Demographic change and economic development at the local level in Brazil

Ernesto F. L. Amaral
Research question

- **Main question:** What are the effects of changing age and educational compositions on male earnings in Brazil?

- Within the labor force (15–64 years of age), the population is getting older and better educated with regional variation.

- Age and education increase earnings.

- Larger proportion of older and more educated males causes:
  - Competition in the labor market.
  - Negative impacts on earnings of competing workers.
Previous studies

– **Human capital:** schooling and work experience have positive impacts on earnings (Mincer, 1974).

– **Baby boom:** large cohorts of better educated individuals entered the U.S. labor market, decreasing their relative earnings.
  (Berger, 1985; Bloom and Freeman, 1986; Bloom, Freeman, and Korenman, 1987; Easterlin, 1978; Freeman, 1979; Sapozknikov and Triest, 2007; Welch, 1979)

– Larger cohorts also had positive impacts on labor outcomes.
  (Autor, Katz, and Krueger, 1998; Katz and Autor, 1999; Katz and Murphy, 1992; Shimer, 2001)

– Effects of cohort size on the labor market have been estimated for several developed countries.
  (Biagi and Lucifora, 2008; Borjas, 2003; Brunello, 2010; Korenman and Neumark, 2000; Skans, 2005)
Main contribution

- Few studies have addressed how demographic and educational compositions affect earnings in developing countries.

- Contributes to the literature on demographic change in developing countries by predicting earnings using:
  - Variations in age-education composition.
  - Regional differences.

- This project is part of a broader research agenda dealing with the effects of population changes on demographic, social, and economic outcomes.
Example of Brazil

– Total Fertility Rate: 5.8 in 1970; 1.9 in 2010 (IBGE, 2012).

– Educational expansion began late and has a long way to go (Barro and Lee, 2001; Marcílio, 2001, 2005; Rios-Neto and Guimarães, 2010).

– Improvement in educational attainment coincides with decline in family size and school-age children (Lam and Marteleto, 2005, 2008).

– The country has extensive data that captures information on:
  – Population aging.
  – Educational improvement.
  – Geographic variation.
Age composition, males, 1970–2010

Educational composition, males, 1970–2010

Regional variation

- **Developing countries**: changes in age-education structure usually vary across different areas within the countries.

- In Brazil, **fertility** decline has varied in timing and pace across states and municipalities (Potter et al., 2002; Potter et al., 2010).

- **Educational attainment** increased, but with a great deal of regional disparity (Riani, 2005; Rios-Neto and Guimarães, 2010).
Five regions & 502 micro-regions
Micro-data

- **Minimum comparable areas:** 502 micro-regions.
- **Age** in years is categorized into four groups:
  - Youths (15–24).
  - Young adults (25–34).
  - Experienced adults (35–49).
  - Older adults (50–64).
- **Education:** three groups indicating years of schooling:
  - No further than the first phase of elementary school (0–4).
  - Second phase of elementary school (5–8).
  - At least some secondary school (9+).
- **Earnings** from main occupation: converted to Jan. 2002.
Aggregate-level data

- **Database** is aggregated by census years, micro-regions, and age-education groups (24,096 observations):
  - 4 years * 502 micro-regions * 12 age-education groups.

- Cells with less than 25 people receiving income were excluded:
  - 19,727 observations remained.

- Only male population: labor force participation is not driven by level of earnings, fertility decline, and changes in educational attainment.
## Data setup

<table>
<thead>
<tr>
<th>Census year</th>
<th>Micro-region</th>
<th>Age-education group</th>
<th>Log of mean real earnings log((Y_{git}))</th>
<th>Distr. of male pop.</th>
<th>P11</th>
<th>P12</th>
<th>P13</th>
<th>...</th>
<th>P43</th>
<th>Num. of obs.</th>
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<td>110006</td>
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<td>15–24 years &amp; 0–4 educ.</td>
<td>5.82</td>
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<td>15–24 years &amp; 5–8 educ.</td>
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<td>15–24 years &amp; 9+ educ.</td>
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<td>50–64 years &amp; 9+ educ.</td>
<td>7.73</td>
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### Fixed effects models

