Industrial Deregulation, Skill Upgrading, and Wage Inequality in India

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April, 2007

Abstract

We investigate the relationship between economic deregulation (delicensing), skill upgrading, and wage inequality during the 1980s and 1990s in India. We use a unique dataset on India's industrial licensing regime to test whether industrial deregulation during the 1980s and 1990s played a role in generating demand for skilled workers, as measured by the employment and wagebill shares of white-collar workers, and in raising the returns to skilled labor, as measured by the skill premium. Our analysis focuses not only on the difference between licensed and delicensed industries but also on the comparison of these differences during the 1980s, when India's external sector remained relatively closed to the world economy, and the 1990s, when India underwent massive liberalization reforms and became increasingly integrated with the global economy. We identify two main channels through which industrial delicensing affects the demand for skills and wage inequality: capital- and output-skill complementarities. Our analysis finds two important results. First, capital- and output-skill complementarities existed for firms in both licensed and delicensed industries but were *stronger* in delicensed industries both before and after 1991. The exception is output-skill complementarities with respect to the skill premium, which was lower in delicensed than in licensed industries both before and after 1991. Second, the contribution of industrial delicensing to both types of complementarities was considerably higher during the 1980s and much smaller after 1991. These results suggest that industrial delicensing benefited skilled labor via capital- and output-skill complementarities during the 1980s, the decade *before* India liberalized it's trade and investment regime. Thus, some of the increase in the demand for and returns to skill as a result of capital- and output-skill complementarities, can be attributed to domestic reforms during the pre-1991 period in India.

JEL Codes: F16, J23, J24, O14, O38

Keywords: Capital-skill complementarities, industrial delicensing, trade liberalization, India

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1 Introduction

During the 1980s and 1990s, the Indian labor market experienced two dramatic changes. First, there was a considerable widening of the skill wage gap, as shown in Figures 1 (average nominal wages) and 2 (skill premium). Figure 1 shows the average nominal wages of white- and blue-collar workers between 1980-81 and 1994-95.[1] The average wage of white-collar or skilled workers is always higher than those of blue-collar or unskilled workers. Further, the divergence between these wages began during the mid-1980s and increased over time, especially after 1991. The skill premium, which we define as the ratio of the average white- and blue-collar wage rates, declined during the early 1980s, remained relatively stable until the late 1980s, and rose considerably after 1991. The second change that occurred in the Indian labor market during this period was a large increase in the demand for skilled labor. As shown in Figure 3, (wagebill and employment shares of white-collar workers) there was a gradual increase in the share of the wagebill going to white-collar workers as well as in the share of white-collar workers employed by firms during the 1980s. After 1991, the wagebill and employment shares of white-collar workers rose sharply.

Together, Figures 1-3 reveal an interesting feature of India's labor market during the mid-1980s and early 1990s – that the employment share of white-collar workers rose simultaneously with the skill premium. Since the 1980s and 1990s also mark a period of widespread economic reforms in India, it is reasonable to expect that these reforms may have played a role in skill upgrading and wage inequality. Domestic sector reforms, which consisted of industrial deregulation, began during the mid-1980s and continued after 1991.[2] External sector reforms consisted of the liberalization of trade and foreign investment and began in July 1991.

Industrial deregulation consisted of industrial delicensing reforms for certain industries during the 1980s and 1990s. Delicensing meant freedom from constraints on output, inputs, technology, and location as well as free entry into delincensed industries. Freedom from these constraints allowed firms to take advantage of economies of scale, more efficient input combinations, and new technology. Further, greater domestic competition as a result of free entry into delicensed industries

[1] White- and blue-collar workers are defined as non-production and production workers, respectively.

[2] We use the term deregulation to capture the industrial delicensing reforms implemented during the 1980s and 1990s in India.

provided firms with incentives to innovate, increase productivity, and improve product quality. If output-, capital-, and technology-skill complementarities exist, we would observe skill upgrading and increased wage inequality as a result of industrial deregulation, ceteris paribus. External sector reforms, which consisted of trade and investment liberalization, would have a similar effect on skilled labor by increasing foreign competition for domestic firms and providing them with additional incentives to innovate, increase productivity, and improve product quality. Again, in the presence of output-, capital-, and technology-skill complementarities, we would observe increases in the demand for skilled labor and a widening of the skill-wage-gap.

A large body of literature has established a link between external sector reforms, skill upgrading, and wage inequality in India and other developing countries (Attanasio et al. 2004, Cragg & Epelbaum 1996, Feenstra & Hanson 1996, 1997, 2003, Goldberg & Pavcnik 2004, Gorg & Strobl 2002, Hanson 2003, Harrison & Hanson 1999, Pavcnik 2003, Verhoogen 2004). For the case of India, Berman et al. (2005), Chamarbagwala (2006), Kumar & Mishra (2005), Dutta (2005) all examine the relationship between trade liberalization, skill upgrading, and wage inequality during the 1980s and 1990s. While these studies provide valuable insights into the relationship between external sector reforms, skill upgrading, and wage inequality, they don't allow for a link between domestic sector reforms and the demand for and return to skills. Berman et al. (2005) use Indian industry-level data to examine the relationship between output, capital, trade, and skill, but do not allow for a link between industrial deregulation and skill. Sharma (2006) incorporates domestic deregulation in an analysis of firm behavior and outcomes and provides evidence that domestic deregulation contributed to productivity gains among Indian firms, though it does not address the effect of domestic sector reforms on skill upgrading and wage inequality. Our work builds on Berman et al. (2005) and Sharma (2006) by allowing for industrial deregulation as well as external sector reforms to influence skill upgrading and wage inequality using firm-level data for India.

Our primary contribution is to investigate the relationship between domestic sector reforms, skill upgrading, and wage inequality in India. Incorporating domestic sector reforms, which consisted of industrial deregulation, in an analysis of the demand for and return to skills is particularly important for the case of India. Few of the previous studies on India's labor market control for

the changes in the 1980s, brought about by industrial delicensing, and hence may provide biased estimates of the impact of trade liberalization on skill upgrading and wage inequality. Table 1 brings forward three important points that challenge the predictions of other studies on India. First, the chronology of reforms was such that industrial deregulation began during the mid-1980s and therefore well *before* the external sector reforms were implemented in July 1991. Thus, industrial deregulation may have changed the domestic manufacturing environment during the 1980s and 1990s, which may have, in turn, affected the *ability* and *incentives* of Indian firms to respond to trade and investment liberalization after 1991. Second, the industrial delicensing reforms of the 1980s were quite significant with respect to the percentage of manufacturing output that they affected. Cumulatively, 23% of output and almost 23% of employment had been delicensed by 1990. These two points suggest that ignoring pre-1991 changes in the licensing regime may provide misleading and biased estimates of the impact of the 1991 reforms. Third, delicensing in 1991 was not "across the board" as is the common assumption in most studies. In fact, 16% of manufacturing output and 10% of employment were still under compulsory licensing post-1991. Some of these industries were gradually delicensed in 1993 and 1994. Therefore, studies that ignore the actual chronology of industrial deregulation post-1991 may overstate the impact of the 1991 reforms.

Our results identify two main channels through which industrial delicensing affects the demand for skills and wage inequality: capital- and output-skill complementarities. We find that capital- and output-skill complementarities existed for firms in both licensed and declicensed industries. These complementarities were, however, *stronger* in delicensed industries both before and after 1991. With respect to the skill premium, however, delicensing decreased output-skill complementarities during both periods. Even though industrial delicensing contributed substantially to both capital- and output-skill complementarities during the 1980s, the contribution of delicensing to these complementarities was negligible during the post-1991 period. Our results suggest that industrial delicensing benefited skilled labor via capital- and output-skill complementarities *before* India liberalized trade and investment. Thus, some of the increase in the demand for and returns to skill as a result of capital- and output-skill complementarities, can be attributed to domestic sector reforms during the pre-1991 period in India.

