Demographic change and economic development at the local level in Brazil

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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

- Brazilian Censuses: 1970, 1980, 1991, and 2000.
- 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

Census year	Micro- region	Age- education group	Log of mean real earnings	Distr. of male pop.	P11	P12	P13	 P43	Num. of obs.
		G11–G43	log(Y _{git})	P11-P43					
1970	110006	15–24 years & 0–4 educ.	5.82	0.291	0.291	0	0	 0	1616
1970	110006	15–24 years & 5–8 educ.	6.21	0.041	0	0.041	0	 0	207
1970	110006	15–24 years & 9+ educ.	6.75	0.008	0	0	0.008	 0	39
1970	110006	50–64 years & 9+ educ.	7.73	0.003	0	0	0	 0.003	21
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Fixed effects models

	Baseline model	Composition model					
Dependent variable							
Logarithm of the mean real monthly earnings by age-education group, area, and time	log(Y _{git})	log(Y _{git})					
Independent variables							
12 age-education indicators * time	(G ₁₁ –G ₄₃) * θ _t	(G ₁₁ –G ₄₃) * θ _t					
Distribution of male population into 12 age- education groups * time		(P ₁₁ –Ρ ₄₃) * θ _t					
2008 area-time fixed effects	α _{it}	α _{it}					

Brazilian male working-age population

- Main results: published in *Demographic Research* (2013).
- Description of 15–64 year-old males:
 - Age-education composition, 1970–2000.
 - Proportion with 9+ years of schooling by micro-region, 1970– 2000.
 - Mean real monthly earnings in main occupation, 2000.

Age-education composition, 1970–2000 15–24 25–34



Source: 1970, 1980, 1991, and 2000 Brazilian Demographic Censuses.

Proportion with 9+ years of schooling, 1970¹⁶



Source: 1970 Brazilian Demographic Census.

Proportion with 9+ years of schooling, 1980¹⁷



Source: 1980 Brazilian Demographic Census.

Proportion with 9+ years of schooling, 1991



Source: 1991 Brazilian Demographic Census.

Proportion with 9+ years of schooling, 2000¹⁹



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-group proportions ($P_{11}-P_{43}$), 1970 and 2000.

Effects of age-education indicators (G₁₁–G₄₃)²² on earnings from baseline model, 2000



Effects of age-education indicators (G₁₁–G₄₃)²³ on earnings from composition model, 2000



Effects of group proportions in 502 micro- $^{\rm 24}$ regions (P $_{11}-P_{23}$) on earnings, 1970 and 2000

15–24 years 5–8 education

9+ education



0-4 education

0–4 education

25–34 years 5–8 education

9+ education



Effects of group proportions in 502 micro- $^{\rm 25}$ regions (P_{\rm 31}-P_{\rm 43}) on earnings, 1970 and 2000

35–49 years 5–8 education

9+ education



0-4 education

0–4 education

50–64 years 5–8 education

9+ education



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 loweducation.
 - Female employment: stimulate further increases.

Research papers

- Published:
 - Demographic Research (2013)
 - Main models
 - Population Research & Policy Review (2012)

Decomposition of effects

- Bulletin of Latin American Research (2012)

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.