

Industrial De-licensing, Trade Liberalization, and Skill Upgrading in India

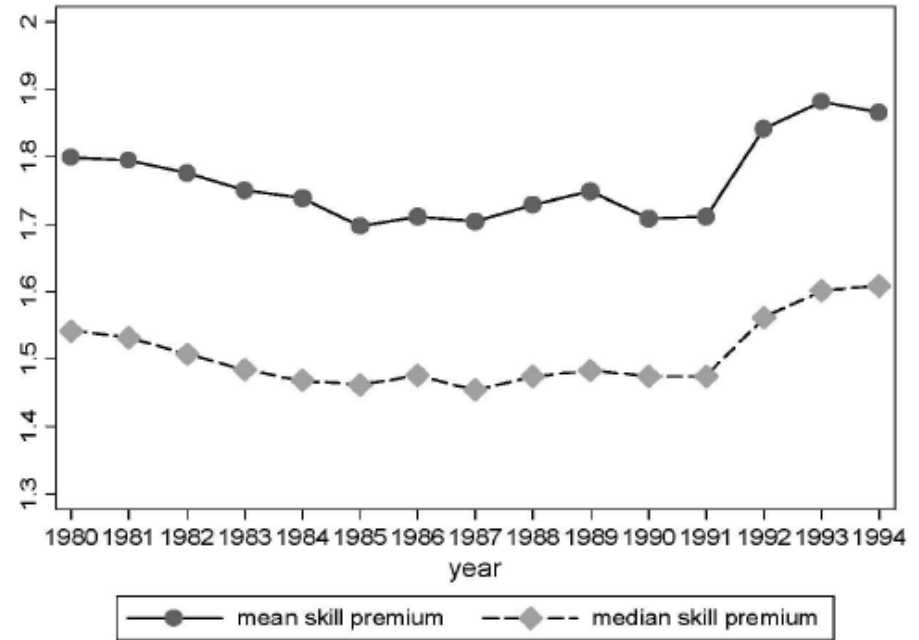
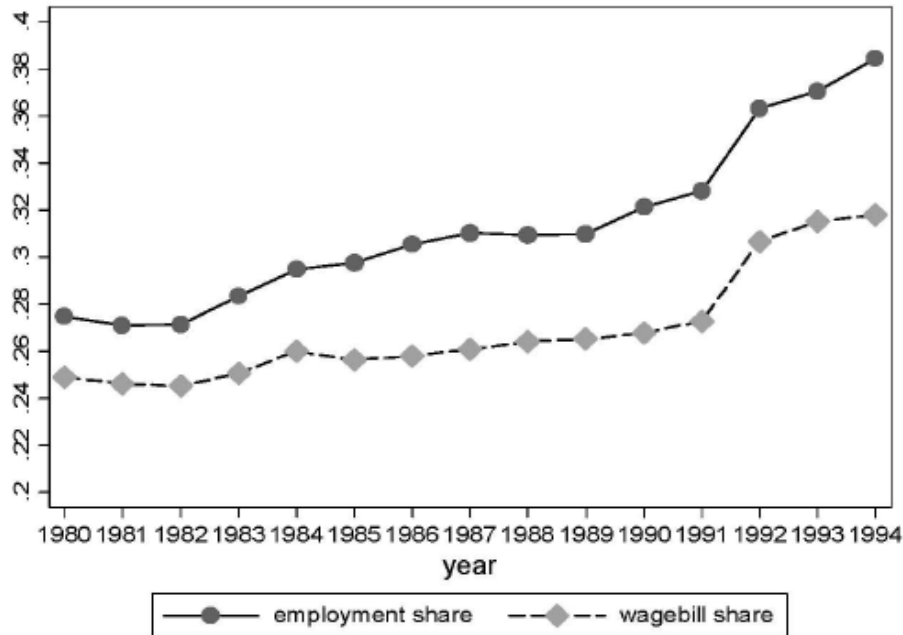
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Basic Question