This paper is organized as follows. Section 2 describes the domestic and external sector reforms during the 1980s and 1990s in India. Section 3 summarizes the mechanisms through which skill upgrading and wage inequality can be affected by domestic and external sector reforms. Section 4 describes our data, estimation, and identification strategy. We discuss our results in Section 5 and conclude in Section 6.

2 Domestic and External Sector Reforms

Even though India's mixed economy framework mandated a role for private enterprise, the government believed it was necessary to provide incentives to private firms to invest in desirable industries and locations. Industrial licensing therefore evolved as a method for the Indian government to control private enterprise in India.[3] A license was a document that permitted a firm to begin or continue production in an industry and was issued by the Ministry of Industry in New Delhi.

The licensing regime controlled entry into an industry and hence the amount of competition faced by a firm. The most important concern for the licensing committee while debating a particular case was the "demand-supply situation" of the good – if it was felt that there was enough existing capacity to satisfy projected demand then the application was rejected, irrespective of the quality of the proposed good and the nature and productivity of the technology that it proposed to use. Another important facet was the type of the good. There was a disdain for variety among policymakers of the time and competition was thought to be wasteful. Import and foreign exchange requirements were also important considerations and a large number of applications were rejected because they required "too" much foreign exchange. Thus, new projects were not assessed on the merit of their efficiency, productivity, or quality (Das 2000).

A license also specified the amount of output that a firm could produce. This was conditional on the proposed location of the project and permission was required to change the location of production. The exact nature of the product was also specified and either permission or a new license was needed to change the product mix. A firm's inputs and technology, though not specified on the license, were also restricted. This is because the most crucial raw materials – steel, cement,

[3]See Sharma (2006) for a detailed description of industrial licensing in India.

coal, fuel, and furnace oil – as well as licenses to import inputs – including machinery and equipment – were controlled by the government with firms receiving annual allotments of these inputs for production. In fact, licensing requirements were implemented primarily through the restricted allocation of these inputs to the firm. Based on the specified output limit on its license, every firm was allotted a fixed amount of these inputs annually. Thus, it was difficult if not impossible for an entrepreneur to produce over the specified output limit on his license.

Policy makers began realizing the crippling effect of the licensing regime on the Indian economy during the 1960s and 1970s and several ad hoc measures were implemented during this period.[4] However, it was only during the 1980s that the government took substantial steps in relaxing the licensing regime by "delicensing" certain industries. Table 1 shows the percentage of manufacturing output and employment that was delicensed during the 1980s and 1990s. While this piece-meal approach to reforming industrial policy continued through the 1980s, the Indian economy faced a severe balance of payments crisis in July 1991 and was forced to take loans from international organizations. It was at this time that the biggest delicensing episode occurred, under pressure from these organizations. Almost all industrial licensing was removed, other than for 16% of manufacturing output.

Along with this, there were massive external sector reforms in 1991, which consisted of trade and investment liberalization. The trade policy reforms aimed at liberalizing and promoting both exports and imports. As a result of lower tariffs, elimination of quotas and import license requirements, and liberalization of technology imports, total exports and imports increased dramatically during the 1990s. Exports were liberalized via the abolition of export subsidies and controls while the liberalization of imports was implemented via a rapid reduction in tariff rates and the abolition of licensing and quantitative restrictions on most imports except consumer goods. The average ad valorem tariff rate fell from 125% in 1990 to 40% in 1999. Besides lower tariffs, non-tariff barriers were reduced by eliminating quantitative restrictions - quotas and import licensing requirements - particularly on capital and intermediate goods. In addition, technology imports were liberalized

[4]The first "delicensing" of firms occurred in 1966 and by 1969, 41 industries were delicensed. However in 1973, these industries were licensed again and it was only in 1975 that the second phase of delicensing began, when 21 industries accounting for 3% of manufacturing output were delicensed.

by eliminating technology license requirements. Foreign direct investment (FDI) was liberalized to a limited extent, resulting in an increase of FDI from $233 million to $3.3 billion during the 1990s. Besides these reforms, the rupee was devalued by 22% (from Rs. 21.20 to Rs. 25.80 per U.S. dollar). The sheer scale and scope of the reforms were so large that this reform episode has been the one that has caught the attention of policy-makers and researchers alike.

The licensing regime affected firm-level productivity and costs through its control on both the firm's *ability* and *incentives* to innovate, reduce costs, use efficient input combinations, adopt new technology, and exploit economies of scale. Direct controls on outputs and inputs affected firms' abilities whereas indirect control of entry affected firms' incentives. Even if direct controls were not fully implemented due to corruption, the effect of indirect controls on incentives was substantial. Licensing restricted entry into most sectors and created artificial monopolies and oligopolies. The average four-firm concentration ratio in Indian manufacturing in 1981 was 54% compared to 32% for the US in 1977. Even among developing countries, India's concentration ratio was closer to Poland's (65% in 1988) rather than Brazil's (32% in 1988).

3 Mechanisms of Skill Upgrading and Increased Wage Inequality

Given the extent of India's licensing regime, it is reasonable to expect that industrial deregulation during the 1980s and 1990s may have played a role in raising the demand for and returns to skill in the country. We explore several hypotheses which explain the mechanisms through which domestic and external sector reforms may affect skills in less developed countries (LDCs). Hypotheses I and II relate both domestic and external sector reforms to the demand for and returns to skill in LDCs. Hypotheses III and IV concern only external sector reforms – that is, trade and investment liberalization.

The first hypothesis (Hypothesis I) relates skill-biased change to increased demand for skilled labor and a rising skill premium. According to this hypothesis, domestic and external sector reforms increase the degree of competition faced by firms as a result of entry of domestic firms as well as from foreign firms. Increased competition provides incentives for firms to become more productive – that

is, exploit economies of scale, utilize more efficient input combinations, and adopt new technology. If these changes are *complementary* to skilled labor, economic liberalization should result in skill upgrading and increased wage inequality. In other words, in the presence of output-, capital-, and technology-skill complementarities, we should observe skill upgrading and a widening skill-wage-gap after economic deregulation. The existing literature focuses solely on trade liberalization and not on domestic sector reforms. Wood (1995) argues that trade liberalization results in "defensive innovation" – that is, greater competition from foreign firms may induce domestic firms in LDCs to either engage in R&D or to adopt new and advanced technologies in order to secure their market share in the domestic and international markets. Because of technology-skill complementarities, adoption of modern technologies raises the demand for and returns to skilled labor. Acemoglu (2003) describes how, as the result of trade liberalization in LDCs, increased capital goods imports can lead to greater demand for skilled workers as a result of capital-skill complementarities, thus increasing the skill-premium. Empirical support for this hypothesis is found by Attanasio et al. (2004) for Colombia and by Harrison & Hanson (1999) for the case of Mexico. Gorg & Strobl (2002) find an increase in the relative wages of skilled labor in Ghana, brought about by skill-biased technological change induced through imports of technology-intensive capital goods or export activity. However, Pavcnik (2003) rejects this hypothesis for Chilean plants. Berman et al. (2005) find evidence of output- and capital-skill complementarities in Indian industries during the 1980s and 1990s, though they exclude any potential effect of industrial deregulation on skill upgrading and wage inequality.

