# Convergence Across Castes

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# Issue

- How do historical inequalities behave during periods of rapid and large macroeconomic changes?
  - accentuate or dampen?
- Who gains and who loses?
- What are the key channels through which distributional changes occur?

# India since 1980

- Perfect environment
- Dramatic changes over the past 25 years
- GDP growth averaged 6-8 percent since the mid 80s
  - 1947 to mid-80s growth averaged 3 percent
- Sectoral transformation from agriculture to services and high-skill sectors

# Caste System

- long history of social division due to castes
- has existed for centuries
- widespread social segmentation
- we focus on SC/STs: a quarter of Indian population

# Key Questions

- *How have these historically disadvantaged groups of Indian society fared during this period of macroeconomic changes?*
- *What are the mechanisms behind these changes?*

# This paper

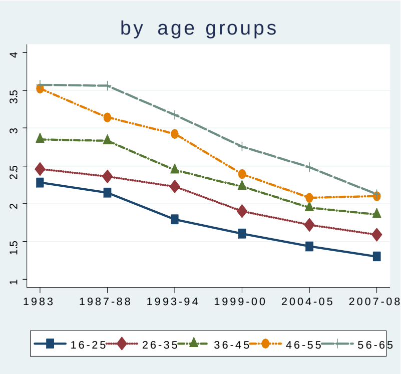
- Focus on aggregate growth, sectoral transformation and caste gaps
- Describe the key data patterns
- Develop a multi-sector, heterogenous agent model to examine the influence of aggregate shocks on the caste gaps

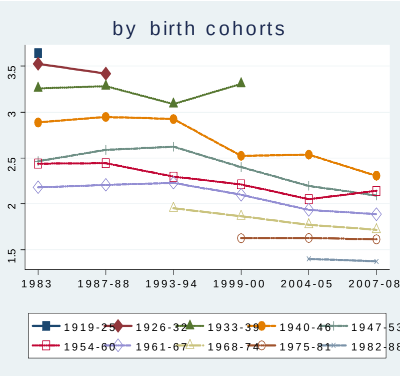
# Data

- National Sample Survey (NSS) of India
- 6 rounds: R38 (1983-84), R43 (1987-88), R50 (1993-94), R55 (1998-99), R61 (2004-05), R64 (2007-08)
- Include all individuals belonging to male-led households
  - 16 to 65 y.o.
  - not enrolled in any education institutions
  - working full-time
  - have industry of employment and education information
- Average sample size: 40,000 households; 170,000 individuals

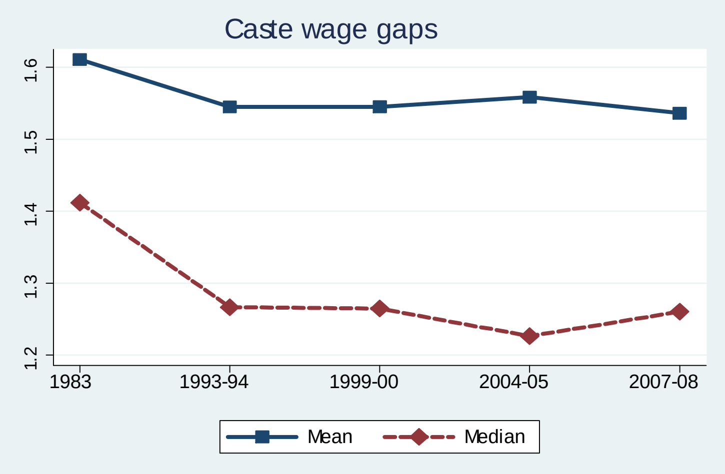
# Education Gap (years)