- Did industrial de-licensing and trade liberalization contribute to skill-upgrading in India between 1980 and 1994?
 - After controlling for plant size, de-licensing increased relative demand for skilled workers during 1980s
 - Capital-skill and output-skill complementarities contribute 75%(57%) and 35%(29%) resp. of growth in shares of skilled workers in de-licensed industries
 - Complementarities weaker after trade reforms

Motivation: Large rise in employment of skilled workers & skill premium



Motivation: Indian policy lessons

- Series of industrial and trade policy reforms
 - De-licensing of manufacturing industry, mid-1980s onwards
 - Trade reforms, 1991 onwards
 - FDI liberalization, 1991 onwards
 - SSI De-reservation, 2000 onwards
- Evidence of real effects of these reforms
 - Aghion et al (2005), Sharma(2006, 2008), Aghion et al (2008), Sivadasan(2009), Topalova(2010)

Mechanisms

- **Skill-biased technological change**
 - Reforms raise competition, force plants to raise productivity (Sharma 2006)
 - If these changes are complementary to skilled labor, reforms raise demand for skill
 - Acemoglu(2003), Attanasio(2004), Harrison & Hanson(1999), Berman et al(forthcoming)
- **Quality upgrading as a result of greater competition**
 - Quality may be complementary to skill
 - Verhoogen (2004) Mexico

Mechanisms (contd.)

- **Stolper-Samuelson theorem**
 - Trade liberalization lowers demand for, and returns to the factor used intensively in the production of formerly protected goods
 - Human- and physical-capital-intensive sectors highly protected in India during the 1980s => demand for, and returns for skill should decline after trade liberalization

Mechanisms (contd.)

- Global production sharing or outsourcing
 - Feenstra and Hanson (1996, 2003): Developed countries transfer the production of intermediate goods and services to LDCs Feenstra and Hanson (1996)
 - For LDCs these activities are skill-intensive => rise in demand for skill after external sector reforms

Data

- De-licensing: 4-digit level indicator from Sharma(2006)
- Tariffs: 3-digit levels from Das(2003)
- ASI unit-level data 1980-1994
 - Repeated cross-sections
 - Use occupational measure of skill – non-production versus production workers

Gradual freedom from License Raj

- Licensing regime controlled entry/exit into manufacturing, as well as plant output, location, technology etc
 - De-licensing began gradually in 1984, continued piecemeal through the 1980s (Sharma 2006, 2008)
 - ~20% manufacturing output de-licensed by 1990
 - Major episode in 1991, leaving only 16% under licensing

Exemption from licensing at plant level

- *Exemption based on book-value of assets, same threshold for all industries*
 - Define: $NE_{it} = 1$ if $K_{it} < K_{Threshold}$
- Both types affected differently by licensing
 - Exempt plants constrained in size
 - Not Exempt (NE) plants constrained in output, protected from competition
- Provides within-industry variation that helps us identify effect of de-licensing

Main specification

$$Y_{ijts} = \alpha + \beta_1 DL_{jt} + \beta_2 NE_{ijts} + \beta_3 \ln \left(\frac{K_{ijts}}{O_{ijts}} \right) + \beta_4 \ln(O_{ijts}) + \beta_5 DL_{jt} * NE_{ijts} \\ + \beta_6 DL_{jt} * \ln \left(\frac{K_{ijts}}{O_{ijts}} \right) + \beta_7 DL_{jt} * \ln(O_{ijts}) + \delta_j + \gamma_t + \lambda_s + \epsilon_{ijts},$$

- Account for differential trends in Exempt and NE plants
- Include proxies for important mechanisms
 - Capital-skill complementarities
 - Output-skill complementarities