Quality-upgrading by firms, as a result of greater competition, is the second hypothesis (Hypothesis II). The basic argument is that domestic and external sector liberalization may induce a quality upgrading of firms, where quality refers to either firm productivity or product quality. Verhoogen (2004) finds strong support for this hypothesis for the case of Mexico where greater exports as a result of the peso crisis resulted in better quality products being produced by exporters. Because higher quality products require a higher proportion of skilled workers, the relative demand for and returns to skilled labor increased. For India, Sharma (2006) finds that firms that were delicensed also experienced higher productivity both before and after the country's external

sector reforms of 1991 but does not examine the relationship between reforms and skills. If higher firm-level productivity is complementary to skilled labor, we would expect that there would be skill upgrading as well as higher returns to skilled labor among Indian firms.

The third hypothesis (Hypothesis III) is based on the Stolper-Samuelson (SS) theorem in the Heckscher-Ohlin-Samuelson model and relates solely to external sector reforms in trade. The SS theorem predicts that trade liberalization will raise the demand for and returns to the abundant factor of production – that is, unskilled labor in most LDCs. Even though at first glance this theorem predicts a decrease in the wage gap between skilled and unskilled labor in LDCs, on closer inspection it shows that as protective import tariffs, quotas, and licenses are removed, the price of formerly protected goods will fall. By the SS Theorem, a decrease in the relative price of a good will decrease the relative price of the factor used intensively in the production of that good and increase the relative price of other factors. Since in many LDCs – namely Colombia, Mexico, Brazil, and Morocco – the most protected sectors were those that were intensive in unskilled labor, the SS theorem predicts that trade liberalization in these countries should lower unskilled wages. Thus, an increased demand for skilled labor and a widening skill-wage-gap support the predictions of the SS theorem in these countries. India, on the other hand, had its highest protection levels – both, tariff and non-tariff barriers – in human- and physical-capital-intensive sectors. Therefore, the rising demand for and returns to skilled labor in India contradict the predictions of the SS theorem for the country - which are an increase in the demand for and returns to unskilled labor and an expansion of unskilled-labor-intensive sectors.

Global production sharing or outsourcing, which relates solely to external sector reforms in investment, is the fourth hypothesis (Hypothesis IV) that has been provided to explain the rising skill premium and demand for skilled labor in LDCs. Feenstra & Hanson (1996) and Feenstra & Hanson (2003) argue that trade and investment liberalization on the part of LDCs allows developed countries (DCs) to transfer the production of intermediate goods and services to LDCs. For LDCs these activities are skill-intensive, which results in a greater demand for and returns to skilled labor. Therefore, external sector reforms that promote trade in manufactures and services and those that attract foreign direct investment can benefit skilled workers in LDCs. Feenstra & Hanson (1997)

find empirical support for this hypothesis for the case of Mexico.

Our empirical analysis provides evidence that there was increased demand for and returns to skilled labor during the 1980s – i.e. before India's external sector reforms were implemented in 1991 – and that these increases occurred via capital- and output-skill complementarities. These results support Hypotheses I and II and indicate that domestic sector reforms played an important role in skill upgrading and wage inequality before India underwent massive liberalization in international trade and investment. The lifting of microeconomic constraints for domestic firms brought about greater competition and therefore more incentives for firms to increase productivity and improve product quality. Our analysis does not allow us to evaluate whether or not Hypotheses III and IV are supported by the Indian experience since our dataset ends in 1994-1995, only three years after the onset of external sector reforms. Moreover, due to lack of detailed data on industry-level trade protection, we do not include a measure of trade liberalization but only compare how deregulation influenced skilled labor during the pre- and post-1991 periods. Other studies, however, have shown that given the large increase in the relative demand for and relative returns to skilled labor during the 1990s, there is very little support for Hypothesis III (Chamarbagwala 2006).

4 Data, Estimation, and Identification Strategy

4.1 Empirical Analysis

Our data comes from two sources. In order to measure the extent of industrial deregulation faced by a firm, we have collected a unique and detailed dataset of industrial policy in India from the 1970s onwards. Using this data, we can identify which four-digit industry underwent reform – that is, freedom from licensing requirements – in each year from 1970 until 1990. The main source of this data was internal government publications and notifications issued to administrative ministries. Some commonly available publications like the Economic Survey were also used. The second source of data is firm-level data from the Annual Survey of Industries (ASI), conducted by the Central Statistical Organization (CSO), for the years 1980-81 until 1994-95. The survey covers all factories registered under the Factories Act of 1948 and only covers the formal sector in Indian

manufacturing.[5]

We begin by investigating the relationship between domestic sector reforms, skill upgrading, and wage inequality prior to the 1991 external sector reforms. In doing so, we allow for capital- and output-skill complementarities to exist. The translog production function (Berman et al. 1994) provides the theoretical motivation for our estimation equation. To focus on the pre-1991 relationship between industrial delicensing and skills, we restrict our sample to only include the period *before* the external sector reforms of July 1991. Thus, we only include firms during the period 1980-81 to 1990-91 and estimate the following equation.

$$Y_{ijts} = \alpha + \beta_1 Dereg_{jt} + \beta_1 ln\left(\frac{K_{jt}}{O_{jt}}\right) + \beta_2 ln\left(O_{jt}\right) + \epsilon_{ijts} \tag{1}$$

Here Y_{ijts} is a measure of the relative demand for skilled labor or the natural log of the skill premium for firm i producing in industry j located in state s in year t. We use 2 alternate measures of the relative demand for skilled labor – that is, the proportion of white-collar workers employed by the firm and the firm's wagebill share of white-collar workers. The skill premium is measured as the ratio of the white-collar wage rate to the blue-collar wage rate and captures the relative return to skilled labor. White- and blue-collar workers are non-production and production workers respectively. The employment share of white-collar workers is defined as $\frac{White-CollarWorkers_{ijts}}{TotalWorkers_{ijts}}$ whereas the wagebill share of white-collar workers is defined as $\frac{White-CollarWages_{ijts}}{TotalWages_{ijts}}$. In order to estimate the relative return to skilled labor we use the natural log of the skill premium, which is defined as $\frac{White-CollarWageRate_{ijts}}{Blue-CollarWageRate_{ijts}}$. $Dereg_{jt}$ is an indicator that takes a value of 1 if industry j was delicensed in year t and 0 otherwise. $ln\left(\frac{K_{jt}}{O_{jt}}\right)$ is the natural log of the firm's capital-output ratio whereas $ln\left(O_{jt}\right)$ is the natural log of the firm's output. K_{jt} is measured as the capital stock of the firm, which is defined as the average of firm j's fixed capital over year t.[6] Output is measured as firm j's real output in year t, which is calculated using industry-specific deflators. For Equation 1 and all subsequent regressions, we estimate robust standard errors, clustered at the 4-digit industry-level.

[5] A factory is defined as units employing 20 or more workers. For our analysis, we use data on all establishments as defined by the Industries Development and Regulation Act of 1951 since these firms were the ones that came under the ambit of industrial licensing. These are firms that employ 50 or more workers and use power in the production process or firms that employ 100 or more workers without using power during production.

[6] Fixed capital is defined as the "book value of assets in plant, machinery, land, and building". This definition does not take account of inflation or the economic value of capital owned by the firm.

Summary statistics of our key variables are presented in Table 2 for five periods. The period 1980-81 to 1983-84 is pre-reform with no industrial or external sector policy changes. During 1984-85 and 1990-91 there was only industrial deregulation and the 1991-92 to 1994-95 period was characterized by both industrial deregulation and external sector reforms. There is a steady rise in the average employment and wagebill shares of white-collar workers over the 1980s and 1990s whereas the natural log of the skill premium falls slightly during the late 1980s and then rises after 1991. The average natural logs of the capital-output ratio and the output level are also increasing over this time period.

