India's Increasing Skill Premium
Role of Demand and Supply

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Abstract

The tertiary (college)-secondary (high school) wage premium has been increasing in India over the past decade, but this increase differs across age groups. The increase in wage premium has been driven mostly by younger age groups, while older age groups have not experienced any significant increase. This paper uses the demand and supply model with imperfect substitution across age groups developed by Card and Lemieux (2001) to explain the uneven increase in the wage premium across age groups in India. The findings of this paper are that the increase in the wage premium has come mostly from demand shifts in favor of workers with a tertiary education. More importantly, the demand shifts occurred in both the 1980s and 1990s. The relative supply has played an important role not only determining the extent of increase in wage premium, but also its timing. The increase in relative supply of tertiary workers during 1983-1993 negated the demand shift; as a result, the wage premium did not increase much. But during 1993-1999, the growth rate of the relative supply of tertiary workers decelerated, while relative supply became virtually stagnant during 1999-2004. Both these periods saw an increase in the wage premium as the countervailing supply shift was weak.

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1 Introduction

India's inability to reduce poverty in spite of a sustained period of high GDP growth during the last decade has drawn a great amount of interest.[1] The poverty ratio declined from 36 percent in 1993-94 to 27.5 percent in 2004-05, yet the number of poor remains at 302 million.[2] Recently, there is a growing focus on wage inequality in post-1991 reform era. The interest in wage inequality is due to two reasons. First, after four decades of import-substitution industrialization strategy, India initiated a drastic liberalization of its external sector and industrial policy in 1991. Second, there is a growing recognition that greater income inequality tends to slow poverty reduction (Ravallion and Chen, 1997). The effects of trade liberalisation on wage inequality in developing countries has been has been quite varied. The East Asian newly-industrialised economies experienced a reduction in wage inequality after opening with a strong export-orientation in the 1960s and 1970s. However, a number developing countries that opened up to trade more recently, liberalization did not lead to reduction in wage inequality; on the contrary, some have seen an increase in the skilled wage premium, for example Brazil (Green, Dickerson and Arbache, 2001), Mexico (Hanson and Harrison, 1999; Robertson, 2000), Chile (Beyer, Rojas, and Vergara, 1999), Morocco (Currie and Harrison, 1997), Costa Rica (Robbins and Gindling, 1999), and Columbia (Robbins, 1996a) (Green, Dickerson and Arbache, 2004).

India also experienced both liberalization of trade and a rising skill premium (Chamarbagwala, 2006). Prior studies on India find that wage inequality has been increasing and returns to tertiary education play an important role in that increase (Kijima, 2006; Chamarbagwala, 2006). Kijima (2006) finds an increase in wage inequality in urban India (male workers) in the 1990s and attributes this rise to an increase in the returns to observed skills, specifically tertiary education. Most of the literature on wages in India concentrates on explaining wage inequality and discusses the wage premium only in terms of how it relates to wage inequality; the wage premium itself has not been studied in detail.

The rising wage premium for skilled workers since 1980s in many OECD countries is well-documented. In the United States, for example, Katz and Autor (1999) estimate that the real wages of high school drop-outs, the least skilled workers, fell over the 1963-1995 period (by about -4.5 percent), while the real wages of college graduates rose sharply (by about 22.4 percent). But, a considerable amount of controversy exists about the extent to which the increase in the wages of skilled workers can be explained by shifts in

[1] See 'The Great Indian Poverty Debate' (Deaton and Koezel, 2005) for a collection of articles exploring various issues on poverty in India.

[2] These estimates are based on Uniform Recall Period. On Mixed Recall Period the poverty rates declined from 26.1 percent in 1999-00 to 21.8 percent in 2004-05. The change in Recall Period by National Sample Survey in 1999-2000 consumer survey has given rise to considerable controversy in Poverty Estimates (Himansu and Sen, 2004; Deaton, 2003).

labor demand favoring high-skilled labor at the expense of low-skilled labor (Juhn *et al.*, 1993; Bound and Johnson, 1993; Autor *et al.*, 1998) or a deceleration in the relative supply of high-skilled labor compared to low skilled-labor (Katz and Murphy, 1992; Card and Lemieux, 2001).

The Indian labor force can be broadly classified into five different skill categories depending on education level: tertiary, secondary, middle, primary and below primary (includes illiterates).[3] Tertiary graduate being the highest skill group, while below primary being the lowest skill group. Figure 1 plots the wage gaps for different skill groups over the past two decades in urban India. The wage gap is calculated using individual-level data; details are given in the data section and data appendix. The wage gap between adjacent skill groups at the lower end shows very little change over the last two decades, while the wage gap between workers with secondary and middle schooling shows a modest increase of 8 percent during the same period. But, the major beneficiary is tertiary graduate (college degree) workers whose gap with the adjacent lower education group, i.e. secondary graduate (high school) workers, has shown a considerable increase after the 1990s for regular employed workers.[4] The wage gap between tertiary and secondary graduate workers increased in last two decades from 34 percent to 50 percent.[5] As secondary graduate workers themselves experienced a modest increase in wages relative to lower skill groups, this implies the wage gap of tertiary graduate workers experienced a major increase compared to all other groups. This is consistent with studies which point to increasing returns to tertiary education contributing to the increase in wage inequality.

Interestingly, most of the increase in the wage gap is concentrated after 1991, coinciding with liberalization and high GDP growth rate. Also, this rise in wage premium for tertiary graduate workers compared to secondary graduate workers differs across age groups. The wage gap rose from 27 percent to 55 percent for the younger group (age 23-32), while it decreased from 42 percent to 41 percent for the older group (48-57) (Figure 2).[6] Similar trends have also been observed in the US, UK and Canada (Card and Lemieux, 2001). The tertiary-secondary wage gap not increasing at the same rate across age groups indicates the presence of imperfect substitution across different age groups.

In their seminal paper, Katz and Murphy (1992) demonstrate how the relative supply of college graduates to high school graduates combined with a linearly increasing trend in labor demand for college graduates drives the relative wages of college graduates in the US. Card and Lemieux (2001) refine this

[3]The pattern of Indian education system is given in the appendix Table A1.

[4]Regular employed workers are defined as individuals who worked in others' farm or non-farm enterprises and, in return received salary or wages on a regular basis (i.e. not on the basis of daily or periodic renewal of work contract).

[5]In rural India the tertiary-secondary wage gap rose from 25 percent to 41 percent over the last two decades.

[6]Similar but less accentuated trends are observed in rural areas also.

finding for the US, UK and Canada by allowing for imperfect substitutability across age groups. This paper follows the approach in Card and Lemieux (2001) to assess whether the age group specific relative supplies combined with steadily increasing demand for skilled labor provide an explanation for the observed changes in the wage premium between tertiary and secondary graduate workers.[7] The other contribution of this paper is to obtain estimates of the elasticity of substitution between these two education groups and across age groups, which would be a first for India, to my best knowledge.

The results indicate demand shifts in favor of tertiary graduate workers throughout the study period. In the early part of the study period, there was also an increase in the aggregate relative supply of tertiary graduate workers, which perhaps kept a check on the tertiary-secondary wage premium. However, between 1993 and 1999, the increase in relative supply of tertiary graduate workers decelerated and, combined with increasing demand, led to an increase in the wage premium. Between 1999 and 2004, the relative supply of tertiary graduate workers stagnated and the younger age group experienced almost a 15 percent increase in the wage premium. The stagnant relative supply of tertiary graduate workers has important implications for the tertiary-secondary wage premium and wage inequality. Given that India is growing at a sustained rate of more than 8 percent over the last few years and is projected to maintain this performance in the near future, demand shifts for high skill workers are probably going to be maintained, with the relative supply of tertiary workers remaining roughly constant. This implies that inequality will not decrease, and may increase further in the near future, unless the stagnation in the relative supply of tertiary graduates is corrected.

The remainder of the paper is organized as follows. Section 2 deals with the empirical strategy. Section 3 describes the data and data trends. Section 4 investigates the results and alternative specifications. Finally, Section 5 concludes.

2 Empirical Strategy

2.1 Theoretical Framework

Following Card and Lemieux (2001), assume that aggregate output at time t depends on two CES sub-aggregates of secondary (S) and tertiary (T) graduate labor:

[7] The focus on tertiary-secondary wage gap is motivated by the fact that this gap has increased sharply during the last decade. Also, prior studies pointing out that the return to tertiary education is the main contributor to wage inequality warrants choice of focus on tertiary graduate workers.

$$S_t = \left[\sum_j (\alpha_j S_{jt}^{\eta})\right]^{\frac{1}{\eta}} \tag{1}$$

$$T_t = \left[\sum_j (\beta_j T_{jt}^{\eta})\right]^{\frac{1}{\eta}} \tag{2}$$

where $-\infty < \eta \leq 1$ is a function of the partial elasticity of substitution (σ_A) between different age groups (j) with the same level of education ($\eta = 1 - 1/\sigma_A$); α_j and β_j are relative efficiency parameters of secondary and tertiary graduate workers (assumed to be fixed over time). In principle, η could be different for different educational groups, but for simplicity assume η to be identical across education groups.

Aggregate output in period t, Y_t, is a function of secondary graduate labor, tertiary graduate labor and technology efficiency parameters, θ_{St} and θ_{Tt} :

$$Y_t = f(S_t, T_t; \theta_{St}, \theta_{Tt}) \tag{3}$$

Assume that aggregate production function is CES:

$$Y_t = (\theta_{St} S_t^{\rho} + \theta_{Tt} T_t^{\rho})^{\frac{1}{\rho}} \tag{4}$$

where $-\infty < \rho \leq 1$ is a function of elasticity of substitution (σ_E) between the two education groups ($\rho = 1 - 1/\sigma_E$). In this setting, the marginal product of labor for a given age-education group depends on both the group's own supply of labor and the aggregate supply of labor in its education category. In particular, the marginal product of secondary graduate workers in age group j is:

$$\frac{\partial Y_t}{\partial S_{jt}} = \frac{\partial Y_t}{\partial S_t} \times \frac{\partial S_t}{\partial S_{jt}} \tag{5}$$

$$= \theta_{St} S_t^{\rho-\eta} \Psi_t \times \alpha_j S_{jt}^{\eta-1}$$

where $\Psi_t = (\theta_{St} S_t^{\rho} + \theta_{Tt} T_t^{\rho})^{\frac{1}{\rho}-1}$.