Gaps by age and birth cohorts



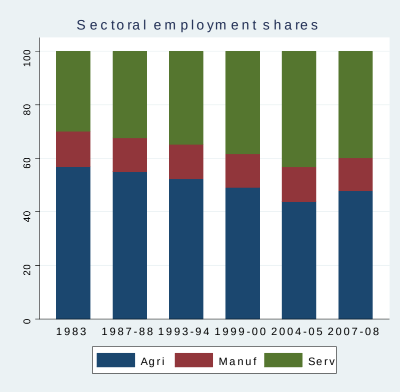



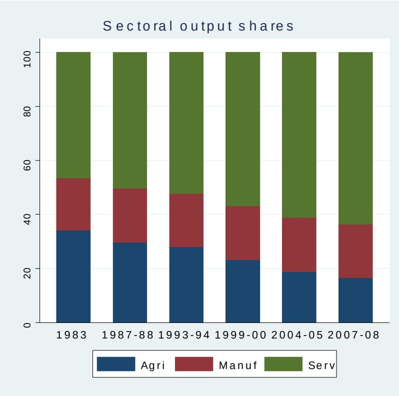
# Wage Gaps


Caste wage gaps
1.6
1.5
1.4
1.3
1.2
1983
1993-94
1999-00
2004-05
2007-08
Mean
Median

# Structural transformation

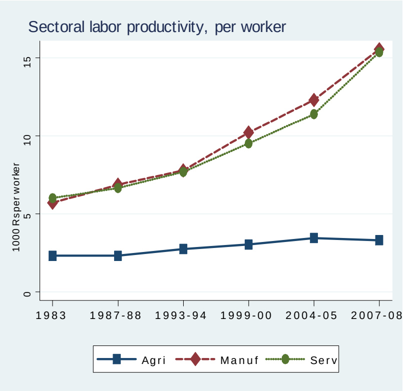
Sectoral Compositions

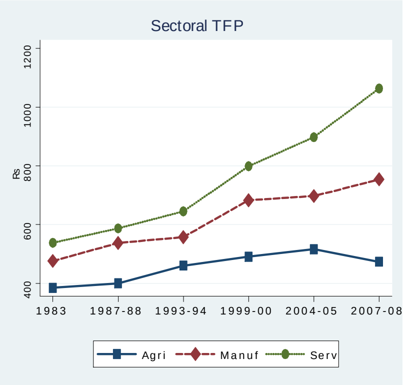


# Productivity

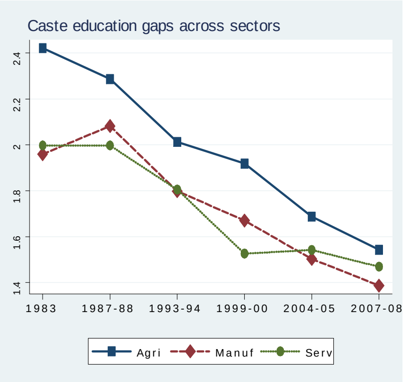
Sectoral Productivity

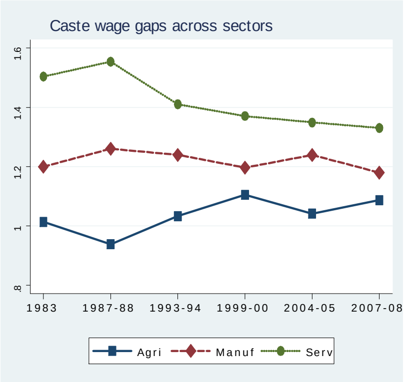


# Sectoral education and wage gaps

## Sectoral Compositions



# Summary

- Education levels and wages have been converging between SC/STs and non-SC/STs
- Structural shift toward services
- Broad-based productivity growth
- Sectoral wage gaps
  - converging in services
  - widening in agriculture
  - unchanged in manufacturing

# Question

- Can aggregate shocks explain the caste convergence?
- Under what conditions?
- Can this be consistent with the sectoral dynamics shown above?