4.2 Identification

There are two potential sources of endogeneity of industry deregulation which may provide biased and inconsistent estimates of β_1 in Equation 1. The first potential source of endogeneityu is unobserved heterogeneity or omitted variable bias at the industry level. Our main explanatory variable, $Dereg_{jt}$, varies at the 4-digit industry-level of the National Industrial Classification (NIC). Political economy factors, like political affiliation and lobbying power, also vary at the industry-level and may determine whether or not industry j gets delicensed in any given year t. If political power is also concentrated among highly skilled industries, then there may be a spurious correlation between industrial deregulation and the demand for and return to skilled labor, which would bias our estimate of β_1. In order to control for unobservable heterogeneity at the industry-level, we include 4-digit industry fixed effects, δ_j. We also include year (γ_t) and state (λ_s) fixed effects to control for year- and state-specific unobservables. Equation 2 includes industry, year, and state fixed effects.

$$Y_{ijts} = \alpha + \beta_1 Dereg_{jt} + \beta_1 ln\left(\frac{K_{jt}}{O_{jt}}\right) + \beta_2 ln\left(O_{jt}\right) + \delta_j + \gamma_t + \lambda_s + \epsilon_{ijts} \tag{2}$$

The nature of industrial delicensing in India provides yet another potential source of bias of β_1: there may be a reverse causation between skill upgrading or wage inequality and industrial delicensing. The reforms of the 1980s have been characterized by some as "reforms by stealth". There was no consensus for economic reforms in the 1980s. More importantly, it is clear from policy documents that the government was eager to portray the changes of the 1980s as a continuation

of the existing system even though these reforms introduced dramatic changes that veered away from the high-regulation, socialist paradigm that had been operating since the 1950s. Under these circumstances, it is possible that the Indian government chose industries for deregulation based on certain industry-specific characteristics that either raised the chances of success of the reforms or that minimized social costs in case of failure. For example, the government may have chosen to delicense more skill-intensive industries if government officials expected skill-intensity to enhance the success of the reforms or to minimize the employment effects of delicensing. In this case, β_1 will not measure the effect of industrial delicensing on skills. Rather, it will capture the *selection* of skill-intensive industries into delicensing. While industry fixed effects may control for some industry-specific characteristics that may have determined selection into delicensing, in order to get reliable estimates we need *within-industry* variation in our delicensing measure.

In order to identify the effect of industrial deregulation on skill upgrading and wage inequality, we therefore interact the delicensing indicator with the capital-output ratio and output level of a firm. Not only does this provide us with within-industry variation, but it also allows us to examine the *indirect* effect of deregulation on skills via capital- and output-skill complementarities. We thus identify only the indirect effect of industrial deregulation – that is, the *interaction* of deregulation with the capital-output ratio and output level of a firm – and not the direct effect of industrial delicensing on skills.

Our identification strategy coincides closely with an important institutional feature of the licensing regime in India – there was an important size-based difference in the application of licensing provisions. In particular, firms that had assets in plant, machinery, land, and building less than a threshold value were exempt from industrial licensing requirements. A firm's capital-output ratio and output level are negatively correlated with a firm's exemption status. Thus, firms with a higher capital-output ratio and output level were more likely to have assets over the threshold value and were therefore more likely to be under the burden of licensing provisions.

Table 3 presents summary statistics of our key variables for firms that were not exempt from industrial licensing (columns (2) and (3)) and for firms that were exempt from licensing requirements (columns (4) and (5)) for three periods. In all three periods, firms that were not exempt from

licensing had approximately twice the average natural log of the capital-output ratio and roughly 1.5 times the average natural log of output compared to firms that were exempt from licensing. Moreover, in each period, the average employment and wagebill shares of white-collar workers as well as the average natural log of the skill premium were higher in firms that were not exempt from licensing.

Equation 3 includes interactions of the capital-output ratio and output level of a firm with our industrial delicensing measure. This specification is equivalent to a difference-in-differences estimation.

$$\begin{aligned} Y_{ijts} = \alpha + \beta_1 Dereg_{jt} + \beta_2 ln\left(\frac{K_{jt}}{O_{jt}}\right) + \beta_3 ln\left(O_{jt}\right) + \beta_4 Dereg_{jt} * ln\left(\frac{K_{jt}}{O_{jt}}\right) \\ + \beta_5 Dereg_{jt} * ln\left(O_{jt}\right) + \delta_j + \gamma_t + \lambda_s + \epsilon_{ijts} \end{aligned} \tag{3}$$

Finally, we examine whether the effects of industrial deregulation on skills were different during the pre- and post-1991 periods using data from 1980-81 to 1994-95. To do so, we estimate Equation 4, which is equivalent to a difference-in-difference-in-differences estimation procedure.

$$\begin{aligned} Y_{ijts} = \alpha + \beta_1 Dereg80_j + \beta_2 Post91_t + \beta_3 ln\left(\frac{K_{jt}}{O_{jt}}\right) + \beta_4 ln\left(O_{jt}\right) + \beta_5 Dereg80_{jt} * Post91_t \\ + \beta_6 Dereg80_j * ln\left(\frac{K_{jt}}{O_{jt}}\right) + \beta_7 Dereg80_j * ln\left(O_{jt}\right) + \beta_8 Post91_t * ln\left(\frac{K_{jt}}{O_{jt}}\right) \\ + \beta_9 Post91_t * ln\left(O_{jt}\right) + \beta_{10} Dereg80_j * Post91_t * ln\left(\frac{K_{jt}}{O_{jt}}\right) \\ + \beta_{11} Dereg80_j * Post91_t * ln\left(O_{jt}\right) + \delta_j + \gamma_t + \lambda_s + \epsilon_{ijts} \end{aligned} \tag{4}$$

In Equation 4 we use a different measure of industrial deregulation. $Dereg80_j$ is an indicator that takes a value of one if industry j was delicensed in any year during the 1980s and zero otherwise. We use this alternate measure of industrial delicensing in order to isolate the impact of delicensing during the 1980s from the effects of the post-1991 reforms. As described in Section 2, the post-1991 reforms consisted of industrial delicensing as well as trade and investment liberalization. Equation 4 therefore allows us to examine the effect of pre-1991 industrial delicensing on skills and how firms that were delicensed during the 1980s performed, with respect to skill upgrading and wage inequality, both before and after the 1991 reforms.

All variables are weighted with firm-level multipliers and winsorized at the 1% level. In all

regressions we include an indicator of whether the firm is a factory or not.[7] We also include indicators for the type of ownership and organization of a firm. For ownership structure, we include two indicators – one for a joint sector firm and the other for a firm in the private sector. The omitted group consists of firms in the public sector. We include two indicators to capture overall differences in organization structure – one for a public or private limited company and the other for a co-operative society. The omitted group consists of firms that are individual proprietorships or partnerships.[8]

5 Results

5.1 Results for the Pre-1991 Period

We present results of estimating Equation 2 in Table 4, which provides evidence of both capital- and output-skill complementarities. A higher capital-output ratio as well as higher output levels are associated with larger employment (column (3)) and wagebill (column (4)) shares of white collar workers as well as with a higher ln skill premium (column (5)). A 1% increase in the capital-output ratio is associated with a 1.2 and 1.7 percentage point increase in the employment and wagebill shares of white-collar workers. Thus, with respect to the capital-output ratio, the elasticity of the employment share of white-collar workers is 0.063 and the elasticity of the wagebill share of white-collar workers is 0.066.[9] Output-skill complementarities are stronger – a 1% increase in the output level is associated with a 2.2 and 3.4 percentage point increase in the employment and wagebill shares of white-collar workers.[10] With respect to output, therefore, the elasticities of the employment and wagebill shares of white-collar workers are 0.116 and 0.132, respectively. In regressions estimating the natural log of the skill premium, the coefficients β_2 and β_3 measure the

[7] A factory is a firm that employs 50 or more workers and uses power in the production process or one that employs 100 or more workers without using power in the production process.