Similarly, the marginal product of tertiary graduate workers in age group j is:

$$\frac{\partial Y_t}{\partial T_{jt}} = \frac{\partial Y_t}{\partial T_t} \times \frac{\partial T_t}{\partial T_{jt}} \tag{6}$$

$$= \theta_{Tt} T_t^{\rho-\eta} \Psi_t \times \beta_j T_{jt}^{\eta-1}.$$

Efficient utilization of different skill groups requires that relative wages are equated to relative marginal products. Under this assumption, the ratio of the wage rate of tertiary graduate workers in age group j (w_{jt}^T) to the wage of secondary graduate workers in the same age group j (w_{jt}^S) satisfies the following equation:

$$\log\left(\frac{w_{jt}^T}{w_{jt}^S}\right) = \log\left(\frac{\theta_{Tt}}{\theta_{St}}\right) + (\rho - \eta)\log\left(\frac{T_t}{S_t}\right) + \log\left(\frac{\beta_j}{\alpha_j}\right) + (\eta - 1)\log\left(\frac{T_{jt}}{S_{jt}}\right) \tag{7}$$

If the relative employment ratios are taken as exogenous, equation (7) leads to a simple model for the observed tertiary-secondary wage gap for workers in age group j and year t. Substituting for ρ and η yields:

$$r_{jt} = \log\left(\frac{w_{jt}^T}{w_{jt}^S}\right) = \log\left(\frac{\theta_{Tt}}{\theta_{St}}\right) + \log\left(\frac{\beta_j}{\alpha_j}\right) + \left[\frac{1}{\sigma_A} - \frac{1}{\sigma_E}\right]\log\left(\frac{T_t}{S_t}\right) - \frac{1}{\sigma_A}\log\left(\frac{T_{jt}}{S_{jt}}\right) + e_{jt} \tag{8}$$

where e_{jt} reflects sampling variation in measured wage premium or any other source of variation in age group-specific wage premiums. Equation (8) can be rearranged as:

$$r_{jt} = \log\left(\frac{\theta_{Tt}}{\theta_{St}}\right) + \log\left(\frac{\beta_j}{\alpha_j}\right) - \frac{1}{\sigma_E}\log\left(\frac{T_t}{S_t}\right) - \frac{1}{\sigma_A}\left[\log\left(\frac{T_{jt}}{S_{jt}}\right) - \log\left(\frac{T_t}{S_t}\right)\right] + e_{jt} \tag{9}$$

According to (9), the tertiary-secondary wage gap for a given age group depends on both the aggregate relative supply of tertiary graduate labor (T_t/S_t) in period t, and on the age group specific relative supply of tertiary graduate labor (T_{jt}/S_{jt}). Any change in age group specific relative supplies would be expected to shift the age profile of the tertiary-secondary wage gap, with an effect that depends on the size of $1/\sigma_A$.

2.2 Implementation

Direct estimates of (9) is not feasible since T_t and S_t are not observable. As shown in (1) and (2), T_t and S_t are dependent on α_j's, β_j's and σ_A. Thus, following Card and Lemieux (2001), a two-step estimation procedure is utilized. In the first step, estimates of the α_j's, β_j's and σ_A are obtained. In the second step, the resulting estimates of T_t and S_t are used to estimate (9).

Step I

In the first step, σ_A is estimated from a regression of age-group specific tertiary-secondary wage gaps on age group specific relative supplies of tertiary graduate labor, age effects (which absorb the relative productivity effect $\log(\beta_j/\alpha_j)$, and time effects (which absorb the combined relative technology shock and any effect of aggregate relative supply):

$$r_{jt} = b_j + d_t - (1/\sigma_A)\log\frac{T_{jt}}{S_{jt}} + e_{jt} \tag{10}$$

where b_j and d_t are the age and year effects, respectively. Given the estimate of $1/\sigma_A$, the relative efficiency parameters, α_j's and β_j's, can be computed by equating marginal products to wages. Taking logs yields:

$$\log(w_{jt}^S) + (1/\sigma_A)\log S_{jt} = \log(\theta_{St} S_t^{\rho-\eta}\Psi_t) + \log\alpha_j \tag{11}$$

$$\log(w_{jt}^T) + (1/\sigma_A)\log T_{jt} = \log(\theta_{Tt} C_t^{\rho-\eta}\Psi_t) + \log\beta_j \tag{12}$$

The left-hand side of these equations can be estimated using the first-step estimate of $1/\sigma_A$, while the leading term on the right-hand side of (11) and (12) can be replaced with a set of year dummies. Thus, the age group specific productivity factors, $\log\alpha_j$ and $\log\beta_j$, can be estimated by the age effects in a pair of regression models based on (11) and (12) that also include unrestricted year dummies.

Step II

Given the estimates of α_j's, β_j's and η, the aggregate supplies of tertiary and secondary graduate labor can be constructed. With these estimates in hand, and some assumption concerning the time path of relative productivity term $(\theta_{Tt}/\theta_{St})$, equation (9) can be estimated directly. Following the existing literature, assume that $\log(\theta_{Tt}/\theta_{St})$ can be captured by a linear time trend and changes in labor supply are exogenous.

3 Data

3.1 Description

The analysis is based on individual-level household survey data from the Employment and Unemployment Schedule administered by the National Sample Survey Organization (NSSO), Government of India. Data from five rounds-conducted in 1983 (38th Round), 1987-88 (43rd Round), 1993-94 (50th Round), 1999-00 (55th Round) and 2004-05 (61st Round)-are used. The data constitute a repeated cross section and contain information on household size and composition, social group, religion, monthly consumption, landholdings, demographic variables (age, gender, marital status), educational participation and attainment, and a detailed employment section on principal and subsidiary activities (industry, occupation, type and amount of wages earned, and intensity of each activity). Each survey covers about 120,000 households and over half a million individuals. Approximately 35 percent of the sample comes from urban areas; the remainder from rural areas. The sample of households is drawn based on a stratified random sampling procedure and all the analysis is done using survey weights.

In the data, workers are classified as self-employed, regular wage/salaried and casual labor. Wages are reported at current prices for regular wage/salaried and casual labor. State-specific rural-urban official poverty lines are used to deflate all wages to 1983 prices. Educational attainment is reported by levels of education achieved. It is not possible to identify dropouts as they are grouped with the lower education level completed. The data classify 15 years or more of education as tertiary; 10-12 years of education is coded as secondary

The analysis is restricted to urban regular wage/salaried workers, as more than nearly 65 percent of regular jobs with tertiary and secondary graduate workers are concentrated in urban area.[8] The estimated wage premiums are based on regular wage/salaried workers between the ages of 23 and 57, while relative education group supplies are constructed using all type of workers between 23 and 57.[9] A detailed description of construction of the wage sample and estimation of the wage premium is given in the data appendix. Changes in employment shares of different skill groups in regular jobs over time are presented in Table 1. The employment share of tertiary graduates in regular jobs has gone up from 19 percent to 30 percent over the last two decades; an overall increase of 11 percent. The employment share of secondary graduates also saw a modest increase of 4 percent during the same period, and the lower skill groups have seen their shares decline.

3.2 The Evolution of the Tertiary-Secondary Wage Premium

The estimates of the wage premiums are reported in Table 2. Comparisons within a column of the table show the changing tertiary-secondary wage premium for a specific age group. For the age group 23-27, the wage premium increased between 1983 and 1987-88, remained approximately constant for next decade and then increased sharply between 1999-00 and 2004-05. The wage premium for the age group 28-32 has also seen a steady upward trend. The wage premium rose for the age group 23-42 between 1999-00 and 2004-05, but for the older groups 48-51 and 52-57, the wage premium did decrease during the same period. The overall increase in wage premium of tertiary graduate workers is mostly driven by younger age groups.

Comparisons within the rows of the table reveal the age profile of the tertiary-secondary wage gap at a point of time. Figure 3 plots these age profiles of the wage premium for different years. In 1987-88

[8]The 1987-88 rural sample suffers from lots of missing data on wages. The sample size in higher age groups for the 1983 and 1993-94 rural samples becomes too restrictive to implement the empirical strategy for rural area separately. The attention to urban areas only is consistent with some other studies (e.g. Kijima (2006), Kumar and Mishra (2005), Bhaumik and Chakravaty (2006)).

[9]It takes a minimum of 21 years of age to complete tertiary education. Choice of the lower age cut-off of 23 is to allow tertiary graduates to get into labor force. The upper cut-off of age is motivated by the fact that the retirement age is 58 - 62 depending on the state and nature of employer.

and 1993-94 the entire age profile shifted down except for the two youngest age groups. Incidentally, the late 1980s and early 1990s are associated with fiscal and balance of payments crises followed by structural adjustment in India. In 1999-00, the entire wage premium profile shifts upwards, while in 2004-05, the upward shift is only experienced for the younger age groups (23-42 years old); for older age groups (43-57 years old) the wage premium decreased compared to 1999-00. Overall, for the period 1983-2005, the tertiary-secondary wage premium is an increasing and slightly concave function of age.

The shifting age profiles suggest two separate forces underlying the evolution of the tertiary-secondary wage premium over time. On the one hand, the overall set of wage premiums can rise or fall over time (as they appear to have done). On the other hand, the relative wage premiums for specific age groups can rise or fall independently of the wage premiums for the other groups. The length of the sample period does not allow estimation of complete age profiles of wage premium for any single cohort, but the incomplete age profiles of different cohorts are plotted in Figure 4. The figure indicates upward shifts in the age profile of the wage premium for cohorts separated in birth by ten years.