# Model

- One-period lived closed economy
- Continuum of agents of measure $L$
  - measure $S$ of these agents belong to caste $s$ for SC/ST
  - measure $N = L - S$ belong to caste $n$ for non-SC/ST
- Each agent $i$ maximizes utility from $u(c_i)$:

$$c_i = (c_i^a - \bar{c})^\theta (c_i^m)^\eta \left(c_i^h\right)^{1-\theta-\eta}$$

# Endowments

- Each agent born with one unit of labor time and an endowment of ability $e_i$
- Ability productive in both market work and skill acquisition
- Ability $e_i$ drawn from i.i.d. process with cdf

$$G_j(e), \quad e \in \left[\underline{e}_j, \bar{e}^j\right], \quad j = s, n$$

- We assume
  - *Assumption 1:* $\underline{e}_s \leq \underline{e}_n$
  - *Assumption 2:* $\bar{e}^s \leq \bar{e}^n$
- Captures effect of historical discrimination at time of entry to labor market

# Labor market

- Three sectors of potential work
  - sectors $a, m, h$
- Sector $a$ technology only requires basic ability
- Sectors $m$ and $h$ require sector-specific skills
- Skill acquisition costs are in terms of sector $m$ goods
  - Sector $m$ training cost: $f_j^m(e_i), \quad f_j^{m\prime} < 0, \quad j = s, n$
  - Sector $h$ training cost: $f_j^h(e_i), \quad f_j^{h\prime} < 0, \quad j = s, n$
  - Costs are allowed to be sector and caste specific

# Sectoral production technologies

- Sector $a$ : $y_i^a = Ae_i$
- Sector $m$ : $y_i^m = Me_i$
- Sector $h$ : $y_i^h = He_i$
- Skill acquisition costs are like entry costs here

# Occupation choice

- Agent of caste $j$ with ability $e_i$ remains unskilled if and only if

$$\begin{aligned} Ae_i &\geq p_m \left( Me_i - f_j^m \left( e_i \right) \right) \\ Ae_i &\geq p_h He_i - p_m f_j^h \left( e_i \right) \end{aligned}$$

- Conditions imply the ability thresholds defined by:

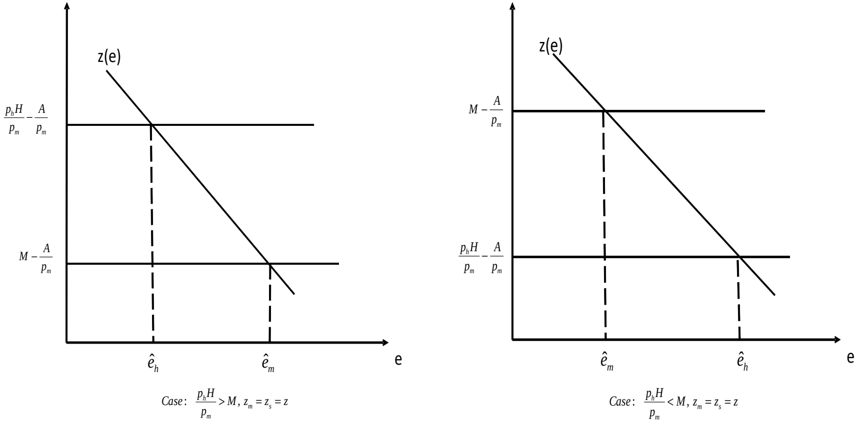
$$z_j^m \left( \hat{e}_j^m \right) = M - \frac{A}{p_m}, \quad j = s, n$$

$$z_j^h \left( \hat{e}_j^h \right) = \frac{p_h}{p_m} H - \frac{A}{p_m}, \quad j = s, n$$

  - $z_j^m (e) \equiv \frac{f_j^m (e)}{e}$ and $z_j^h (e) \equiv \frac{f_j^h (e)}{e}$

# Ability thresholds

Alternative scenarios



# Specializing the problem

- *Assumption 4*: Skill acquisition cost is

$$f_j(e) = \phi\left(\gamma_j^k - \alpha e\right) \text{ for } j = s, n \text{ and } k = m, h \text{ with } \gamma_j^k > \alpha \bar{e}^j$$

- *Assumption 5*: $\frac{\gamma_j^h}{\gamma_j^m} = \beta$ for $j = s, n, \ \beta > 0$
- *Assumption 6*: $G_j(e)$ is uniform on the support $\left[\underline{e}_j, \bar{e}^j\right]$ for $j = s, n$.

