

# **Demographic change and economic development at the local level in Brazil**

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# Outline

- Research question and background.
- Data and methods.
- Results.
- Internal migration.
- Final considerations and future projects.

# 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; Sapoznikov 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)

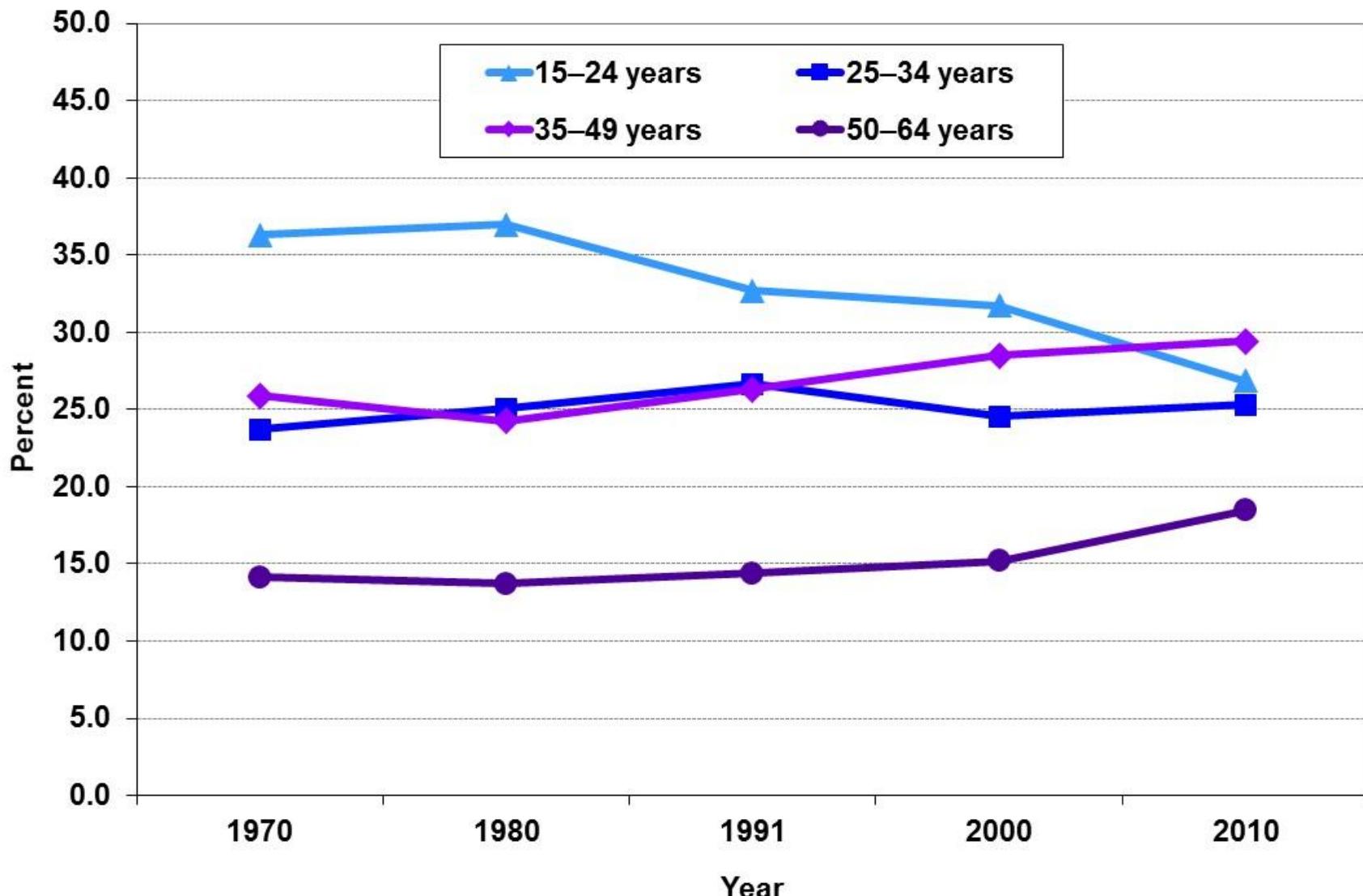
# Main contribution

- 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