3.3 The Evolution of the Relative Supply

The estimates of relative supplies of tertiary and secondary graduates are based on a broad sample of workers. All types of workers (regular, casual and self-employed) between the ages of 23 and 57 are included. Three different types of supply measures are used to check the robustness of the findings. The first supply measure is the number of hours supplied by each education group, which takes account of any differences in number of hours supplied by different education groups. The second is a simple count of number of the workers assuming each can potentially supply one unit of labor, and the third is a simple count of the labor force (defined as workers plus those who are available or seeking work). The third measure takes into account the unemployed. Tertiary graduates are treated as pure tertiary equivalents; secondary graduates as pure secondary equivalents. Middle school graduates (those who have completed at least 8 but less than 10 years of education) are allocated to secondary school graduates weighted by their wage relative to secondary school graduates.

Figure 5 shows the evolution of the log of the relative fraction of tertiary versus secondary workers for two age groups: 23-27 year olds and 53-57 year olds. The figure is based on the hours supply measure; the other two supply measures show similar trends.[10] The older group 53-57 experienced an upward trend throughout the study period, but the younger group has an almost stagnant relative supply.

Educational attainment of a cohort is assumed to be approximately constant over time unless there is a

[10] Appendix Figure A1 and Figure A2.

very high percentage of late completions in a cohort. To check this hypothesis and further investigate the trends in relative supplies, the age and cohort effects are fitted to the relative fraction of tertiary graduate workers. Formally, suppose that the log supply ratio of workers in age group j and year t consists of a cohort effect for the group, λ_{t-j} (dated by their year of birth), and an age effect ϕ_j:

$$\log\left(\frac{T_{jt}}{S_{jt}}\right) = \lambda_{t-j} + \phi_j + e_{jt} \tag{13}$$

λ_{t-j} is assumed to be constant for a cohort as cohorts do not add much additional education after labor market entry, while ϕ_j is the age profile of relative labor supply assumed to be constant across cohorts. ϕ_j allows labor supply by education groups to differ over the life cycle. The model fits very well for all three supply measures, with R^2 exceeding 99 percent in each case.[11] All age and cohort dummies in the model are statistically significant. The estimated cohort effects are plotted in Figure 6.[12] There is a positive inter-cohort trend before the early 1960s, but the trend almost stagnated in the 1960s and early 1970s. There is slight positive trend again in the late 1970s cohort.

4 Results

4.1 Results

In the first stage of the two-step estimation process, age group specific wage premium for different age groups in various years are regressed on the age group specific relative supply, year and age effects (equation 10). Since the wage premium across age groups in different years are estimated from different sample sizes and hence vary in precision, all the regressions are weighted by the inverse of the sampling variances of the estimated wage premiums. The first-stage results for three different supply measures are presented in Table 3. Columns (1), (3) and (5) report results from the models including unrestricted year affects. The estimated effects of (log) age group specific relative supply on (log) age specific relative wage premium are statistically significant. Hence, age group specific supplies played an important role in determining age group specific wage premium.

Although the estimated effects of age group specific relative supply are dependent on the choice of supply measure used, the estimates are fairly close. The coefficient on the (log) age group specific relative labor supply lies between -0.168 using workers as the supply measure and -0.20 using labor force as the supply measure. As a result, the estimated elasticity of substitution across age groups lies between 5

[11] The results are given in appendix Table A2.

[12] The cohort effects are standardized to age 38-42. The cohort effects for the other two supply measures are plotted in appendix Figure A3 and Figure A4.

(=1/0.20) and 5.95 (=1/0.168). These estimates are comparable in magnitude to those found by Card and Lemieux (2001) for the US, UK and Canada.

The estimated year effects which absorbs the technology shock and the effect of changing aggregate relative supply does not show a statistically significant change during 1983-1993, but shows a steep rise in 1999 and 2004. Since technology shocks and aggregate relative supply have opposite effects on the wage premium, much cannot be read into year effects until one knows the behavior of aggregate relative supply.

Column (2), (4) and (6) of Table 3, report the results of the same models except the year effects have been replaced with a linear time trend. Replacing the unrestricted year effects with a trend does not change the critical coefficients drastically, but the fit of the model deteriorates.

In the second stage, age group specific wage premium by year are regressed on both age group specific relative supplies and aggregate relative supplies of tertiary graduate workers (equation 9). Aggregate supplies are calculated using the estimates of elasticity across age groups estimated in first stage and the tertiary, secondary efficiency parameters which are estimated by fitting equations (11) and (12).[13] The relative technology shock variable is assumed to follow a linear time trend.[14] The results are presented in columns (1), (2) and (3) of Table 4.

Aggregate relative supply has a statistically significant effect on the wage premium. The estimated coefficient on aggregate relative labor supply lies between -0.464 using labor force as the supply measure and -0.491 using hours as the supply measure. As a result, the elasticity of substitution between tertiary and secondary equivalent workers lies between 2.04 (=1/0.491) and 2.16 (=1/0.464). Evidence from other countries suggests an elasticity of substitution between tertiary and secondary graduates between 1.1 and 2.5.[15] Thus, the estimated elasticity between 2 to 2.2 is consistent with other countries' experiences, especially from developing counties like Brazil and Columbia. Also, similar estimates are obtained for $(1/\sigma_A)$ in both stages as predicted by the theoretical model.

The time trend variable is statistically significant and coefficient implies an almost 7% increase in demand in each five year period. Columns (4), (5) and (6) of Table 4 present the results of the same models except a post-1991 dummy is included to capture any significant change in demand in the post-1991 reform era. The belief that most of the increase in demand occurred in the 1990s is rejected as the post-1991 dummy is statistically insignificant.

[13]The estimated efficiency parameters for age groups are reported in the appendix Table A3.

[14]Adding higher order terms in time (i.e., time square and time cubic) does not improve the fit of the model. Moreover, with higher order terms in the model, both the trend and higher order terms become insignificant; the sign of the coefficient on the relative supply index also changes to positive, which is counter-intuitive. This is not inconsistent with the steady demand hypothesis, i.e. technological change happens at constant rate, which is captured by a linear time trend.

[15]Appendix Table A4 presents elasticity estimates from some other countries.

The aggregate relative supply index that is used in the second-stage is plotted in Figure 7. The relative supply index shows that the relative supply of tertiary workers increased in the 1980s, the rate of growth decreased between 1993-94 and 1999-00, while it became virtually stagnant between 1999-00 and 2004-05. Given the trends in supply, an increase in the wage premium for tertiary workers could not have come without a shift in demand throughout the study period. The wage premium did not change during 1983-1987; it increased by 3 percent during 1987-1993. In both these periods, the aggregate supply of tertiary workers was increasing. The only way this is possible is if a positive demand shift negated or outweighed the positive supply shift. Similarly, during 1993-1999 and 1999-2004, there was a deceleration and stagnation, respectively, in relative supply. But, considering that these two periods saw major increases in the wage premium, demand-side changes must have played a key role. Thus, given a continual shift in demand combined with a stagnant relative supply is one potential explanation for the increase in the wage premium experienced in late 1990s (Figure 1).

These findings are consistent with prior studies. For example, Kijima (2006) experimenting with different elasticity values across education groups, finds that the growth rate of relative demand for tertiary graduate workers is faster than that of log relative supply of tertiary workers after 1993, while before 1993 implied demand grew at a slower or same rate as relative supply. Chamarbagwala (2006), using the Katz and Murphy methodology, also finds that demand shifts played an important role in relative wage changes in India during 1983-1999.

Given these findings, three important questions arise. First, what accounts for the shift in favor of tertiary or highly skilled workers? Second, why is there no evidence of a break in demand for skilled labor in post-1991 reform era? Third what accounts for the stagnation in the relative supply of tertiary workers?

Although this paper does not explore the reasons for the demand shift, prior studies using data from 1983 to 1999 point to skill-biased technological change as the main reason. Kijima (2006) finds that the increase in demand is unlikely to be due to trade policy and comes mostly from within industry skill upgrading or skill-biased technological change. Chamarbagwala (2006) also documents a large shift in favor of skilled workers and finds that this demand shift is primarily within sectors; skill upgrading within industries explains most of the rising demand for skilled workers. Skill-biased technological change is consistent with the assumption of a linear trend for demand change (Murphy *et al.,* 1998).

Regarding why there is no evidence of a break in demand in 1991, one should keep in mind that the 1980s were quite different from the previous three decades. After experiencing three decades of a low 'Hindu rate of growth' of around three percent a year, the Indian economy grew at a much faster rate (5-6%) in the 1980s. The average growth rate between 1981-82 and 1990-91 was 5.7 percent, while the annual growth rate during the eleven-year period from 1992-93 to 2002-03 was 5.9 percent. Thus, the growth rates in the

1980s and 1990s were comparable (Panagariya, 2003). In addition, while the conventional wisdom traces the policy reform to the 1990s, many policy reforms were introduced during 1980s. Panagariya (2003) points out that the reforms in the 1980s must be viewed as a precursor to those in the 1990s, rather than a part of the isolated and sporadic liberalizing actions during the 1960s and 1970s which were often reversed within a short period. The difference between the reforms in the 1980s and those in the 1990s is that the former were limited in scope and without a clear roadmap, whereas the latter were systematic. Joshi and Little (1994, chapter 13), who have extensively studied Indian macroeconomic policies in the 1980s, recognize the role of the reforms but regard fiscal expansion financed by external and internal borrowing as the key to the acceleration of growth during the 1980s. This is also the view expressed indirectly by Ahluwalia (2002, p. 67) who states that while the growth record in the 1990s was only slightly better than in the 1980s, the 1980s growth was unsustainable, "fuelled by a buildup of external debt that culminated in the crisis of 1991" (Panagariya, 2003). Thus, from a pure growth perspective, the 1980s and 1990s were not very different. So, if skilled-biased technological change has been the driving force for high GDP growth and mostly came through within sector upgrading and not through trade reforms, there is no reason to expect the 1980s to be very different from the 1990s.

Factors leading to stagnation in the relative supply of tertiary graduate workers is an important question for education policy makers and for future research. This has great implications for the tertiary-secondary wage premium and wage inequality in India given that India is projected to maintain a very high growth rate of around 8-9% in the near future. One possibility is that the massive expansion of elementary education has not been matched at higher stages. Figure 8 presents transition across different stages of schooling. Only one-fourth of students starting at middle school (class 8) end up enrolling in the first year of tertiary education. Only a certain percentage of that enrolment actually completes tertiary education. It seems that drop outs at each stage remain a major problem for the Indian education system. Given the Indian government's efforts to encourage enrollment in elementary schools, unless the dropout rate at later stages is addressed, the relative supply of tertiary graduates is not going to increase in the near future.

