Convergence Across Castes

Viktoria Hnatkovska ¹  Amartya Lahiri ²

¹University of British Columbia
²CAFRAL and University of British Columbia

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Introduction

- How do historical inequalities behave during periods of rapid and large macroeconomic changes?
- Who gains and who loses?
- What are the key channels through which distributional changes occur?
India since 1980

- Perfect environment
- Dramatic macroeconomic changes over the past 25 years
- Long history of social division due to castes
- Widespread social segmentation
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 fortunes of SCSTs relative to others since 1983
- Develop a model to examine effects of aggregate shocks on caste gaps
- Quantitatively evaluate the fit of the model
Data

- National Sample Survey (NSS) of India
  - 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
Wage data

- Average real daily wage
- Expressed in 1983 rural Maharashtra prices
- Accounts for cross-state price differences
Education gaps (years)

(a) Age cohorts
by age groups

(b) Birth cohorts
overall

1 1.5 2 2.5 3 3.5 4
16−25 26−35 36−45 46−55 56−65

1.5 2 2.5 3 3.5
1983 1987−88 1993−94 1999−00 2004−05
Wage gaps: Non-SCST/SCST

(a) Median gap

Median Relative Wage Gaps

(b) Mean

Mean Relative Wage Gaps
Accounting for Wage Gaps

Caste wage gap, 1983

Caste wage gap, 2011–12

\[
\ln(wage(\text{NonSC/ST}) - \ln(wage(\text{SC/ST}))
\]

percentile

actual explained:demogr explained:edu explained:quota
Structural Transformation

Sectoral Employment Share

Sectoral Output Share
Sectoral Productivity

(a) Labor productivity

(b) TFP
Sectoral Employment Gaps

(a) Caste employment distribution

(b) Employment distribution gaps
Sectoral Education and Wage Gaps

(a) Education gaps

- Caste education gaps across sectors

(b) Wage gaps

- Caste wage gaps across sectors
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 $u(c_i)$:
  \[ c_i = (c_i^a - \bar{c})^\theta (c_i^m)^\eta (c_i^h)^{1-\theta-\eta} \]
Endowments

- Agent \( i \): one unit of labor time and ability endowment \( e_i \)
- Ability productive in both market work and skill acquisition
- Ability \( e_i \) drawn from i.i.d. process with cdf

\[
G_j(e), \quad e \in [e_j, \bar{e}^j], \quad j = s, n
\]

- Assume (a) \( e_s \leq e_n \); (b) \( \bar{e}^s \leq \bar{e}^n \)
- Captures effect of historical discrimination
Labor market

- Three sectors of potential work

- 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: $f_j^m(e_i), \quad f_j^{m'} < 0, \quad j = s, n$
  - Sector $h$ training cost: $f_j^h(e_i), \quad f_j^{h'} < 0, \quad j = s, n$
Sectoral production technologies

- Sector $a$: $y_{i}^{a} = Ae_{i}$
- Sector $m$: $y_{i}^{m} = Me_{i}$
- Sector $h$: $y_{i}^{h} = He_{i}$
Agent of caste \( j \) with ability \( e_i \) remains unskilled if and only if

\[
Ae_i \geq p_m \left[ Me_i - f_j^m (e_i) \right] \\
Ae_i \geq p_h He_i - p_m f_j^h (e_i)
\]

Conditions imply the ability thresholds defined by:

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

\[
z_j^h \left( \hat{e}_j^h \right) \equiv \frac{f_j^h (\hat{e})}{\hat{e}} = \frac{p_h}{p_m} H - \frac{A}{p_m}, \quad j = s, n
\]
Ability Thresholds

Case: $\frac{p_h H - A}{p_n} > M$, $z_m = z_s = z$

Case: $\frac{p_h H - A}{p_n} < M$, $z_m = z_s = z$
Market clearing and equilibrium

- Market clearing conditions

\[ c^a = y^a \]
\[ c^m = y^m - F \]
\[ c^h = y^h \]

- **Equilibrium:** The Walrasian equilibrium for this economy is a vector of prices \( \{p_m, p_h\} \) and quantities \( \{c^a, c^m, c^h, y^a, y^m, y^h, F^m, F^h, \hat{e}_s^m, \hat{e}_s^h, \hat{e}_n^m, \hat{e}_n^h\} \) such that all worker-households satisfy their optimality conditions, budget constraints are satisfied and all markets clear.
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**: \( \frac{\gamma_j^h}{\gamma_j^m} = \beta \text{ for } j = s, n, \beta > 0 \)

