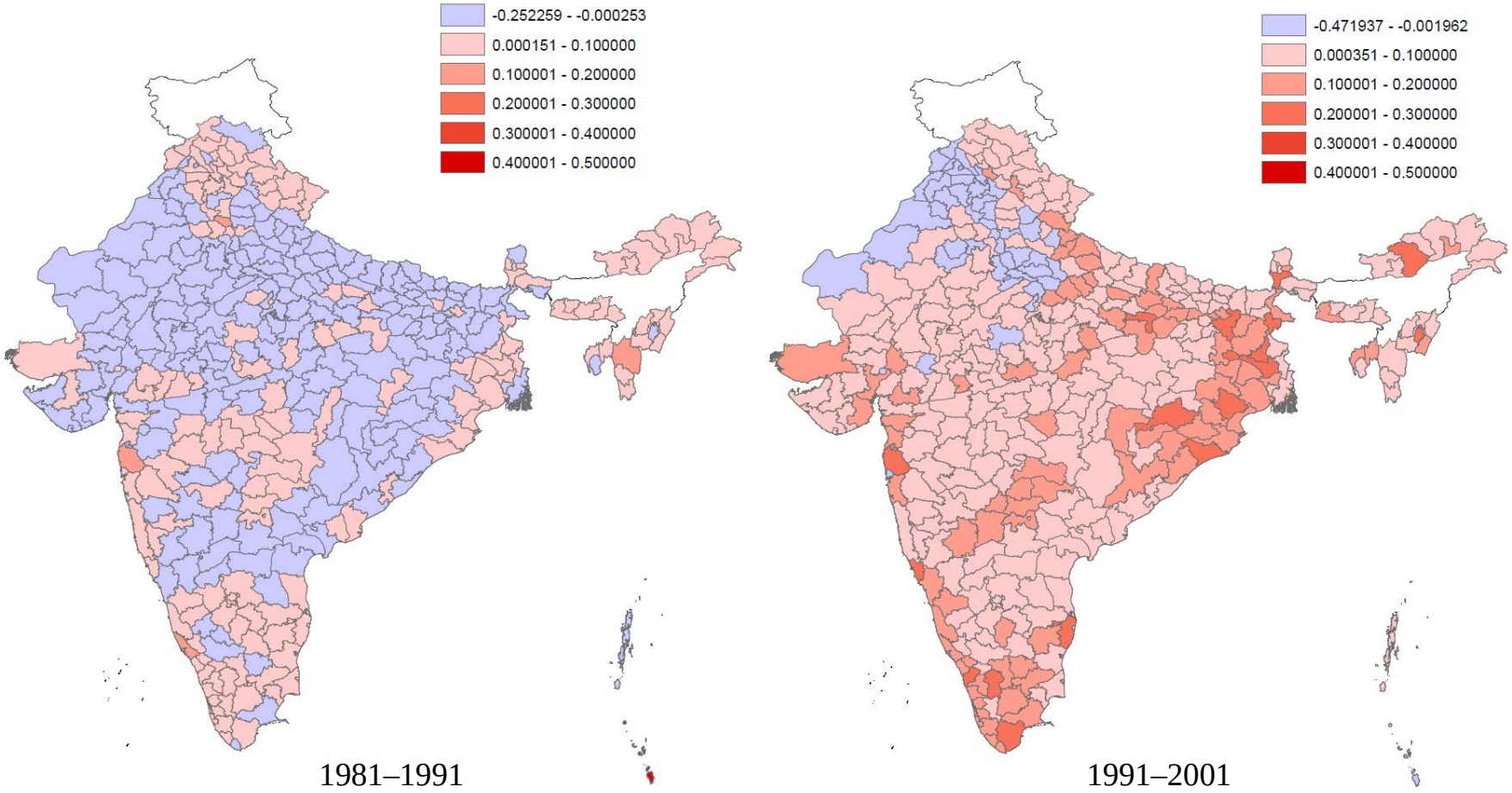
Note: * Significant at 10%; ** significant at 5%; *** significant at 1%. Coefficient estimates for other variables are not reported to save space.

Table 10 Estimation result 2 (wealth effect model)