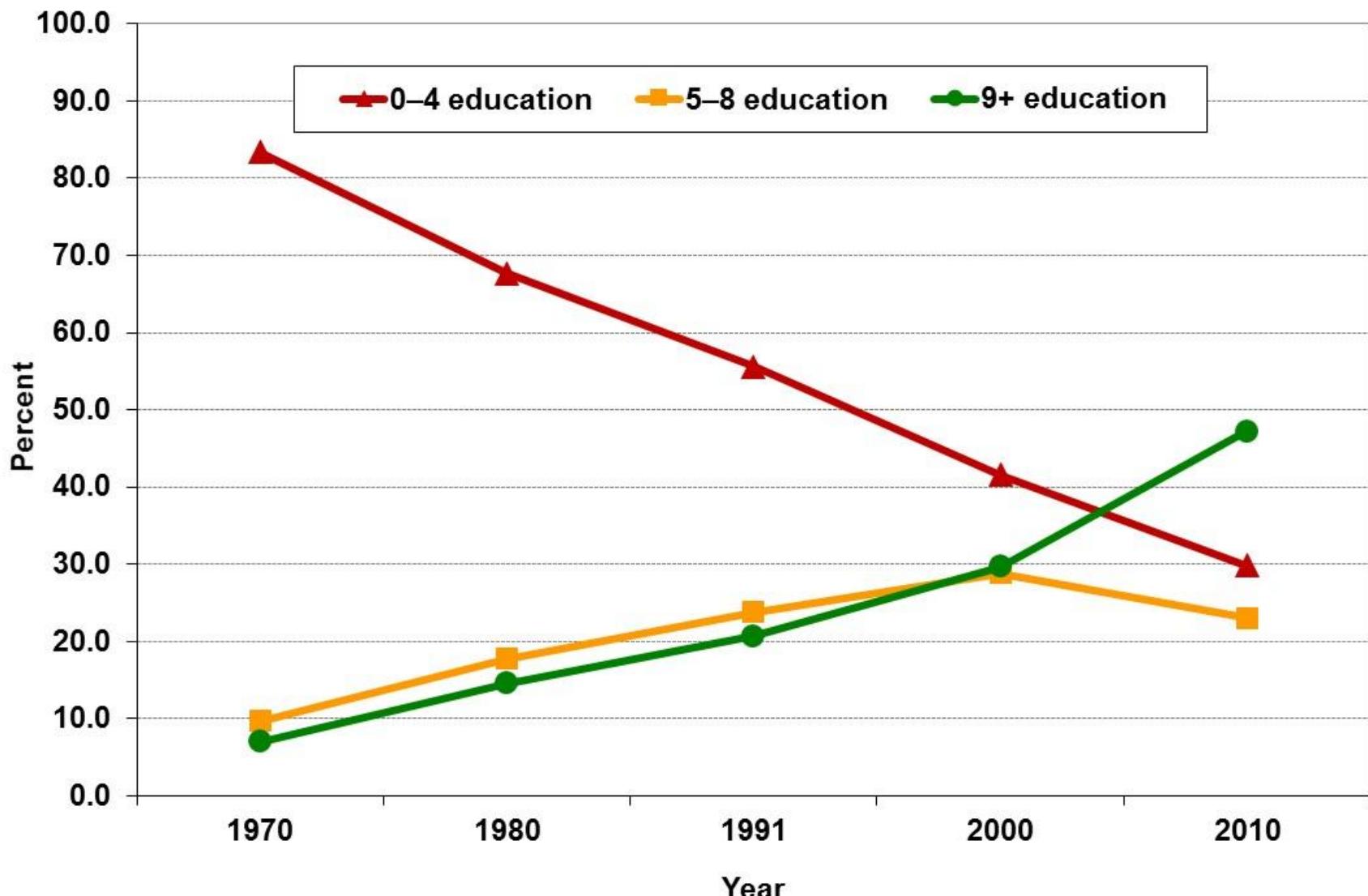
- Total Fertility Rate: 5.8 in 1970; 1.9 in 2010 (IBGE, 2012).
- Educational expansion began late and has a long way to go (Barro and Lee, 2001; Marcílio, 2001, 2005; Rios-Neto and Guimarães, 2010).
- Improvement in educational attainment coincides with decline in family size and school-age children (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



Source: 1970, 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses.