[8] The four major choices for organizing a business in India are individual proprietorships, partnerships, companies (private or public limited), and co-operative societies. The individual proprietorship form consists of entrepreneurs who have sole ownership of the establishment. Establishments with multiple owners or shareholders may be partnerships, companies, or co-operative societies. See Chapter 3 of Ramani et al. (2004) for a detailed discussion of alternative business forms.

[9] These elasticities are calculated as β_2 divided by the average employment and wagebill shares of white-collar workers in the period 1980-81 to 1990-91 (shown in Table 2.

[10] Our results are qualitatively similar to Berman et al. (2005), who find that output-skill complementarities are substantially larger than capital-skill complementarities in Indian industries.

elasticity of the skill premium with respect to the capital-output ratio and output, which are 0.022 and 0.040, respectively.

While there is a positive and significant relationship between the capital-output ratio and output level with respect to the employment and wagebill shares of white-collar workers, the coefficient estimates of *Dereg* cannot be identified as the *effect* of industrial delicensing on these measures. In order to control for industry selection into delicensing based on its skill-intensity, we need within-industry variation in our delicensing measure. Interacting our delicensing measure with the capital-output ratio and output level of a firm provides within-industry variation and allows us to identify the effect of industrial delicensing on skill upgrading and wage inequality via capital- and output-skill complementarities. Table 5 presents coefficients and robust standard errors from estimating Equation 3. Capital- and output-skill complementarities remain robust across *all* industries, both licensed and delicensed.

The coefficient estimate of *Dereg* can be interpreted as changes in skill upgrading and wage inequality *between* industries as a result of industrial deregulation. There appears to be substantial *skill downgrading* between industries as a result of industrial deregulation during the 1980s in India – the coefficient estimates show a 9.4 and 10.1 percentage point decline in the employment and wagebill shares of white-collar workers as a result of industrial deregulation. These coefficient estimates, however, may be contaminated as a result of selection into industrial delicensing based on skill-intensity or other characteristics and only the *within-industry* effects of delicensing via capital- and output-skill complementarities can be identified.

In order to compare firms in licensed and delicensed industries, Table 6 presents coefficients and F-test statistics in Panel A. In Panel B, elasticities are calculated using the coefficient estimates in Panel A and the average employment and wagebill shares of white-collar workers from Table 2 (0.19 and 0.26 respectively). Panel C summarizes the degree of capital- and output-skill complementarities in terms of elasticities based on the change in the average capital-output ratio (80.65%) and output level (81.49%) during the period 1980-81 to 1990-91. Panel C shows that an increase of 80.65% in the average capital-output ratio between 1980-81 and 1990-91 is associated with a 4.67% and 6.37% rise in the employment share of white-collar workers for firms in licensed and delicensed

industries, respectively. For the wagebill share of white-collar workers, these figures are 5.27% and 6.82% for firms in licensed and delicensed industries, respectively. The skill premium increased by 1.77% and 2.34% in licensed and delicensed industries as a result of an 80.65% increase in the capital-output ratio. Even though these changes are small, we find that industrial deregulation *strengthened* capital-skill complementarities with respect to the employment and wagebill shares of white-collar workers as well as the skill premium within industries during the 1980s in India.

With respect to output-skill complementarities, an increase of 81.49% in the average output level between 1980-81 and 1990-91 is associated with a 9.01% and 12.87% rise in the employment share of white-collar workers for firms in licensed and delicensed industries, respectively. For the wagebill share of white-collar workers, there is a 10.34% and 13.16% increase for firms in licensed and delicensed industries, respectively. However, the skill premium increased more for firms in licensed industries (by 3.34%) than in delicensed industries (by 2.77%). Thus, while industrial delicensing during the 1980s *strengthened* output-skill complementarities with respect to the relative *demand* for skilled labor within industries, it *weakened* it for the relative *return* to skilled labor.

Overall, industrial deregulation appears to have increased the relative demand for skilled workers via both capital- and output-skill complementarities during the 1980s in India. On the other hand, industrial deregulation increased the relative return to skilled workers via capital-skill complementarities but decreased the relative return to skilled labor through output-skill complementarities.

5.2 Results for the Pre-and Post-1991 Period

Table 7 presents coefficients and robust standard errors from estimating Equation 4 which allows us to examine the contribution of industrial delicensing to capital- and output-skill complementarities both before and after 1991. Tables 8 and 9 present coefficient and F-test statistics in Panel A, elasticities in Panel B, and complementarities in Panel C for firms in licensed and delicensed industries for the pre- and post-1991 periods, respectively. In Panel B, the average employment and wagebill shares of white-collar workers of 0.19 and 0.26 are used to calculate elasticities for the pre-1991 period. For the post-1991 period these shares are 0.22 and 0.30, respectively. In Panel C, we use an 80.65% change in the average capital-output ratio and an 81.49% change in the output

level to calculate complementarities during the pre-1991 period. For the post-1991 period, complementarities are calculated using a 50.94% change in the average capital-output ratio and a 13.12% change in the average output level. The degree of capital- and output-skill complementarities for firms in licensed and delicensed industries during the pre-1991 period are almost identical to those reported in Table 6. We therefore focus on comparing the extent of complementarities before and after 1991.

Three observations are striking in comparing capital- and output-skill complementarities before and after 1991. First, the degree of capital-skill complementarities are *lower* for firms in *both* licensed and delicensed industries in the post-1991 period compared to the pre-1991 period. Panel C in Tables 8 and 9 show that pre-1991 capital-skill complementarities were approximately three that of post-1991 capital-skill complementarities for the employment and wagebill shares of white-collar workers in licensed industries. For delicensed industries, pre-1991 capital-skill complementarities were roughly four times that of post-1991 capital-skill complementarities for the employment and wagebill shares of white-collar workers. For the skill premium, pre-1991 capital-skill complementarities are roughly three and four times the post-1991 levels in licensed and delicensed industries, respectively. Second, a similar but stronger result is found for output-skill complementarities – pre-1991 levels are approximately eight (nine) times that of post-1991 levels for the employment and wagebill shares of white-collar workers in licensed (delicensed) industries. For the skill premium, pre-1991 output skill complementarities are roughly seven and eight times that of post-1991 levels in licensed and delicensed industries, respectively.

These first two observations are contrary to expectation. If both domestic and external sector reforms are expected to increase the relative demand for and relative returns to skilled labor, then one should expect higher capital- and output-skill complementarities in the post-1991 period, when industries underwent delicensing as well as trade liberalization, compared to the pre-1991 period, when only delicensing was in effect. Moreover, stronger capital- and output-skill complementarities are expected in the post-1991 period for firms in both licensed and delicensed industries due to increased international competition for all firms.

Third, we find that industrial delicensing strengthened the relative demand for and relative

returns to skilled labor more in the pre-1991 than the post-1991 period. Compared to licensed industries, capital- and output-skill complementarities are between 1.3 and 1.5 times as much in delicensed industries before 1991. After 1991, capital- and output-skill complementarities in delicensed industries are either the same or upto 1.2 times that in licensed industries. The exception is output-skill complementarities with respect to the skill premium, which is stronger in licensed than delicensed industries in both periods.

