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
- 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

by age groups

by birth cohorts
Wage Gaps

Caste wage gaps

- Mean
- Median
Structural transformation

Sectoral Compositions

Sectoral employment shares

Sectoral output shares
Productivity

Sectoral Productivity

Sectoral labor productivity, per worker

Sectoral TFP

Sectors: Agri, Manuf, Serv
Sectoral education and wage gaps

Sectoral Compositions

Caste education gaps across sectors

Caste wage gaps across sectors

[Graphs showing trends in sectoral compositions from 1983 to 2007-08 for agriculture (Agri), manufacture (Manuf), and service (Serv) sectors.]
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 $u(c_i)$:

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

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

- We assume
  - Assumption 1: $e_s \leq e_n$
  - 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: $f_j^m(e_i)$, $f_j^{m'} < 0$, $j = s, n$
  - Sector $h$ training cost: $f_j^h(e_i)$, $f_j^{h'} < 0$, $j = s, n$
- 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

\[
Ae_i \geq p_m \left( Me_i - f^m_j(e_i) \right) \\
Ae_i \geq p_h He_i - p_m f^h_j(e_i)
\]

- Conditions imply the ability thresholds defined by:

\[
z^m_j \left( \hat{e}^m_j \right) = M - \frac{A}{p_m}, \quad j = s, n
\]

\[
z^h_j \left( \hat{e}^h_j \right) = \frac{p_h}{p_m} H - \frac{A}{p_m}, \quad j = s, n
\]

- \( z^m_j(e) \equiv \frac{f^m_j(e)}{e} \) and \( z^h_j(e) \equiv \frac{f^h_j(e)}{e} \)
Ability thresholds

Alternative scenarios

Case: \( \frac{p_n H - A}{p_m} > M, z_m = z_i = z \)

Case: \( \frac{p_n H - A}{p_m} < M, z_m = z_i = z \)
Specializing the problem

- **Assumption 4**: Skill acquisition cost is

\[ f_j(e) = \phi \left( \gamma_j^k - \alpha e \right) \] for \( j = s, n \) and \( k = m, h \) 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 \([e_j, \bar{e}^j]\) 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:

  \[
  A = \mu \bar{A} \\
  H = \mu \bar{H} \\
  \phi = \frac{\mu}{\bar{\phi}} 
  \]

- \( \mu \) 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 if $\frac{\gamma_n}{\gamma_s} > \frac{e_n}{\hat{e}_s}$; and (ii) reduces the caste wage gap in sector $h$ if and only if $\frac{\gamma_n}{\gamma_s} > \frac{\bar{e}_n}{\hat{e}_s}$.

- 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

Non-SCST/Muslim

Muslims/SCST
Muslim wage gaps

Muslim Wage Gaps

Non-SCST/Muslim

Muslim/SCST

Mean Median

Mean Median


Mean Median

1.05 1.1 1.15 1.2 1.25 1.3


Mean Median
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)

Relative labor market gaps

- Ifp
- employed
- full-time
- part-time
Aggregation

- Aggregate sectoral outputs

\[
\begin{align*}
y^a &= S \int_{\hat{e}_s^m} \ Ae_i dG_s (e) + N \int_{\hat{e}_n^m} \ Ae_i dG_n (e) \\
y^m &= S \int_{\hat{e}_s^h} \ Me_i dG_s (e) + N \int_{\hat{e}_n^h} \ Me_i dG_n (e) \\
y^h &= S \int_{\hat{e}_s^h} \ He_i dG_s (e) + N \int_{\hat{e}_n^h} \ He_i dG_n (e)
\end{align*}
\]

- Aggregate skill acquisition costs

\[
F = S \left[ \int_{\hat{e}_s^h} f_s^m (e_i) \ dG_s (e) + \int_{\hat{e}_s^h} f_s^h (e_i) \ dG_s (e) \right]
+ N \left[ \int_{\hat{e}_n^h} f_n (e_i) \ dG_n (e) + \int_{\hat{e}_n^h} f_n^h (e_i) \ dG_s (e) \right]
\]
Equilibrium determination

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

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

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

\[ \hat{e}_s \]

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