4.2 Alternative specifications

Some alternative specifications are considered to check further the robustness of the estimates with respect to supply measures used.

First, the sample is restricted to urban men only for the estimation of the wage premium and supply measures. The estimated coefficient on the relative supply of tertiary graduate workers in the first stage lies

between -0.143 using workers as the supply measure and -0.172 using labor force as the supply measure.[16] This implies an elasticity of substitution across age groups between 5.8 (=1/0.172) and 7 (=1/0.143). The estimated elasticity in the male sample is higher than that found in the full sample using both sexes. The second-stage estimation results are presented in Table 5. The estimated coefficient on the aggregate relative labor supply of tertiary graduate workers lies between -0.540 using hours as the supply measure and -0.572 using workers as the supply measure. This implies an elasticity of substitution between the two education groups between 1.75 (=1/0.572) and 1.85 (=1/0.540). These estimates are a little lower than the baseline results obtained using both sexes. Also, the time trend variable is statistically significant and indicates an 8% demand growth in favor of tertiary graduate workers in each five-year period.

Second, since this paper's aim is to explain the wage premium between completed tertiary and secondary education, the supply measure is restricted to pure tertiary and pure secondary (i.e., middle school is excluded from the secondary supply measure). The age group specific relative supply is statistically significant at the 10% significance level using each of the three supply measures.[17] The estimated coefficient on (log) age group specific relative supply lies between -0.160 using workers as the supply measure and -0.190 using labor force as the supply measure. Hence, the estimated elasticity of substitution between different age groups lies between 5.2 (=1/0.190) and 6.25 (=1/0.160). The estimated elasticity is very similar to the one estimated earlier using secondary equivalents as the supply measure. The results of the second-stage estimation is presented in Table 6. The estimated coefficient on (log) aggregate relative supply lie between -0.465 using hours as the supply measure and -0.504 using labor force as the supply measure. This gives an elasticity of substitution between tertiary and pure secondary workers between 1.96 (=1/0.504) and 2.15 (=1/0.465), which is very close to the estimates obtained when secondary equivalents are used as the supply measure. The time trend is statistically significant and implies an almost 6.5% increase in demand in each five-year period.

Third, both urban and rural areas and both sexes are pooled together to present an overall picture of India. The estimated coefficient on the relative supply of tertiary graduate workers in the first-stage lies between -0.158 using workers as the supply measure and -0.205 using labor force as the supply measure.[18] This implies an elasticity of substitution across age groups between 4.9 (=1/0.205) and 6.33 (=1/0.158). The results of second-stage estimation are presented in Table 7. The estimated coefficient on aggregate relative labor supply of tertiary graduate workers lies between -0.383 using hours and -0.481 using workers. This implies an elasticity of substitution between the two education group between 2.07 (=1/0.481) and

[16]The first-stage results are presented in the appendix Table A5.

[17]The first-stage results are presented in the appendix Table A6.

[18]The first-stage results are presented in the appendix Table A7.

2.61 (=1/0.383). These estimates are higher than the estimates obtained using urban areas only. This implies that the elasticity of substitution between education groups in rural areas is higher than in urban areas. Also, the time trend is statistically significant and indicates 5.3% to 6.5% demand growth in favor of tertiary graduate workers in each five-year period. The growth rate of demand in favor of the tertiary graduate workers is less in the pooled sample than the urban only sample, which indicates a lower growth rate of demand for skilled workers in rural areas compared to urban areas.

5 Conclusion

The paper uses individual-level data from urban India covering approximately two decades (1983-2005) to document the trends in wage premium between tertiary and secondary graduate workers. The findings indicate that the wage premium has not only been increasing, but also the increase has not been similar across different age groups, suggesting imperfect substitutability across different age groups. To explain these trends, the simple demand and supply model developed by Card and Lemieux (2001) that allows for imperfect substitutability across different age groups, is used.

The empirical findings of the paper are fourfold. First, the increase in the wage premium is mostly driven by demand shifts, although the relative supply of tertiary graduate workers has also played an important role in shaping the wage premium. An increasing relative supply of tertiary workers in the 1980s negated some of the demand shift, preventing the wage premium from rising much, but the late 1990s saw a stagnation in the relative supply of tertiary workers and the wage premium rose substantially in this period.

Second, the estimated elasticity of substitution across different age groups lies between 5 and 7 in urban areas. Although the elasticity of substitution across age groups is high, ignoring the imperfect substitutability is likely to introduce biases into the estimation of the effects of shifts in demand or supply of workers with tertiary or secondary education on the wage premium.

Third, the estimated elasticity of substitution between tertiary and secondary graduate workers lies between 1.75 and 2.16 in urban areas. In rural areas this is higher. Fourth, the increase in the wage premium is not directly the result of economic reforms initiated during 1991. The demand shift toward tertiary workers existed even in 1980s, as the Indian economy grew at rate of 5 to 6 percent per annum as a result of massive public expenditure.

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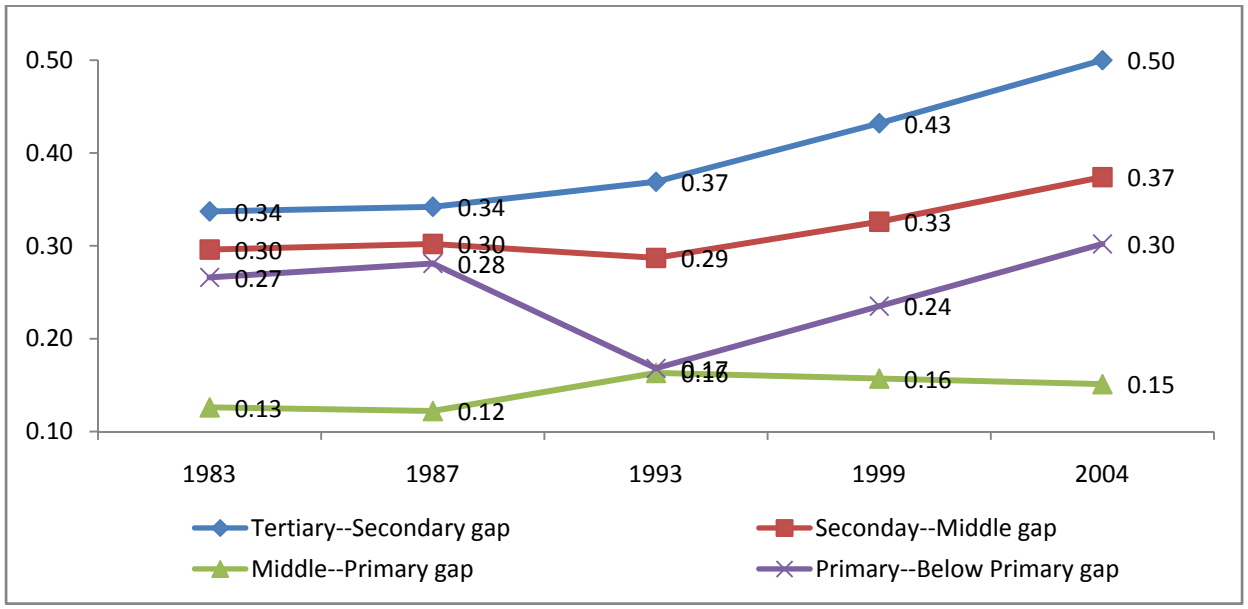
A Data Appendix

Wage Sample and Wage premiums

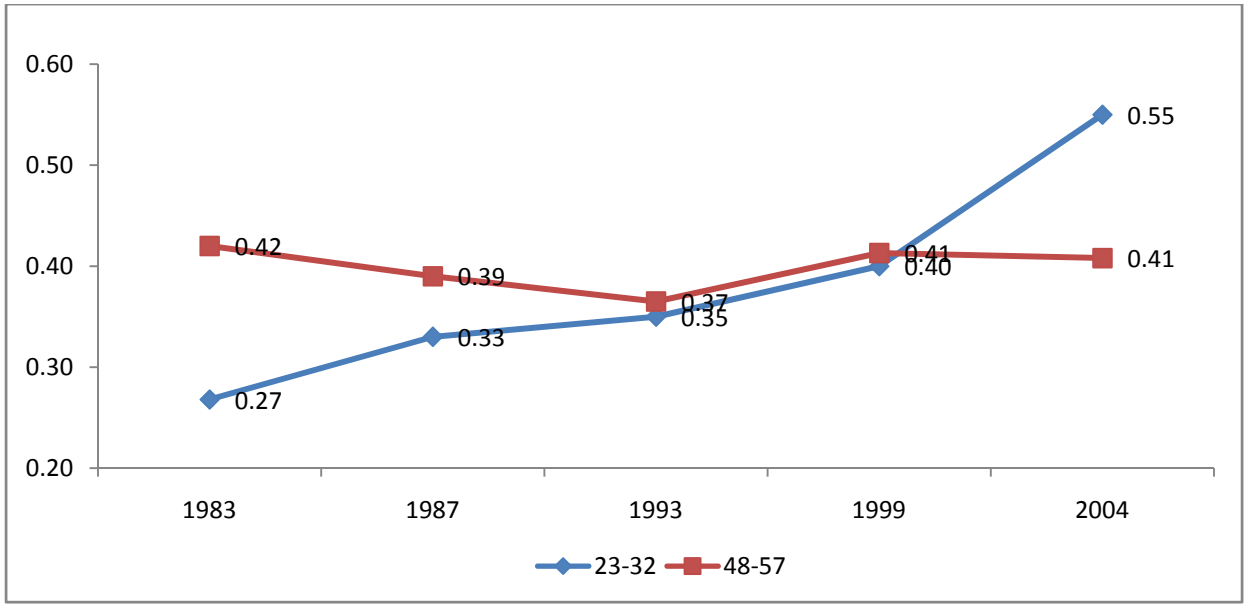
The wage sample includes regular wage/salaried workers in age group 23-57 years with exactly a tertiary or secondary education. The wage distribution was trimmed by 0.5% both at top and bottom for each year for both urban and rural areas. The datasets has information on wages earned in last week and the numbers of days worked in last week (days are categorized according to intensity of work). The weekly wages reported in survey is used as the sample is restricted to regular salaried whose wages might not be directly dependent on the days worked in last week. The wage gaps are estimated in separate regressions for each age group in each year using wage sample of regular workers with exactly a tertiary or secondary degree. Each model include log of real weekly wage as dependent variable and tertiary education dummy, age and dummies for scheduled caste, scheduled tribe and states as independent variables.