One reason for the decline in the strength of capital- and output-skill complementarities in the 1990s could lie in the short time span of our data for the 1990s – firms may take time to adjust to major policy changes such as trade and investment liberalization. Thus, data that extends into the late 1990s may be required to conduct a more robust comparison of the contribution of industrial deregulation to skill upgrading and wage inequality during the 1980s and 1990s.

6 Conclusion

In this paper we use disaggregated data on firm-level employment as well as on industrial deregulation to analyze a puzzling finding. Nearly 15 years after major industrial and trade reforms took place in India, the wage gap between skilled and unskilled workers has risen, contrary to the predictions of the Heckscher-Ohlin model of international trade. One possible explanation may be that increased competition induces firms to innovate, upgrade their technology, and increase their output levels in order to take advantage of economies of scale, leading to an increase in the demand for skilled labor. Using data spanning India's industrial deregulation in the 1980s as well as the major trade reforms of the 1990s we analyze the behavior of the employment share of skilled workers, the wagebill share of skilled workers, and the skill premium (ratio of skilled wage to unskilled wage). The chronology of Indian reforms, with piece-meal industrial deregulation in the 1980s and external sector reforms in the 1990s, allows us to separate the effects of domestic and external reforms.

We find that for the 1980s capital- and output-skill complementarities exist for firms in all industries, but are stronger in industries that were delicensed. The exception is output-skill complementarities, which are weaker with respect to the skill premium in delicensed industries. Strikingly,

there seems to be a decline in the extent of complementarities in the years immediately following the massive reforms of 1991 and these results are surprising given the extensive external sector reforms that were implemented in 1991. Perhaps more extensive data, that goes well into the late 1990s, is needed since it may have taken several years before India's external sector reforms benefited skilled labor.

Our regression results as well as simple diagrammatic analysis confirm that an increasing trend in the relative demand for skilled workers preceded the external sector reforms of 1991 and that industrial deregulation in India played a role in this. Our results therefore support Hypotheses I and II, described in Section 3. Once microeconomic constraints were lifted from firms, they could invest in more capital as well as produce more output and take advantage of economies of scale. Thus, it is not surprising that both capital and output play important roles in skill upgrading. Increased competition, brought about by industrial delicensing during the 1980s, appears to have provided firms with greater incentives to increase productivity and product quality, thereby benefiting skilled workers in India.

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Figure 1: Trends in Average Nominal Wages: India, 1980-81 to 1994-95

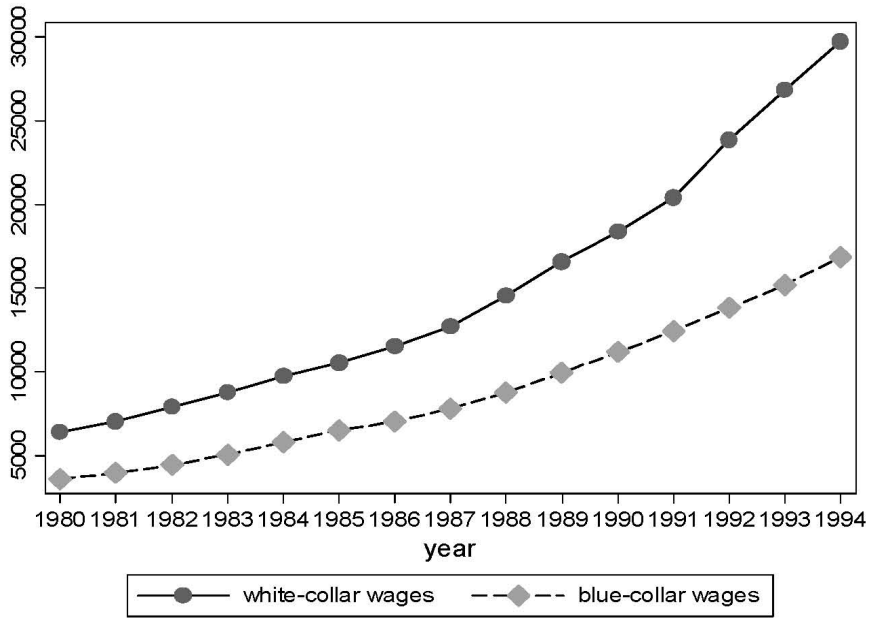

Figure 2: Trends in the Skill Premium: India, 1980-81 to 1994-95

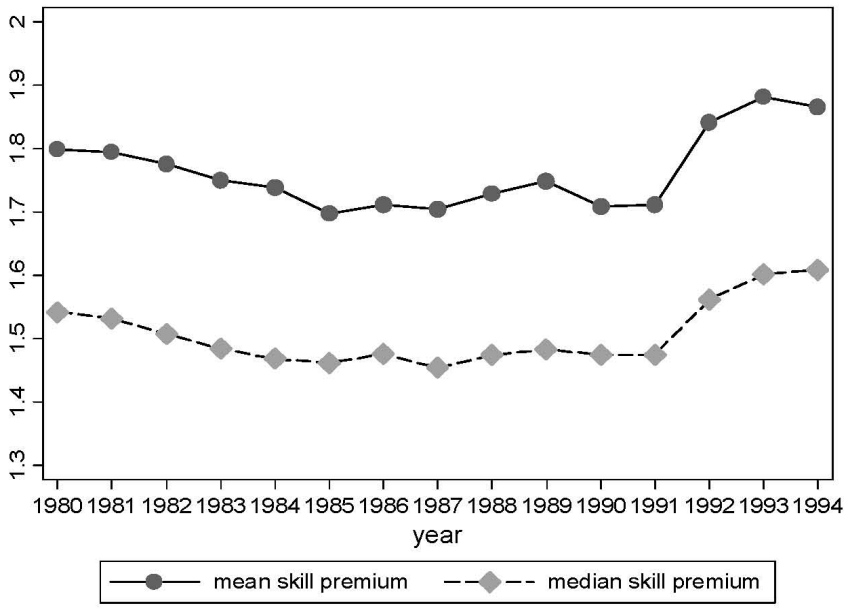

Figure 3: Trends in the Wagebill and Employment Shares of White-Collar Workers: India, 1980-81 to 1994-95

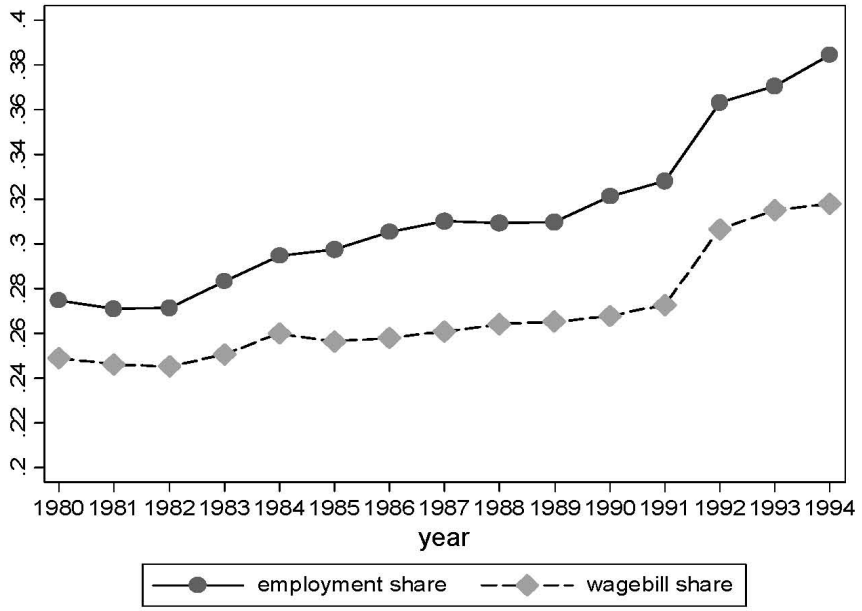

Table 1: Percentage of Cumulative Output and Employment in Delicensed Industries

Year	**% Output**	**% Employment**
1984	7.00	7.64
1985	14.00	15.06
1986	20.00	17.91
1987	25.00	23.51
1988	25.00	23.43
1989	23.00	22.40
1990	23.00	22.84
1991	84.17	90.07
1992	83.70	90.31
1993	84.47	91.00

To compute these figures we use delicensing and firm-level data at the 4-digit level of the National Industrial Classification (NIC).