- **Assumption 6**: \( G_j(e) \) is uniform on the support \([e_j, \bar{e}^j]\) for \( j = s, n \).
Implications

▶ Ability thresholds

\[
\frac{\hat{e}^m_n}{\hat{e}^m_s} = \frac{\gamma^m_n}{\gamma^m_s} \\
\frac{\hat{e}^h_n}{\hat{e}^h_s} = \frac{\gamma^h_n}{\gamma^h_s}
\]

▶ Relative sectoral ability thresholds

▶ proportional to relative fixed costs of acquiring skills

▶ \( \hat{e}^k_n > \hat{e}^k_s \) if and only if \( \gamma^k_n > \gamma^k_s \)
Two-sector example

- Specialize to two-sector case: only sectors $a$ and $m$

- Productivity:

\[
\begin{align*}
A &= \mu \bar{A} \\
\bar{M} &= \mu \bar{M} \\
\phi &= \frac{\mu}{\phi}
\end{align*}
\]

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

\[ p_m = \frac{(\frac{1-\theta}{\theta}) [y^a - \bar{c}L]}{y^m - F} \]

\[ p_m = \frac{A\hat{e}_s}{M\hat{e}_s - \phi (\gamma_s - a\hat{e}_s)} \]

\[ \frac{\hat{e}_n}{\hat{e}_s} = \frac{\gamma_n}{\gamma_s} \]

- First equation: optimal consumption and market clearing
- Second equation: ability threshold condition
- Third equation: threshold gaps between the castes
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 if $\frac{\gamma_n}{\gamma_s} > \frac{e_n}{e_s}$; and (ii) reduces the caste wage gap in sector $m$ if and only if $\frac{\gamma_n}{\gamma_s} > \frac{\bar{e}_n}{\bar{e}_s}$. 
Aggregate Productivity Shock

- Rise in $\mu$ affects all sectors symmetrically

- Non-homotheticity means excess supply of agricultural good
  - agricultural good becomes cheaper: $p_m$ rises
  - more attractive to work in $m$–sector

- $\hat{e}_s$ and $\hat{e}_n$ fall: agents with lower ability begin to get trained
Productivity shocks and wage gaps

- Wage gap in $h$ falls if higher costs of getting skilled for type $n$ more than offsets their ability advantage

- For wage gap in $a$ to rise, the opposite must be true

- Differential skill costs key – affirmative action programs
Can model generate the observed changes?

- Can quantified version of the model generate the observed trends
  - Approach: calibrate model to match 1983 facts
  - Hit it with observed productivity shocks
  - What is the implied time path of the caste wage gap?
Calibration

- Six key data moments
  - three sectoral occupation distribution gaps
  - three sectoral wage gaps between non-SCSTs and SCSTs

- We choose
  - skilling cost parameters \((\gamma^m_s, \gamma^h_s, \gamma^m_n, \gamma^h_n)\)
  - relative ability ratios \((\frac{e^m_n}{e^m_s}, \frac{e^h_n}{e^h_s})\)
  - match sectoral occupation and wage gaps in 1983

- Effect of observed change in sectoral labor productivity?
### Parameterization

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<td>$H_{A \ 1983}$</td>
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**Calibrated variables for 1983**

| $\gamma_{s,1983}^m$ | 8.23 | $\gamma_{s,1983}^h$ | 11.79 |
| $\gamma_{n,1983}^m$ | 10.52| $\gamma_{n,1983}^h$ | 15.2  |
| $\frac{e_{sn}}{e_s}$ | 1.04 | $\frac{\bar{e}_{sn}}{\bar{e}_s}$ | 1.37  |
Caste Employment Distribution

Labor Share of different sectors within group

labor share within group 1983

labor share within group 1993

labor share within group 1988

labor share within group 1998

labor share within group 2003

labor share within group 2008
Caste Wage Gaps

Wage gap by sectors

Wage gap by sector 1983

Wage gap by sector 2010
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

Non-SCST/Muslim

Muslim/SCST


Muslim Wage Gaps

Non-SCST/Muslim

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Muslim/SCST

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Conclusions

▶ India has seen a catch-up in education and wages of SC/STs

▶ We have studied the potential role of aggregate shocks

▶ Aggregate productivity shocks can have differential effects
  ▶ requires pre-existing subsidization of skilling costs for SCSTs
  ▶ affirmative action programs may have been important

▶ Mechanism appears to do well quantitatively