Figure 1: Wage Premium for different skill groups



Note: The wage Premiums are estimated in separate regressions in each year using wage sample of regular workers with education level being exactly same as the two education degrees considered. Each model include log of real weekly wage as dependent variable and a dummy variable for the higher level of education between the two education levels considered, age and dummies for scheduled caste, scheduled tribe and states as independent variables.

Figure 2: Tertiary-Secondary Wage Premium for different age groups



Note: The wage premiums are estimated in separate regressions for each age group in each year using wage sample of regular workers with exactly a tertiary or a secondary degree. Each model include log of real weekly wage as dependent variable and tertiary education dummy, age and dummies for scheduled caste, scheduled tribe and states as independent variables.

Figure 3: Age profile of Tertiary-Secondary Wage Premium at different points of time

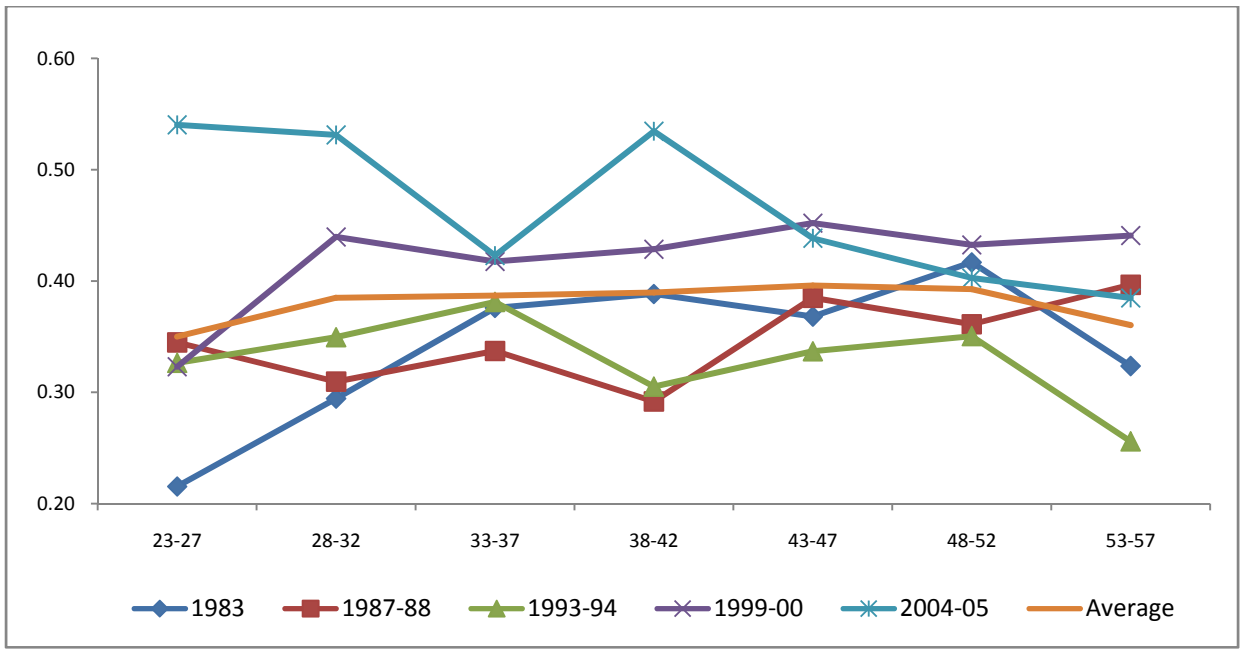


Figure 4: Age-Profile of Wage Premium for different cohorts

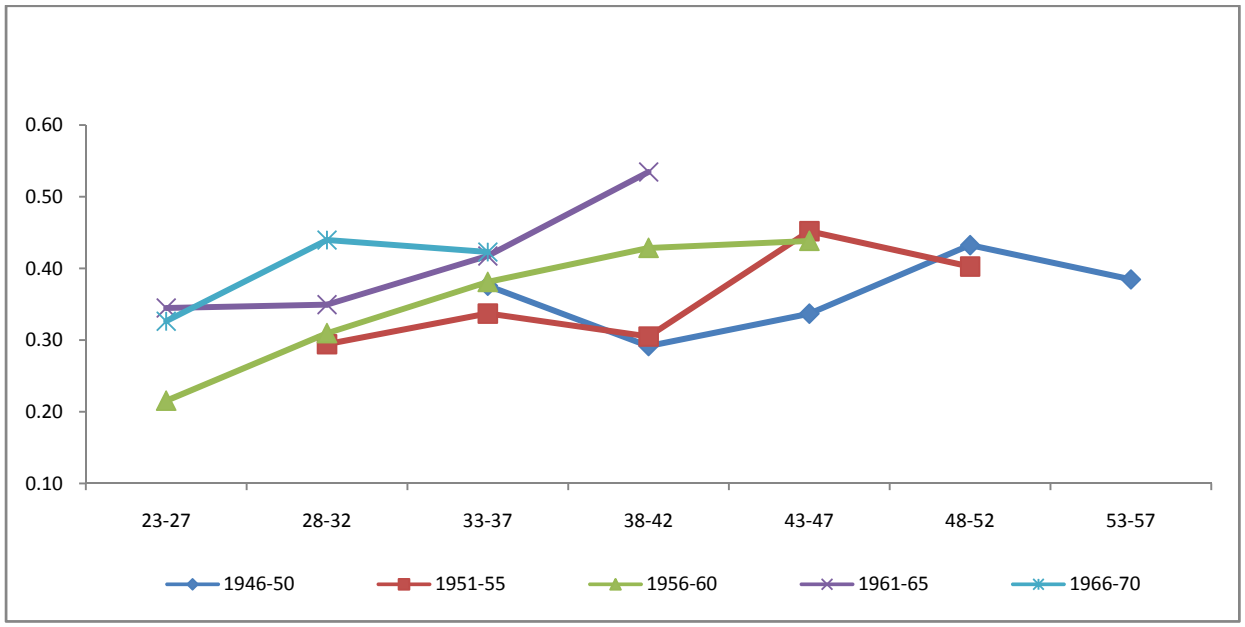


Figure 5: Age Group Specific Relative Supply of Tertiary graduate workers

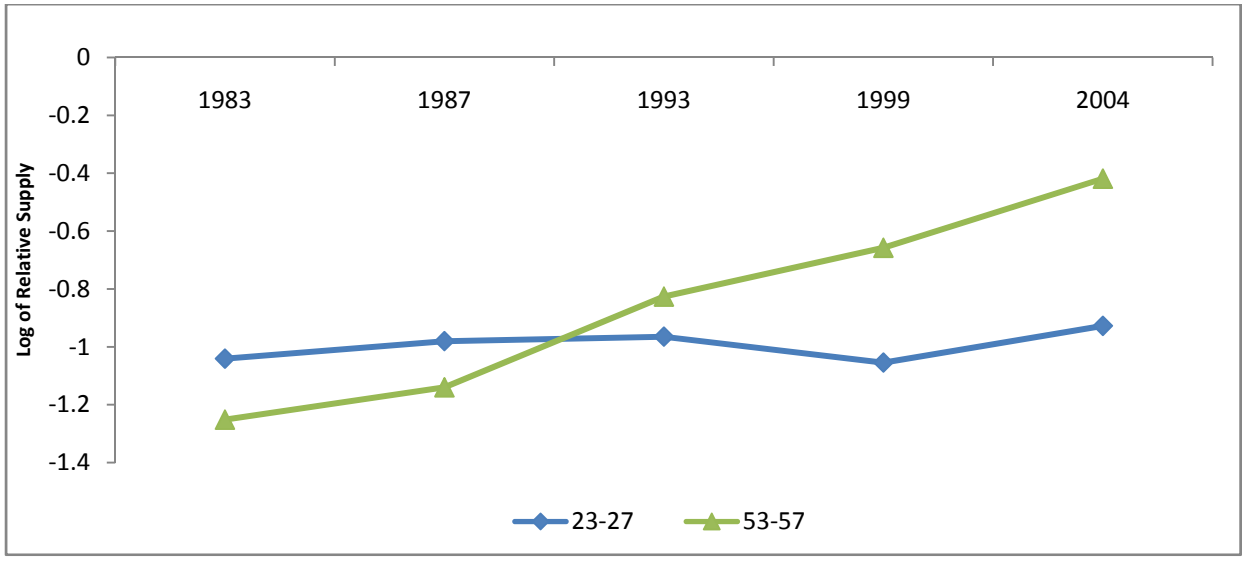
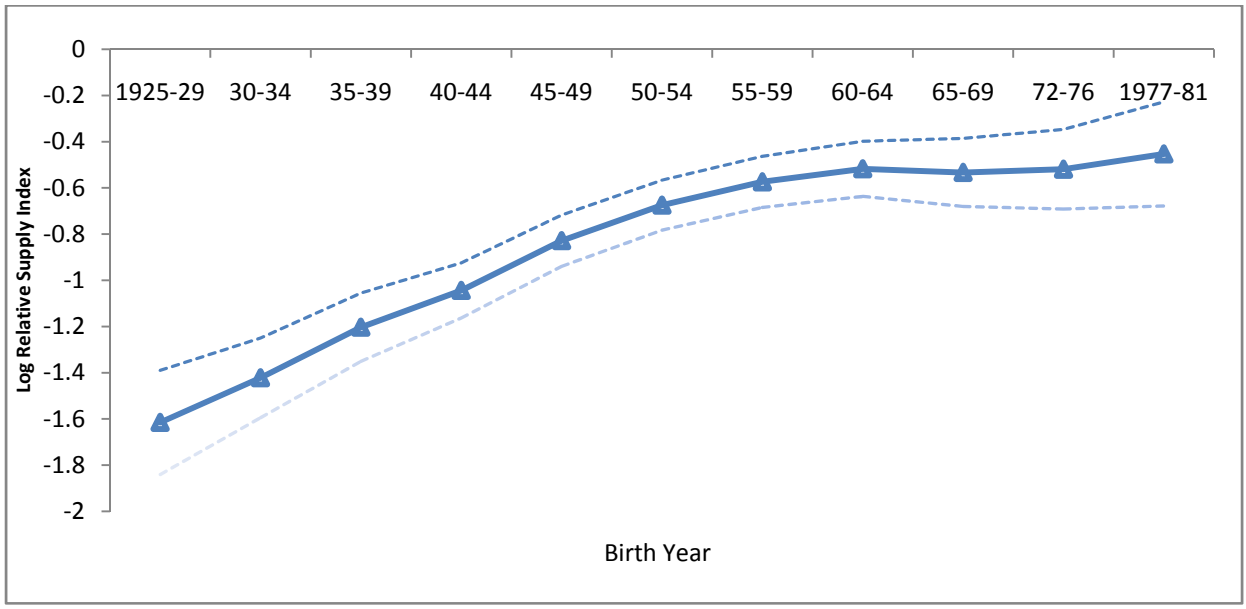