Table 2: Summary Statistics

Variable	**Mean**	**Std. Dev.**
(1)	(2)	(3)
1980-81 to 1983-84		
Employment Share	0.18	0.16
Wagebill Share	0.25	0.21
Ln Skill Premium	0.43	0.53
Ln Capital-Output Ratio	1.38	2.11
Ln Real Output	10.08	1.92
Number of firms	194056	
1984-85 to 1990-91		
Employment Share	0.20	0.16
Wagebill Share	0.26	0.21
Ln Skill Premium	0.40	0.53
Ln Capital-Output Ratio	1.97	1.87
Ln Real Output	10.44	1.90
Number of firms	321814	
1991-92 to 1994-95		
Employment Share	0.22	0.17
Wagebill Share	0.30	0.22
Ln Skill Premium	0.46	0.53
Ln Capital-Output Ratio	2.41	1.83
Ln Real Output	10.61	1.95
Number of firms	189851	
1980-81 to 1990-91		
Employment Share	0.19	0.16
Wagebill Share	0.26	0.21
Ln Skill Premium	0.41	0.53
Ln Capital-Output Ratio	1.77	1.98
Ln Real Output	10.32	1.92
Number of firms	515870	
1980-81 to 1994-95		
Employment Share	0.20	0.16
Wagebill Share	0.27	0.21
Ln Skill Premium	0.43	0.53
Ln Capital-Output Ratio	1.96	1.96
Ln Real Output	10.40	1.93
Number of firms	705721	

Source: Annual Survey of Industries (1980-81 to 1994-95) and industrial deregulation data collected by the authors. All variables are weighted with firm-level multipliers and winsorized at the 1% level. Real output is in 1993-94 Rupees.

Table 3: Summary Statistics for Non-Exempt and Exempt Firms

Variable	**Non-Exempt Firms**		**Exempt Firms**	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
(1)	(2)	(3)	(4)	(5)
1980-81 to 1983-84				
Employment Share	0.29	0.13	0.18	0.16
Wagebill Share	0.39	0.15	0.25	0.21
Ln Skill Premium	0.47	0.36	0.43	0.53
Ln Capital-Output Ratio	3.00	1.12	1.37	2.11
Ln Real Output	15.32	1.31	10.04	1.87
Number of firms	2542	206062		
1984-85 to 1990-91				
Employment Share	0.30	0.14	0.19	0.16
Wagebill Share	0.41	0.17	0.26	0.21
Ln Skill Premium	0.52	0.43	0.40	0.53
Ln Capital-Output Ratio	3.47	1.11	1.95	1.87
Ln Real Output	15.35	1.36	10.38	1.83
Number of firms	6339	317892		
1991-92 to 1994-95				
Employment Share	0.32	0.14	0.22	0.17
Wagebill Share	0.44	0.17	0.30	0.22
Ln Skill Premium	0.56	0.46	0.46	0.53
Ln Capital-Output Ratio	4.14	1.12	2.39	1.83
Ln Real Output	15.68	1.34	10.56	1.89
Number of firms	3638	187119		

Source: Annual Survey of Industries (1980-81 to 1994-95) and industrial deregulation data collected by the authors. All variables are weighted with firm-level multipliers and winsorized at the 1% level. Real output is in 1993-94 Rupees.

Table 4: OLS Results of Equation 2: Industrial Deregulation, Skill Upgrading, and Wage Inequality in India, Pre-1991

Variable	**Coefficient**	**Employment Share of White-Collar Workers**	**Wagebill Share of White-Collar Workers**	**Ln Skill Premium**
(1)	(2)	(3)	(4)	(5)
Dereg	β_1	0.006***	0.005*	0.002
		[0.002]	[0.003]	[0.007]
$ln(K/O)$	β_2	0.012***	0.017***	0.022***
		[0.001]	[0.001]	[0.004]
$ln(O)$	β_3	0.022***	0.034***	0.040***
		[0.002]	[0.002]	[0.004]
Constant	α	-0.080***	-0.142***	-0.055
		[0.021]	[0.023]	[0.058]
Industry Fixed Effects		Yes	Yes	Yes
State Fixed Effects		Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes
Observations		474976	475173	414907
R-squared		0.23	0.27	0.11

Source: Annual Survey of Industries (1980-81 to 1990-91) and industrial deregulation data collected by the authors. The omitted year is 1980-81. Industry fixed effects are at the 4-digit NIC level. All regressions include indicators for whether or not the firm is a factory and for the type of ownership and organization. The omitted ownership structure is public sector firms and the omitted organization consists of individual proprietorship and partnership firms. Robust standard errors, clustered at the 4-digit industry-level, are in parentheses. A *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

Table 5: OLS Results of Equation 3: Industrial Deregulation, Skill Upgrading, and Wage Inequality in India, Pre-1991

Variable	**Coefficient**	**Employment Share of White-Collar Workers**	**Wagebill Share of White-Collar Workers**	**Ln Skill Premium**
(1)	(2)	(3)	(4)	(5)
$Dereg$	β_1	-0.094***	-0.101***	0.06
		[0.024]	[0.031]	[0.064]
$ln(K/O)$	β_2	0.011***	0.017***	0.022***
		[0.001]	[0.002]	[0.005]
$ln(O)$	β_3	0.021***	0.033***	0.041***
		[0.002]	[0.003]	[0.005]
$Dereg * ln(K/O)$	β_4	0.004***	0.005**	0.007
		[0.001]	[0.002]	[0.005]
$Dereg * ln(O)$	β_5	0.009***	0.009***	-0.007
		[0.002]	[0.003]	[0.006]
$Constant$	α	-0.069***	-0.131***	-0.064
		[0.022]	[0.025]	[0.060]
Industry Fixed Effects		Yes	Yes	Yes
State Fixed Effects		Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes
Observations		474976	475173	414907
R-squared		0.23	0.27	0.11

Source: Annual Survey of Industries (1980-81 to 1990-91) and industrial deregulation data collected by the authors. The omitted year is 1980-81. Industry fixed effects are at the 4-digit NIC level. All regressions include indicators for whether or not the firm is a factory and for the type of ownership and organization. The omitted ownership structure is public sector firms and the omitted organization consists of individual proprietorship and partnership firms. Robust standard errors, clustered at the 4-digit industry-level, are in parentheses. A *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

Table 6: Complementarities from Equation 3: Pre-1991

	Employment Share of White-Collar Workers	**Wagebill Share of White-Collar Workers**	**Ln Skill Premium**
Panel A: Coefficients			
Firms in Licensed Industries			
$H_0 : \beta_2 = 0$	0.011***	0.017***	0.022***
	[188.86]	[120.16]	[22.62]
$H_0 : \beta_3 = 0$	0.021***	0.033***	0.041***
	[107.75]	[165.24]	[74.20]
Firms in Delicensed Industries			
$H_0 : \beta_2 + \beta_4 = 0$	0.015***	0.022***	0.029***
	[141.12]	[164.67]	[73.79]
$H_0 : \beta_3 + \beta_5 = 0$	0.030***	0.042***	0.034***
	[380.74]	[524.70]	[40.11]
Panel B: Elasticities			
Firms in Licensed Industries			
Elasticity wrt capital-output ratio	0.058	0.065	0.022
Elasticity wrt output	0.111	0.127	0.041
Firms in Delicensed Industries			
Elasticity wrt capital-output ratio	0.079	0.085	0.029
Elasticity wrt output	0.158	0.162	0.034
Panel C: Complementarities			
Firms in Licensed Industries			
Capital-skill complementarities	4.67	5.27	1.77
Output-skill complementarities	9.01	10.34	3.34
Firms in Delicensed Industries			
Capital-skill complementarities	6.37	6.82	2.34
Output-skill complementarities	12.87	13.16	2.77

Source: Annual Survey of Industries (1980-81 to 1990-91) and industrial deregulation data collected by the authors. F-statistics are presented in parentheses in Panel A. The F-critical value with 1 restriction at the 1% level of significance is 6.63. Average employment and wagebill shares of 0.19 and 0.26 are used to calculate elasticities in Panel B. An increase of 80.65% and 81.49% in the average capital-output ratio and average output level between 1980-81 and 1990-91 are used to calculate complementarities in Panel C.