# Implications

- Ability thresholds

$$\frac{\hat{e}_n^m}{\hat{e}_s^m} = \frac{\gamma_n^m}{\gamma_s^m}$$
$$\frac{\hat{e}_n^h}{\hat{e}_s^h} = \frac{\gamma_n^h}{\gamma_s^h}$$

- Relative sectoral ability thresholds are proportional to the relative fixed costs of acquiring skills
  - $\hat{e}_n^k > \hat{e}_s^k$ if and only if $\gamma_n^k > \gamma_s^k$

# Productivity Shocks

## Two-sector example

- What is the effect of productivity shocks on this economy?
  - sectoral allocations
  - caste wage gaps
- Specialize to two-sector case: only sectors $a$ and $h$
- Productivity:

$$
\begin{aligned}
A &= \mu \bar{A} \\
H &= \mu \bar{H} \\
\phi &= \frac{\mu}{\bar{\phi}}
\end{aligned}
$$

  - $\mu$ is aggregate parameter (common component of TFP)

# Aggregate Productivity Shock

**Proposition 2:** *An increase in aggregate labor productivity* $\mu$ *decreases the ability threshold* $\hat{e}_s$*. This (i) reduces the caste wage gap in sector a if and only* $\frac{\gamma_n}{\gamma_s} > \frac{\underline{e}_n}{\underline{e}_s}$*; and (ii) reduces the caste wage gap in sector h if and only if* $\frac{\gamma_n}{\gamma_s} > \frac{\bar{e}_n}{\bar{e}_s}$*.*

- Rise in $\mu$ leaves unchanged the relative gains and losses from getting skilled
- Higher $\mu$ raises the aggregate supply of the agricultural good *net* of the subsistence amount $\bar{c}L$
  - excess supply of the agricultural good: $p_h$ rises
- $\hat{e}_s$ falls: agents with lower ability now begin to get trained as more attractive to work in $h-$sector

# Wage gaps

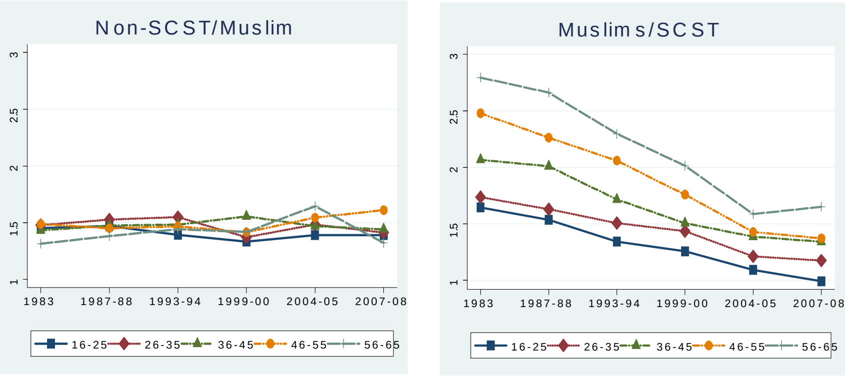
- Fall in $\hat{e}_s$ affects the sectoral wage gaps if the thresholds are affected differentially
- The wage gap in $h$ falls if the higher costs of getting skilled for type $n$ more than offsets their ability advantage
- Differential skill costs key – affirmative action programs

# Some Indirect Evidence

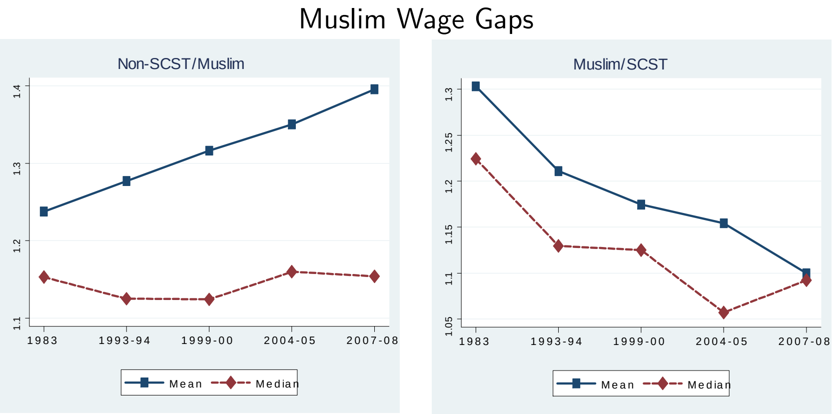
- Model suggests pre-existing reservations were important
- Other minorities without reservations?
- Muslims in India
  - worse off than mainstream
  - no reservations