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Baseline model</th>
<th>Composition model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Logarithm of the mean real monthly earnings by age-education group, area, and time</strong></td>
<td>$\log(Y_{git})$</td>
<td>$\log(Y_{git})$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Baseline model</th>
<th>Composition model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12 age-education indicators * time</strong></td>
<td>$(G_{11} - G_{43}) \cdot \theta_t$</td>
<td>$(G_{11} - G_{43}) \cdot \theta_t$</td>
</tr>
<tr>
<td><strong>Distribution of male population into 12 age-education groups * time</strong></td>
<td></td>
<td>$(P_{11} - P_{43}) \cdot \theta_t$</td>
</tr>
<tr>
<td><strong>2008 area-time fixed effects</strong></td>
<td>$\alpha_{it}$</td>
<td>$\alpha_{it}$</td>
</tr>
</tbody>
</table>
Brazilian male working-age population


- Description of 15–64 year-old males:
  - Mean real monthly earnings in main occupation, 2000.
Age-education composition, 1970–2000

15–24

25–34

35–49

50–64

Proportion with 9+ years of schooling, 1970

Source: 1970 Brazilian Demographic Census.
Proportion with 9+ years of schooling, 1980

Source: 1980 Brazilian Demographic Census.
Proportion with 9+ years of schooling, 1991

Source: 1991 Brazilian Demographic Census.
Proportion with 9+ years of schooling, 2000

Source: 2000 Brazilian Demographic Census.
Mean real monthly earnings in main occupation, 2000

Source: 2000 Brazilian Demographic Census.
Estimating the impacts of relative group size on male earnings

- Baseline model:
  - Effects of age-education indicators ($G_{11}–G_{43}$), 2000.

- Composition model:
  - Effects of age-education indicators ($G_{11}–G_{43}$), 2000.
Effects of age-education indicators ($G_{11} - G_{43}$) on earnings from baseline model, 2000

Effects of age-education indicators ($G_{11}-G_{43}$) on earnings from composition model, 2000

Effects of group proportions in 502 micro-regions ($P_{11}–P_{23}$) on earnings, 1970 and 2000

15–24 years

0–4 education

5–8 education

9+ education

25–34 years

0–4 education

5–8 education

9+ education

Effects of group proportions in 502 micro-regions ($P_{31}-P_{43}$) on earnings, 1970 and 2000

### 35–49 years

- **0–4 education**
- **5–8 education**
- **9+ education**

![Graphs showing earnings trends over time for different education levels and age groups.](image)

### 50–64 years

- **0–4 education**
- **5–8 education**
- **9+ education**

![Graphs showing earnings trends over time for different education levels and age groups.](image)

Robustness checks

- Extra models included as independent variables:
  - Cross effects.
  - Population size of micro-regions.
  - Female workers:
    - Accepted for publication in *Poverty & Public Policy*.
  - Internal migration:
    - Submitted for publication in *Space Populations Societies*.
  - **Original impacts** of distribution of males into age-education groups \((P_{11}-P_{43})\) remained negative and significant.
Final considerations

- **In line with previous studies:** larger cohort-education size generally depresses earnings.

- **Cohort size matters:** negative effects on earnings are greater for workers under age 50.

- **Education matters:** greatest impact on middle group (5–8).

- **Men with low education:** these groups are decreasing over time, but their earnings are not increasing.

- **Time:** effects are becoming less negative over the years.

- **Compositional approach:** can be applied to future studies about socioeconomic outcomes in developing countries.
Implications

- Reduction in economic inequality:
  - More better-educated men: negative impacts reduced differentials in relation to lower-educated men.
  - Fewer younger men: smaller negative impacts on their earnings prevented greater disparities in relation to older men.
  - More employed females: negative impacts on male earnings decreased gender gap.

- Public policies:
  - Demand for education: improve educational levels in areas that still have large proportions of the population with low-education.
  - Female employment: stimulate further increases.
Research papers

- Published:
  - *Demographic Research* (2013)
    Main models
    Decomposition of effects
    Projection exercise

- Accepted:
  - *Poverty & Public Policy* (2013)
    Models with women

- Submitted:
  - *Space Populations Societies*
    Models with migration
  - *Social Forces*
    Effects of race and increasing proportion of Protestants
Research agenda

- **2010 Brazilian Census:** make data compatible with the 502 micro-regions.

- **Other countries (IPUMS-International):** India, Indonesia, South Africa, Mexico, Chile, and Argentina.

- **Include women in both sides of equation:** instrumental variables will predict distribution of female workers.

- **Models by sectors:** estimate impacts of composition on earnings of workers with:
  - Formal employment.
  - Informal employment.
  - Self-employment.