Table 7: OLS Results of Equation 4: Industrial Deregulation, Skill Upgrading, and Wage Inequality in India, Pre- and Post-1991

Variable	**Coefficient**	**Employment Share of White-Collar Workers**	**Wagebill Share of White-Collar Workers**	**Ln Skill Premium**
(1)	(2)	(3)	(4)	(5)
$Dereg80$	β_1	-0.103***	-0.117***	0.028
		[0.025]	[0.032]	[0.061]
$Post91$	β_2	0.040***	0.045***	-0.098***
		[0.011]	[0.016]	[0.010]
$ln(K/O)$	β_3	0.011***	0.017***	0.022***
		[0.001]	[0.002]	[0.005]
$ln(O)$	β_4	0.022***	0.033***	0.042***
		[0.002]	[0.003]	[0.005]
$Dereg80 * Post91$	β_5	0.070***	0.089***	0.070*
		[0.017]	[0.022]	[0.042]
$Dereg80 * ln(K/O)$	β_6	0.004***	0.007***	0.011**
		[0.002]	[0.002]	[0.005]
$Dereg80 * ln(O)$	β_7	0.009***	0.010***	-0.005
		[0.002]	[0.003]	[0.005]
$Post91 * ln(K/O)$	β_8	-0.004***	-0.006***	-0.012***
		[0.001]	[0.002]	[0.004]
$Post91 * ln(O)$	β_9	-0.002**	-0.002*	-0.002
		[0.001]	[0.001]	[0.003]
$Dereg80 * Post91 * Ln(K/O)$	β_{10}	-0.004**	-0.006**	-0.009*
		[0.002]	[0.003]	[0.005]
$Dereg80 * Post91 * Ln(O)$	β_{11}	-0.005***	-0.007***	-0.005
		[0.001]	[0.002]	[0.003]
$Constant$	α	-0.070***	-0.135***	-0.081
		[0.022]	[0.026]	[0.059]
Industry Fixed Effects		Yes	Yes	Yes
State Fixed Effects		Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes
Observations		650469	650767	574990
R-squared		0.24	0.27	0.10

Source: Annual Survey of Industries (1980-81 to 1994-95) and industrial deregulation data collected by the authors. The omitted year is 1980-81. Industry fixed effects are at the 4-digit NIC level. All regressions include indicators for whether or not the firm is a factory and for the type of ownership and organization. The omitted ownership structure is public sector firms and the omitted organization consists of individual proprietorship and partnership firms. Robust standard errors, clustered at the 4-digit industry-level, are in parentheses. A *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

Table 8: Complementarities from Equation 4: Pre-1991

	Employment Share of White-Collar Workers	**Wagebill Share of White-Collar Workers**	**Ln Skill Premium**
Panel A: Coefficients			
Firms in Licensed Industries			
$H_0 : \beta_3 = 0$	0.011***	0.017***	0.022***
	[144.81]	[92.39]	[23.00]
$H_0 : \beta_4 = 0$	0.022***	0.033***	0.042***
	[107.59]	163.03]	83.70]
Firms in Delicensed Industries			
$H_0 : \beta_3 + \beta_6 = 0$			
	0.015***	0.024***	0.033***
$H_0 : \beta_4 + \beta_7 = 0$	[140.71]	[180.92]	[107.94]
	0.031***	0.043***	0.037***
	[412.66]	[572.81]	[54.75]
Panel B: Elasticities			
Firms in Licensed Industries			
Elasticity wrt capital-output ratio	0.058	0.065	0.022
Elasticity wrt output	0.116	0.127	0.042
Firms in Delicensed Industries			
Elasticity wrt capital-output ratio	0.079	0.092	0.033
Elasticity wrt output	0.163	0.165	0.037
Firms in Licensed Industries			
Capital-skill complementarities	4.67	5.27	1.77
Output-skill complementarities	9.44	10.34	3.42
Firms in Delicensed Industries			
Capital-skill complementarities	6.37	7.44	2.66
Output-skill complementarities	13.30	13.48	3.02

Source: Annual Survey of Industries (1980-81 to 1990-91) and industrial deregulation data collected by the authors. F-statistics are presented in parentheses in Panel A. The F-critical value with 1 restriction at the 1% level of significance is 6.63. Average employment and wagebill shares of 0.19 and 0.26 are used to calculate elasticities in Panel B. An increase of 80.65% and 81.49% in the average capital-output ratio and average output level between 1980-81 and 1990-91 are used to calculate complementarities in Panel C.

Table 9: Complementarities from Equation 4: Post-1991

	Employment Share of White-Collar Workers	**Wagebill Share of White-Collar Workers**	**Ln Skill Premium**
Panel A: Coefficients			
Firms in Licensed Industries			
$H_0 : \beta_3 + \beta_8 = 0$	0.007***	0.011***	0.010***
	[54.37]	[68.70]	[19.33]
$H_0 : \beta_4 + \beta_9 = 0$	0.020***	0.031***	0.040***
	[110.73]	[193.81]	[84.61]
Firms in Delicensed Industries			
$H_0 : \beta_3 + \beta_6 + \beta_8 + \beta_{10} = 0$			
	0.007***	0.012***	0.012***
$H_0 : \beta_4 + \beta_7 + \beta_9 + \beta_{11} = 0$	[31.50]	[54.00]	[13.14]
	0.024***	0.034***	0.030***
	[236.66]	[332.10]	[57.74]
Panel B: Elasticities			
Firms in Licensed Industries			
Elasticity wrt capital-output ratio	0.032	0.037	0.010
Elasticity wrt output	0.091	0.103	0.040
Firms in Delicensed Industries			
Elasticity wrt capital-output ratio	0.032	0.040	0.012
Elasticity wrt output	0.109	0.113	0.030
Panel C: Complementarities			
Firms in Licensed Industries			
Capital-skill complementarities	1.621	1.868	0.509
Output-skill complementarities	1.193	1.356	0.525
Firms in Delicensed Industries			
Capital-skill complementarities	1.621	2.038	0.611
Output-skill complementarities	1.431	1.487	0.394

Source: Annual Survey of Industries (1980-81 to 1990-91) and industrial deregulation data collected by the authors. F-statistics are presented in parentheses in Panel A. The F-critical value with 1 restriction at the 1% level of significance is 6.63. Average employment and wagebill shares of 0.22 and 0.30 are used to calculate elasticities in Panel B. An increase of 50.94% and 13.12% in the average capital-output ratio and average output level between 1990-91 and 1994-95 are used to calculate complementarities in Panel C.