# Muslim education gaps

## Gaps by age cohorts



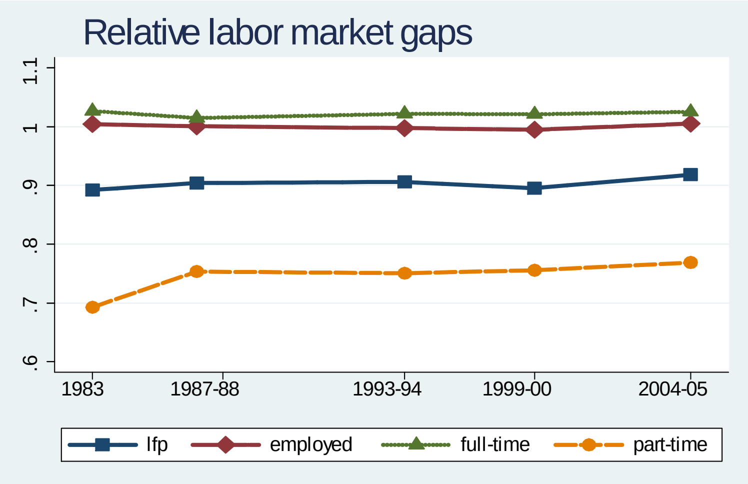
# Muslim wage gaps



# Conclusions

- India has seen sharp catch-up in education and wages of SC/STs
- We have studied the potential role of aggregate shocks
- Aggregate shocks can have differential effects if pre-existing subsidization of education for SC/STs
  - affirmative action programs have been in place since 1950
- How much can this explain quantitatively?

# Labor market participation (Non-SCST/SCST)



# Aggregation

- Aggregate sectoral outputs

$$
\begin{aligned}
y^a &= S \int_{\underline{e}_s}^{\hat{e}_s^m} A e_i dG_s(e) + N \int_{\underline{e}_n}^{\hat{e}_n^m} A e_i dG_n(e) \\
y^m &= S \int_{\hat{e}_s^m}^{\hat{e}_s^h} M e_i dG_s(e) + N \int_{\hat{e}_n^m}^{\hat{e}_n^h} M e_i dG_n(e) \\
y^h &= S \int_{\hat{e}_s^h}^{\bar{e}_s} H e_i dG_s(e) + N \int_{\hat{e}_n^h}^{\bar{e}_n} H e_i dG_n(e)
\end{aligned}
$$

- Aggregate skill acquisition costs

$$
\begin{aligned}
F &= S \left[ \int_{\hat{e}_s^m}^{\hat{e}_s^h} f_s^m(e_i)\, dG_s(e) + \int_{\hat{e}_s^h}^{\bar{e}_s} f_s^h(e_i)\, dG_s(e) \right] \\
&\quad + N \left[ \int_{\hat{e}_n^m}^{\hat{e}_n^h} f_n(e_i)\, dG_n(e) + \int_{\hat{e}_n^h}^{\bar{e}_n} f_n^h(e_i)\, dG_s(e) \right]
\end{aligned}
$$

# Equilibrium determination

$$
\begin{aligned}
p_m &= \frac{\left(\frac{1-\theta}{\theta}\right)\left[y^a - \bar{c}L\right]}{y^m - F} \\
p_m &= \frac{A\hat{e}_s}{M\hat{e}_s - \phi\left(\gamma_s - a\hat{e}_s\right)} \\
\frac{\hat{e}_n}{\hat{e}_s} &= \frac{\gamma_n}{\gamma_s}
\end{aligned}
$$

- First equation: optimal consumption and market clearing
- Second equation: ability threshold condition
- Third equation: threshold gaps between the castes