Figure 6: Relative Supply of Tertiary graduate workers by cohort



Note: The cohort effects are standardized for age group 38-42.

Figure 7: Aggregate Relative Supply Index for Tertiary graduate workers

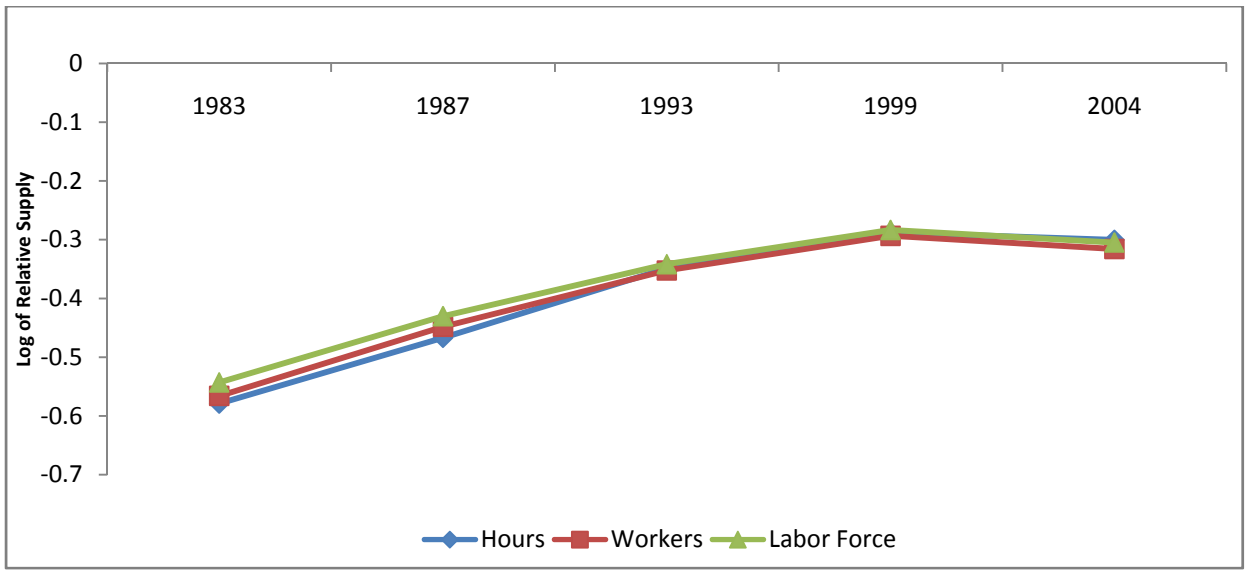
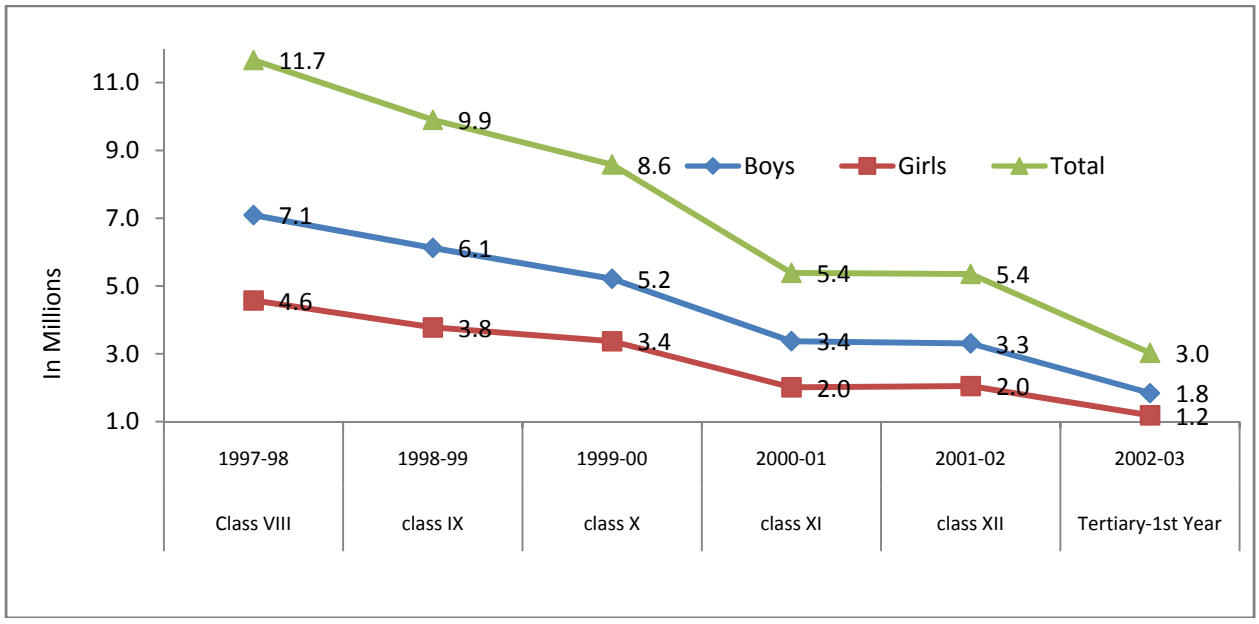


Figure 8: Transition from Middle to Secondary, Sr. Secondary and Tertiary in India



Note: 1) The figure represents all India.
2) The numbers are enrolment numbers. It can be taken approximately as transition rate assuming that repetition in classes is not quite high.
Source: Selected Educational Statistics, MHRD, GOI, Various Years.

Table 1: Change in Employment Shares of different educational groups

	1983	1987-88	1993-94	1999-00	2004-05
Below primary	22.91	21.34	17.96	14.63	14.57
Primary	13.13	13.61	9.99	8.4	9.7
Middle	16.59	13.87	14.47	14.46	14.52
Secondary	28.4	29.47	31.14	32.72	31.5
Tertiary	18.97	21.71	26.45	29.79	29.71
No. of observations	**22,758**	**25,091**	**24,573**	**25,295**	**22,020**

Table 2: Tertiary-Secondary Wage Premium by age groups and year

	23-27	28-32	33-37	38-42	43-47	48-52	53-57
1983	0.215	0.294	0.376	0.388	0.368	0.417	0.324
	(0.043)	(0.027)	(0.027)	(0.032)	(0.037)	(0.044)	(0.066)
1987	0.345	0.310	0.337	0.292	0.385	0.361	0.397
	(0.035)	(0.028)	(0.030)	(0.032)	(0.036)	(0.037)	(0.053)
1993	0.326	0.349	0.381	0.305	0.337	0.350	0.256
	(0.040)	(0.037)	(0.032)	(0.040)	(0.048)	(0.041)	(0.071)
1999	0.323	0.440	0.418	0.429	0.452	0.432	0.441
	(0.042)	(0.040)	(0.041)	(0.036)	(0.036)	(0.037)	(0.052)
2004	0.540	0.531	0.423	0.535	0.438	0.403	0.385
	(0.049)	(0.046)	(0.053)	(0.049)	(0.047)	(0.048)	(0.057)

Note: Standard errors are in parentheses. The table entries are wage differentials in mean log weekly earnings between a tertiary completed worker and secondary completed worker.

Table 3: First Stage Estimates for the Tertiary-Secondary Wage Premium

	(1)	(2)	(3)	(4)	(5)	(6)
	Measures of Supply					
	Labor Force		Workers		Hours	
1987-88	0.033		0.025		0.025	
	(0.028)		(0.027)		(0.027)	
1993-94	0.063		0.051		0.056	
	(0.040)		(0.036)		(0.038)	
1999-00	0.163		0.145		0.151	
	(0.047)		(0.042)		(0.044)	
2004-05	0.208		0.191		0.200	
	(0.047)		(0.043)		(0.045)	
Age Group Specific Relative Supply	-0.200	-0.245	-0.168	-0.216	-0.171	-0.218
	(0.095)	(0.082)	(0.085)	(0.077)	(0.084)	(0.077)
trend		0.059		0.054		0.057
		(0.011)		(0.010)		(0.011)
Adjusted R^2	0.985	0.984	0.984	0.983	0.984	0.984
F	186.733	239.021	183.100	231.690	184.660	233.439
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	35	35	35	35	35	35

Note: Standard errors in parenthesis. Models are fitted by weighted least squares to the age group specific wage premiums by year shown in Table 2. Weights used are inverse of the sampling variances of the estimated wage premiums.