	Elementary or more				Secondary or more				Senior secondary or more			
	Girl		Boy		Girl		Boy		Girl		Boy	
	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value
Literacy rate in 2001	0.004	(3.8)***	0.003	(1.52)	0.001	(1.21)	-0.001	(-0.72)	0.001	(1.19)	0.004	(2.52)**
Laborforce participation rate in 1981	0.099	(0.51)	0.097	(0.34)	-0.032	(-0.24)	0.178	(0.75)	-0.016	(-0.13)	0.229	(0.8)
Difference in laborforce participation rate between 1981 and 1991	0.516	(1.93)*	1.362	(2.1)**	-0.017	(-0.07)	0.883	(1.73)*	-0.466	(-1.81)*	0.712	(1.19)
Difference in laborforce participation rate between 1991 and 2001	0.019	(0.06)	0.111	(0.33)	0.020	(0.09)	-0.469	(-1.66)*	0.100	(0.48)	-0.381	(-1.24)
Proportion of main workers who engaged in non-agriculture in 1981	-0.036	(-0.49)	0.077	(0.71)	-0.063	(-1.22)	0.029	(0.35)	-0.020	(-0.4)	-0.005	(-0.05)
Difference in proportion of main workers who engaged in non-agricultue between 1981 and 1991	-0.310	(-1.54)	0.018	(0.04)	0.057	(0.38)	0.189	(0.59)	-0.046	(-0.3)	-0.619	(-1.75)*
Difference in proportion of main workers who engaged in non-agricultue between 1991 and 2001												
1st quintile (poorest)	-0.453	(-1.93)*	-0.358	(-1.11)	-0.360	(-1.72)*	-0.764	(-2.53)**	0.031	(0.12)	-1.705	(-3.75)***
2nd quintile	-0.056	(-0.29)	0.242	(0.87)	0.176	(1.21)	-0.385	(-1.52)	0.192	(1.1)	-0.933	(-2.92)***
3rd quintile	0.121	(0.65)	-0.052	(-0.18)	0.243	(1.82)*	-0.072	(-0.32)	0.161	(1.13)	-0.449	(-1.72)*
4th quintile	-0.097	(-0.43)	-0.063	(-0.2)	0.173	(1.22)	-0.004	(-0.02)	0.152	(1.08)	-0.341	(-1.38)
5th quintile (richest)	-0.026	(-0.11)	-0.417	(-0.92)	-0.094	(-0.59)	-0.179	(-0.63)	-0.052	(-0.38)	0.048	(0.16)
NOB	2430		2609		3206		3325		2139		2231	
Log-likelihood	-1194.165		-1378.2585		-1151.714		-1404.712		-533.875		-816.85251	

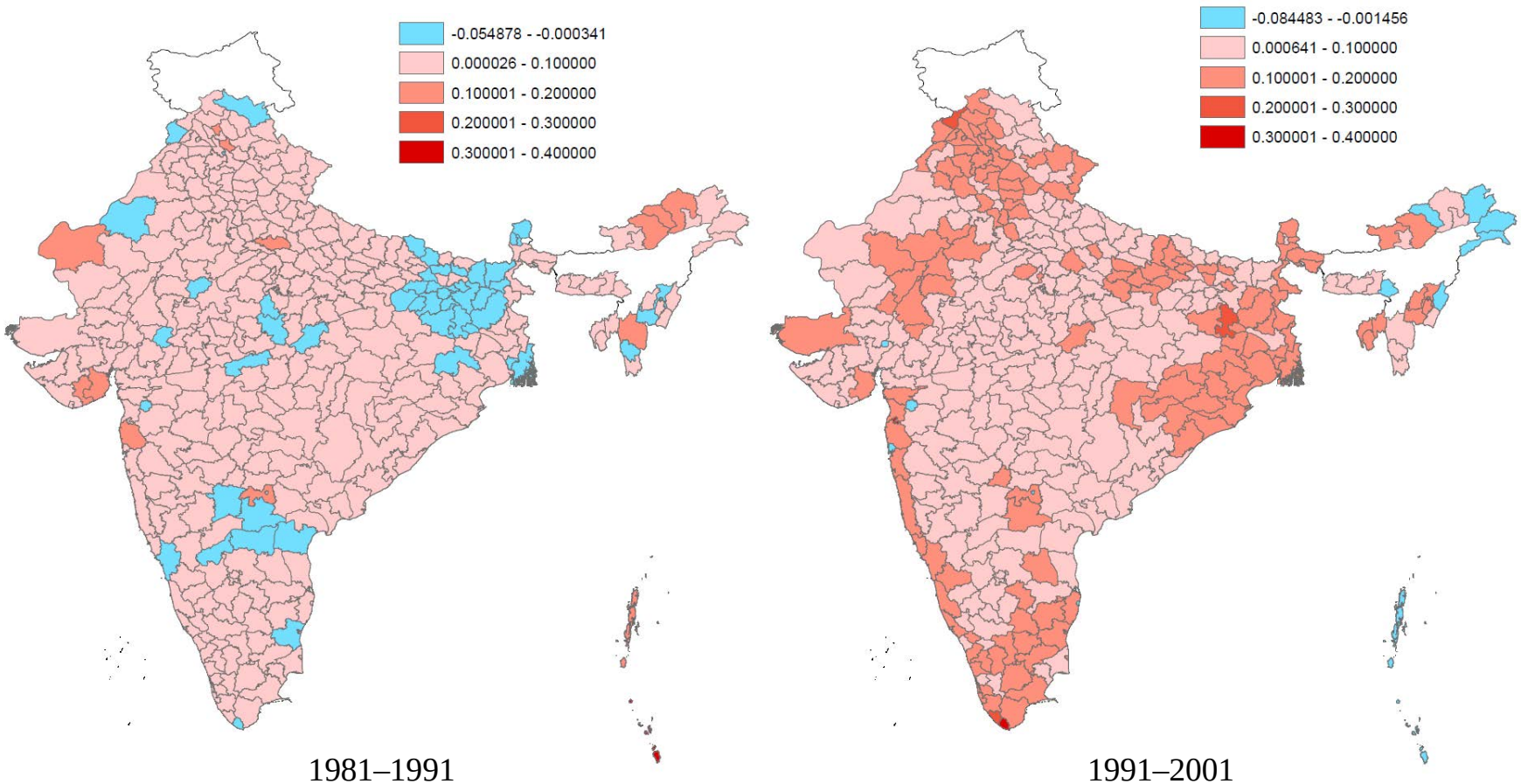
Note: * Significant at 10%; ** significant at 5%; *** significant at 1%. Coefficient estimates for other variables are not reported to save space.