Table 10: Complementarities from Equation 7

Null Hypothesis	1980s Sample	
	Employment Share	Wagebill Share
Panel A: Coefficients and Test Statistics		
<u>Plants in Licensed Industries</u>		
$H_0 : \beta_3 = 0$	0.009*** [259.83]	0.013*** [232.46]
$H_0 : \beta_4 = 0$	0.019*** [74.95]	0.028*** [131.11]
<u>Plants in De-licensed Industries</u>		
$H_0 : \beta_3 + \beta_6 = 0$	0.011*** [240.80]	0.015*** [130.68]
$H_0 : \beta_4 + \beta_7 = 0$	0.026*** [240.80]	0.034*** [344.76]
Panel B: Elasticities		
<u>Plants in Licensed Industries</u>		
Elasticity wrt capital-output ratio	0.047	0.050
Elasticity wrt output	0.100	0.108
<u>Plants in De-licensed Industries</u>		
Elasticity wrt capital-output ratio	0.058	0.058
Elasticity wrt output	0.137	0.131
Panel C: Complementarities		
<u>Plants in Licensed Industries</u>		
Capital-skill complementarities	6.04	6.38
Output-skill complementarities	6.66	7.17
<u>Plants in De-licensed Industries</u>		
Capital-skill complementarities	7.38	7.36
Output-skill complementarities	9.11	8.71

Regression discontinuity design

- What happened to demand for skill in plants immediately above or below threshold?
- Allows us to compare plants that are very similar, but not treated equally by licensing regime
- Caveat: don't have panel data

$$\begin{aligned}
 Y_{ijts} = & \alpha + \beta_1 DL_{jt} + \beta_2 NE_{ijts} + \beta_3 \ln \left(\frac{K_{ijts}}{O_{ijts}} \right) + \beta_4 \ln(O_{ijts}) + \beta_5 DL_{jt} * NE_{ijts} \\
 & + \beta_6 DL_{jt} * \ln \left(\frac{K_{ijts}}{O_{ijts}} \right) + \beta_7 DL_{jt} * \ln(O_{ijts}) + \sum_k \phi_k Z_{ijts}^k + \sum_k \varphi_k DL_{jt} * Z_{ijts}^k \\
 & + \delta_j + \gamma_t + \lambda_s + \epsilon_{ijts}.
 \end{aligned}$$

Table 13: Complementarities from Equation 8 with Third Degree Polynomial of Z ,

Null Hypothesis	1980s Sample	
	Employment Share	Wagebill Share
Panel A: Coefficients and Test Statistics		
<u>Plants in Licensed Industries</u>		
$H_0 : \beta_3 = 0$	0.001 [0.63]	0.006* [3.62]
$H_0 : \beta_4 = 0$	0.005*** [6.95]	0.012*** [18.30]
<u>Plants in De-licensed Industries</u>		
$H_0 : \beta_3 + \beta_6 = 0$	0.016*** [35.35]	0.030*** [45.02]
$H_0 : \beta_4 + \beta_7 = 0$	0.026*** [68.53]	0.042*** [89.63]
Panel B: Elasticities		
<u>Plants in Licensed Industries</u>		
Elasticity wrt capital-output ratio	0.005	0.023
Elasticity wrt output	0.026	0.046
<u>Plants in De-licensed Industries</u>		
Elasticity wrt capital-output ratio	0.084	0.115
Elasticity wrt output	0.137	0.162
Panel C: Complementarities		
<u>Plants in Licensed Industries</u>		
Capital-skill complementarities	0.67	2.94
Output-skill complementarities	1.75	3.07
<u>Plants in De-licensed Industries</u>		
Capital-skill complementarities	10.74	14.71
Output-skill complementarities	9.11	10.75

Trade liberalization & Skill demand

$$\begin{aligned}
 Y_{ijts} = & \alpha + \beta_1 DL80_{jt} + \beta_2 \ln(T_{jt}) + \beta_3 NE_{ijts} + \beta_4 \ln\left(\frac{K_{ijts}}{O_{ijts}}\right) + \beta_5 \ln(O_{ijts}) + \beta_6 DL80_{jt} * \ln(T_{jt}), \\
 & + \beta_7 DL80_{jt} * NE_{ijts} + \beta_8 DL80_{jt} * \ln\left(\frac{K_{ijts}}{O_{ijts}}\right) + \beta_9 DL80_{jt} * \ln(O_{ijts}) + \beta_{10} \ln(T_{jt}) * NE_{ijts} \\
 & + \beta_{11} \ln(T_{jt}) * \ln\left(\frac{K_{ijts}}{O_{ijts}}\right) + \beta_{12} \ln(T_{jt}) * \ln(O_{ijts}) + \beta_{13} DL80_{jt} * \ln(T_{jt}) * NE_{ijts} \\
 & + \beta_{14} DL80_{jt} * \ln(T_{jt}) * \ln\left(\frac{K_{ijts}}{O_{ijts}}\right) + \beta_{15} DL80_{jt} * \ln(T_{jt}) * \ln(O_{ijts}) + \delta_j + \gamma_t + \lambda_s + \epsilon_{ijts}.
 \end{aligned}$$