Table 4: Second Stage Estimates for the Tertiary-Secondary Wage Premium

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Measures of Supply					
	Labor Force	Workers	Hours	Labor Force	Workers	Hours
Trend	0.071	0.071	0.077	0.073	0.072	0.077
	(0.018)	(0.017)	(0.020)	(0.018)	(0.018)	(0.020)
Aggregate Relative Supply	-0.464	-0.481	-0.491	-0.428	-0.451	-0.511
	(0.248)	(0.231)	(0.237)	(0.278)	(0.263)	(0.296)
Age Group Specific Relative Supply	-0.197	-0.168	-0.172	-0.198	-0.169	-0.171
	(0.097)	(0.086)	(0.085)	(0.099)	(0.088)	(0.087)
Post 1991 dummy				-0.012	-0.010	0.005
				(0.038)	(0.039)	(0.043)
Adjusted R^2	0.984	0.984	0.984	0.983	0.983	0.983
F	214.159	212.391	214.081	187.636	185.849	186.946
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	35	35	35	35	35	35

Note: Standard errors in parenthesis. Models are fitted by weighted least squares and weights used are inverse of sampling variances of the estimated wage premium.

Table 5: Second Stage Estimates for the Tertiary-Secondary Wage Premium for Male Sample

	(1)	(2)	(3)
	Measure of Supply		
	Labor Force	Workers	Hours
Trend	0.080	0.080	0.083
	(0.021)	(0.021)	(0.023)
Aggregate Supply	-0.562	-0.572	-0.540
Index	(0.281)	(0.265)	(0.266)
Age-Group Specific	-0.176	-0.145	-0.153
Relative supply	(0.115)	(0.103)	(0.102)
Adjusted R^2	0.979	0.979	0.978
F	161.835	160.642	158.482
(p-value)	(0.000)	(0.000)	(0.000)
N	35	35	35

Note: Standard errors in parenthesis. Models are fitted by weighted least squares and weights used are inverse of sampling variances of the estimated wage premiums.

Table 6: Second Stage Estimates for the Tertiary-Secondary Wage Premium for pure Tertiary and Secondary supply measure

	(1)	*(2)*	*(3)*
	Measure of Supply		
Variable	Labor Force	Workers	Hours
Trend	0.066	0.065	0.066
	(0.018)	(0.018)	(0.019)
Aggregate Relative	-0.504	-0.511	-0.465
Supply	(0.312)	(0.292)	(0.291)
Age Group Specific	-0.192	-0.165	-0.170
Relative Supply	(0.104)	(0.092)	(0.092)
Adjusted R^2	0.983	0.982	0.982
F	199.479	197.15	194.883
(p-value)	(0.000)	(0.000)	(0.000)
Number of observations	35	35	35

Note: Standard errors in parenthesis. Models are fitted by weighted least squares and weights used are inverse of sampling variances of the estimated wage premiums.

Table 7: Second Stage Estimates for the Tertiary-Secondary Wage Premium for All India Sample

	(1)	(2)	(3)
	Measure of Supply		
	Labor Force	Workers	Hours
Trend	0.053	0.053	0.065
	(0.011)	(0.012)	(0.014)
Aggregate Supply Index	-0.383	-0.417	-0.481
	(0.229)	(0.224)	(0.213)
Age-Group Specific	-0.207	-0.178	-0.159
Relative supply	(0.101)	(0.088)	(0.085)
Adjusted R^2	0.988	0.988	0.989
F	293.684	292.133	302.282
(p-value)	(0.000)	(0.000)	(0.000)
N	35	35	35

Note: Standard errors in parenthesis. Models are fitted by weighted least squares where weights used are inverse of sampling variances of the estimated wage premiums.

Appendix

Table A1: Education System in India

Education Level	*Years of Education*
Tertiary	15 or more
Secondary	10-12
Middle	8
Primary	5

Note: There is some state wise variation for Primary/Middle.

Table A2: Estimated Cohort and Age effects in Age Specific Relative Supply of Tertiary graduate workers

	(1)	*(2)*	*(3)*
	Measure of Supply		
	Hours	Workers	Labor Force
Age 23-27	-0.47***	-0.44***	-0.34***
Age 28-32	-0.21***	-0.18***	-0.18***
Age 33-37	-0.10*	-0.09	-0.10*
Age 43-47	0.10*	0.10*	0.10*
Age 48-52	0.23***	0.20***	0.21***
Age 53-57	0.36***	0.34***	0.34***
Cohort 1	-1.62***	-1.60***	-1.59***
Cohort 2	-1.42***	-1.36***	-1.37***
Cohort 3	-1.20***	-1.17***	-1.17***
Cohort 4	-1.04***	-1.02***	-1.03***
Cohort 5	-0.83***	-0.82***	-0.82***
Cohort 6	-0.67***	-0.67***	-0.68***
Cohort 7	-0.57***	-0.59***	-0.60***
Cohort 8	-0.52***	-0.55***	-0.54***
Cohort 9	-0.53***	-0.58***	-0.55***
Cohort 10	-0.52***	-0.57***	-0.51***
Cohort 11	-0.45***	-0.52***	-0.47***
Adjusted R^2	0.99	0.99	0.99
F	200.32	221.5	213.13
(p-value)	(0.00)	(0.00)	(0.00)
N	35	35	35

* p<0.1; **p<.05; *** p<.01

Note: 1. Dependent variable is age group specific relative supply of tertiary graduate workers.
2. Age group 38-42 is used as base dummy.

Table A3: Estimated efficiencies parameters for different age groups

	Tertiary efficiency parameters $\beta's$			*Secondary efficiency parameters* $\alpha's$		
Age Group	Measures of Supply					
	Labor Force	Workers	Hours	Labor Force	Workers	Hours
23-27	1.00	1.00	1.00	1.00	1.00	1.00
28-32	1.29	1.33	1.33	1.26	1.28	1.29
33-27	1.43	1.50	1.50	1.39	1.43	1.43
38-42	1.61	1.69	1.69	1.56	1.62	1.62
43-47	1.66	1.77	1.77	1.63	1.71	1.71
48-52	1.76	1.89	1.88	1.74	1.84	1.84
53-57	1.60	1.75	1.74	1.68	1.81	1.80

Note: Standardized to age group 23-27

Table A4: International evidences on estimates of elasticity of substitution

Author	*Elasticity*	*Country*
A.		
Katz and Murphy (1992)	1.41	USA
Santamaria (2000)	2.1	Colombia
Angrist (1995)	2	Palestine
Blom and Velez (2004)	1.6	Brazil(Urban)
B		
Card and Lemieux (2001)	1.1-1.6	USA
	2-2.5*	USA,UK,Canada
Ferreira (2004)	1.9	Brazil (Urban)

Note: 1.Studies in group A assume perfect substitutability across age groups.
2. Studies in group B do not assume perfect substitutability.
3. * Only takes male sample.

Table A5: Estimated First Stage Results for Urban Male Sample

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Measure of supply					
Variable	Labor Force		Workers		Hours	
1987	0.015		0.009		0.009	
	(0.031)		(0.030)		(0.030)	
1993	0.049		0.039		0.044	
	(0.043)		(0.040)		(0.042)	
1999	0.143		0.128		0.134	
	(0.049)		(0.045)		(0.047)	
2004	0.203		0.191		0.198	
	(0.050)		(0.047)		(0.049)	
Age-Specific	-0.172	-0.230	-0.143	-0.201	-0.146	-0.198
Relative Supply	(0.099)	(0.090)	(0.091)	(0.085)	(0.089)	(0.084)
Trend		0.058		0.053		0.056
		(0.012)		(0.011)		(0.012)
Adjusted R^2	0.98	0.979	0.979	0.978	0.979	0.978
F	140.565	178.8	137.74	173.038	138.763	173.05
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	35	35	35	35	35	35

Note: Standard errors in parenthesis. Models are fitted by weighted least squares and weights used are inverse of sampling variances of the estimated wage premiums.

Table A6: Estimated First Stage Results for pure Tertiary and Secondary supply measure

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Measure of Supply					
Variable	Labor Force		Workers		Hours	
1987-88	0.020		0.015		0.014	
	(0.026)		(0.025)		(0.025)	
1993-94	0.047		0.038		0.041	
	(0.036)		(0.033)		(0.034)	
1999-00	0.144		0.129		0.134	
	(0.043)		(0.038)		(0.039)	
2004-05	0.188		0.175		0.181	
	(0.042)		(0.039)		(0.04)	
Age Group Specific	-0.190	-0.236	-0.160	-0.205	-0.164	-0.204
Relative Supply	(0.099)	(0.091)	(0.089)	(0.085)	(0.088)	(0.085)
Trend		0.053		0.049		0.050
		(0.011)		(0.010)		(0.010)
Adjusted R^2	0.984	0.983	0.984	0.982	0.984	0.982
F	181.288	223.149	178.476	217.267	179.949	217.478
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	35	35	35	35	35	35

Note: Standard errors in parenthesis. Models are fitted by weighted least squares and weights used are Inverse of sampling variances of the estimated wage premiums.

Table A7: Estimated First Stage Results for both Urban and Rural areas-All India

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Measures of Supply					
	Labor Force		Workers		Hours	
1987	0.057		0.052		0.050	
	(0.023)		(0.022)		(0.022)	
1993-94	0.063		0.053		0.057	
	(0.032)		(0.029)		(0.032)	
1999-00	0.141		0.129		0.132	
	(0.037)		(0.032)		(0.036)	
2004-05	0.186		0.176		0.185	
	(0.034)		(0.031)		(0.037)	
Age-Specific Relative	-0.205	-0.244	-0.177	-0.218	-0.158	-0.213
Supply	(0.099)	(0.082)	(0.087)	(0.077)	(0.086)	(0.076)
Trend		0.048		0.045		0.049
		(0.008)		(0.008)		(0.009)
Adjusted R^2	0.989	0.988	0.989	0.988	0.988	0.988
F	255.585	333.661	254.232	325.767	247.013	325.655
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	35	35	35	35	35	35

Note: Standard errors in parenthesis. Models are fitted by weighted least squares and weights used are inverse of sampling variances of the estimated wage premiums.