Figure 1 Changes in proportion of main workers who engage in non-agricultural sectors, at district level (female)



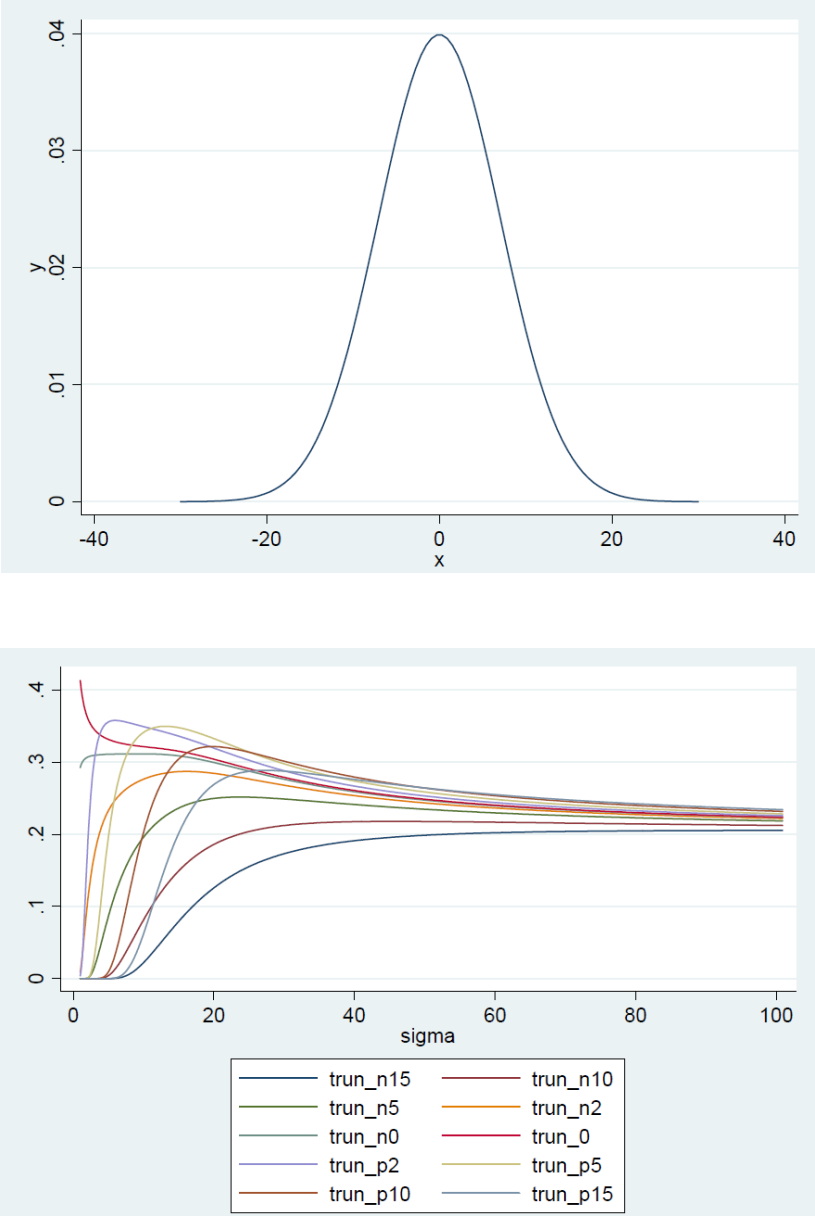
Note: District borders are adjusted to the 1981 Census.

Figure 2 Changes in proportion of main workers who engage in non-agricultural sectors, at district level (male)



Note: District borders are adjusted to align with the 1981 Census.

Figure 3 Changes in standard deviation and the inverse Mills ratio



Note: The top figure is a normal distribution, the standard deviation of which is 10. The bottom figure shows the relationship between the inverse Mills ratio (vertical) and the standard deviation (horizontal), and it examines how the ratio changes with the truncation point and the standard deviation. For instance, trun_n15 indicates the case where the truncation point is -15, and trun_n15 describes the case where the truncation point is +15 in the top figure.