# Educational composition, males, 1970–2010

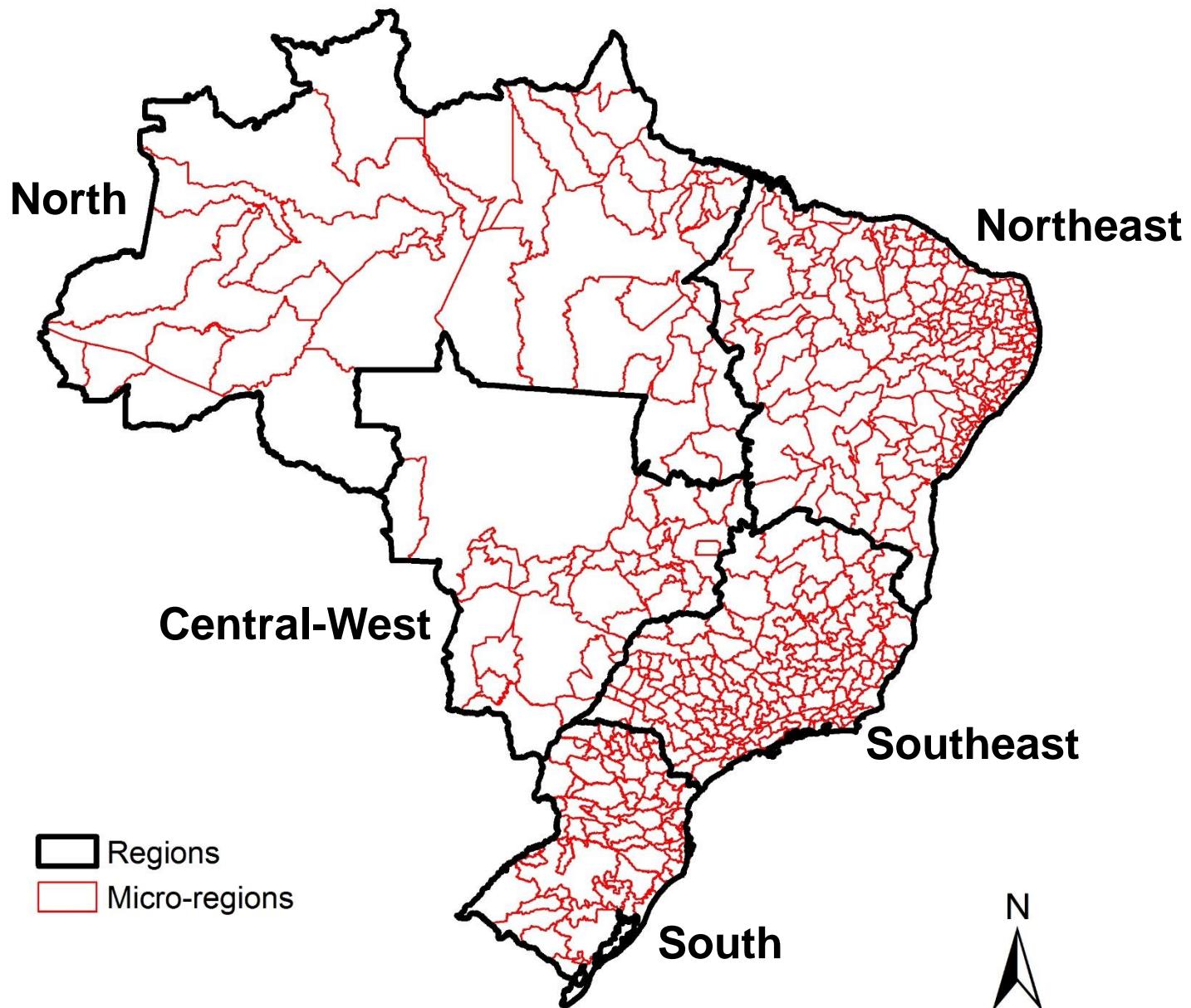


Source: 1970, 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses.