Figure A1: Age Group Specific Relative Supply of Tertiary graduate workers using Labor Force supply measure

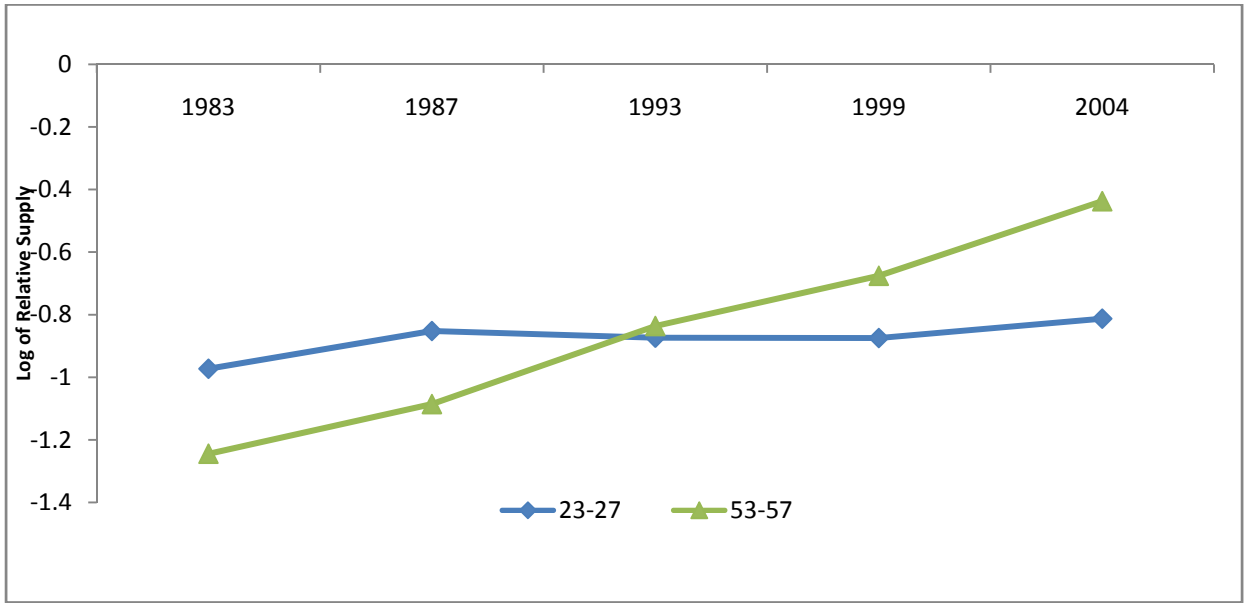


Figure A2: Age Group Specific Relative Supply of Tertiary graduate workers using Workers supply measure

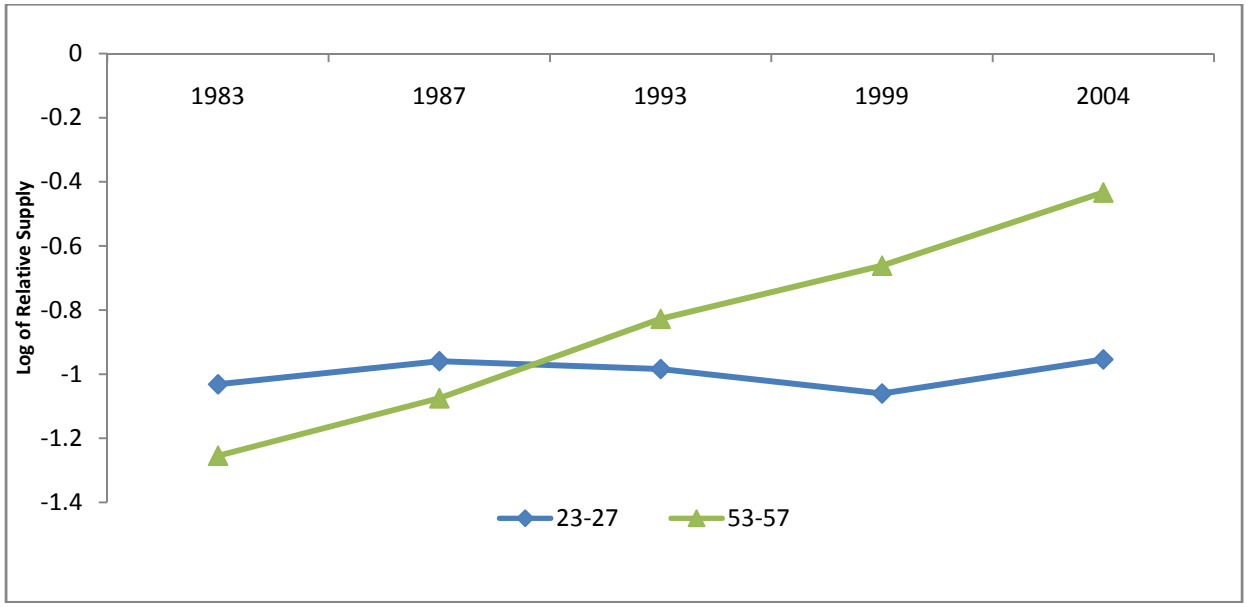
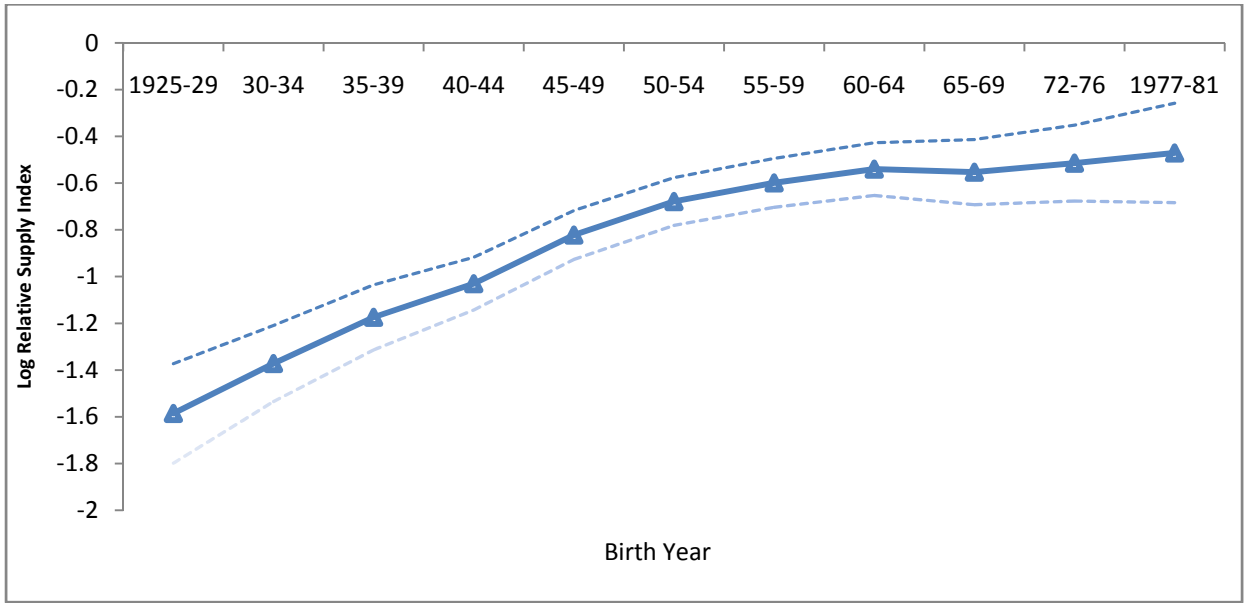
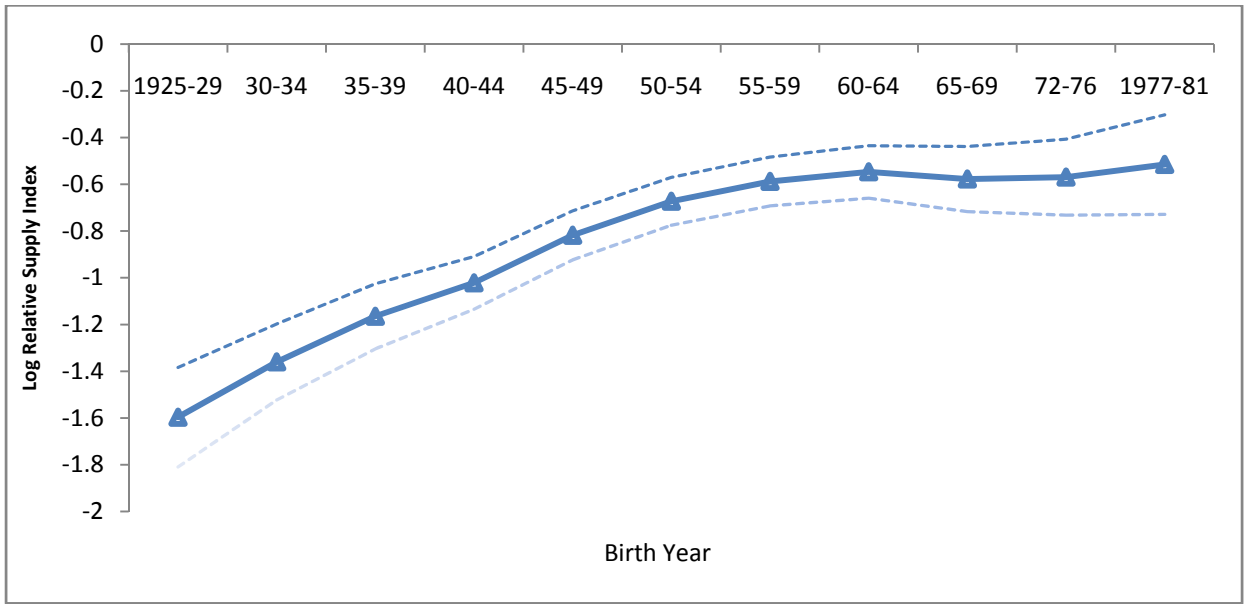


Figure A3: Relative Supply of tertiary educated workers by cohort using Labor Force supply measure



Note: The cohort effects are standardized for age group 38-42.

Figure A4: Relative Supply of tertiary educated workers by cohort using Labor Force supply measure



Note: The cohort effects are standardized for age group 38-42.