Table 16: Complementarities from Equation 9

1980s Trade Regime			1990s Trade Regime		
Null Hypothesis	Employment Share	Wagebill Share	Null Hypothesis	Employment Share	Wagebill Share
Panel A: Coefficients and Test Statistics			Panel A: Coefficients and Test Statistics		
<u>Plants in Licensed Industries</u>			<u>Plants in Licensed Industries</u>		
$H_0 : \beta_4 + \beta_{11} * \ln(T) = 0$	0.008*** [16.31]	0.012*** [15.06]	$H_0 : \beta_4 + \beta_{11} * \ln(T) = 0$	0.007*** [10.7]	0.010*** [10.84]
$H_0 : \beta_5 + \beta_{12} * \ln(T) = 0$	0.018*** [9.16]	0.030*** [12.23]	$H_0 : \beta_5 + \beta_{12} * \ln(T) = 0$	0.018*** [9.66]	0.027*** [13.27]
<u>Plants in De-licensed Industries</u>			<u>Plants in De-licensed Industries</u>		
$H_0 : \beta_4 + \beta_8 + \beta_{11} * \ln(T) + \beta_{14} * \ln(T) = 0$	0.009*** [7.99]	0.013*** [10.48]	$H_0 : \beta_4 + \beta_8 + \beta_{11} * \ln(T) + \beta_{14} * \ln(T) = 0$	0.008*** [7.16]	0.011*** [8.98]
$H_0 : \beta_5 + \beta_9 + \beta_{12} * \ln(T) + \beta_{15} * \ln(T) = 0$	0.229*** [13.77]	0.030*** [16.57]	$H_0 : \beta_5 + \beta_9 + \beta_{12} * \ln(T) + \beta_{15} * \ln(T) = 0$	0.025*** [15.64]	0.034*** [18.79]
Panel B: Elasticities			Panel B: Elasticities		
<u>Plants in Licensed Industries</u>			<u>Plants in Licensed Industries</u>		
Elasticity wrt capital-output ratio	0.040	0.044	Elasticity wrt capital-output ratio	0.035	0.037
Elasticity wrt output	0.090	0.111	Elasticity wrt output	0.090	0.100
<u>Plants in De-licensed Industries</u>			<u>Plants in De-licensed Industries</u>		
Elasticity wrt capital-output ratio	0.045	0.048	Elasticity wrt capital-output ratio	0.040	0.041
Elasticity wrt output	0.145	0.111	Elasticity wrt output	0.125	0.126
Panel C: Complementarities			Panel C: Complementarities		
<u>Plants in Licensed Industries</u>			<u>Plants in Licensed Industries</u>		
Capital-skill complementarities	11.09	12.32	Capital-skill complementarities	9.70	10.27
Output-skill complementarities	7.18	8.86	Output-skill complementarities	7.18	7.97
<u>Plants in De-licensed Industries</u>			<u>Plants in De-licensed Industries</u>		
Capital-skill complementarities	12.48	13.35	Capital-skill complementarities	11.09	11.30
Output-skill complementarities	11.56	8.86	Output-skill complementarities	9.97	10.04

Conclusions

- Industrial de-licensing during the 1980s raised relative demand for skilled labor
 - Capital- and Output-skill complementarities stronger in de-licensed industries
 - True both pre- and post-trade reforms
- Complementarities weaker in all industries after trade liberalization
- De-licensing in the 1980s raised skill demand *more* than de-licensing in 1991
- The License “Raj” may have contributed to the software and BPO boom of the 1990s
 - Licensing kept returns to skill low => cost advantage for skilled service sector