# 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

# Fixed effects models

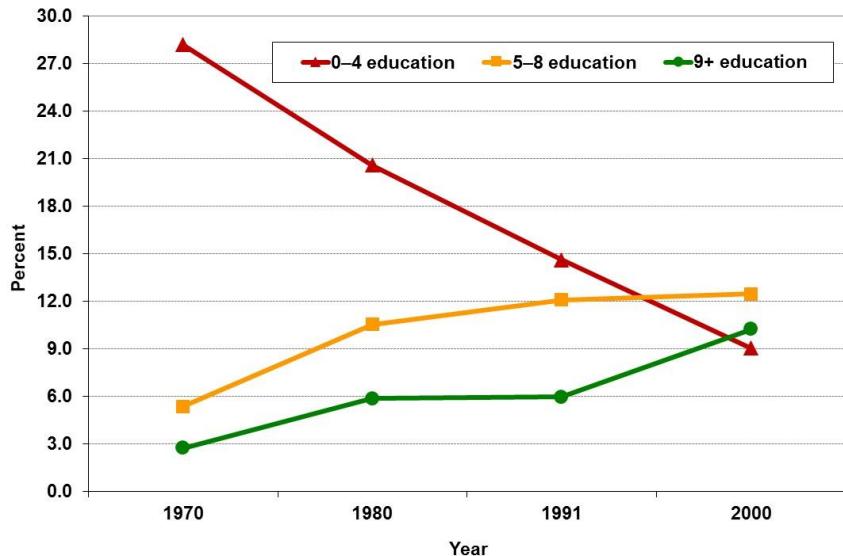
	Baseline model	Composition model
Dependent variable		
Logarithm of the mean real monthly earnings by age-education group, area, and time	$\log(Y_{git})$	$\log(Y_{git})$
Independent variables		
12 age-education indicators * time	$(G_{11} - G_{43}) * \theta_t$	$(G_{11} - G_{43}) * \theta_t$
Distribution of male population into 12 age-education groups * time		$(P_{11} - P_{43}) * \theta_t$
2008 area-time fixed effects	$\alpha_{it}$	$\alpha_{it}$

# Brazilian male working-age population

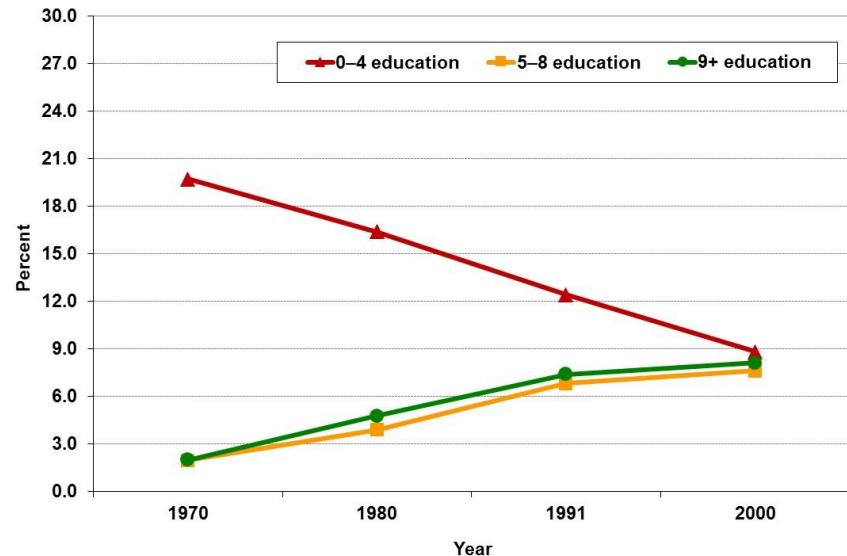
- Main results: published in *Demographic Research* (2013).
- Description of **15–64 year-old males**:
  - Age-education composition, 1970–2000.
  - Proportion with 9+ years of schooling by micro-region, 1970–2000.
  - Mean real monthly earnings in main occupation, 2000.

# Age-education composition, 1970–2000

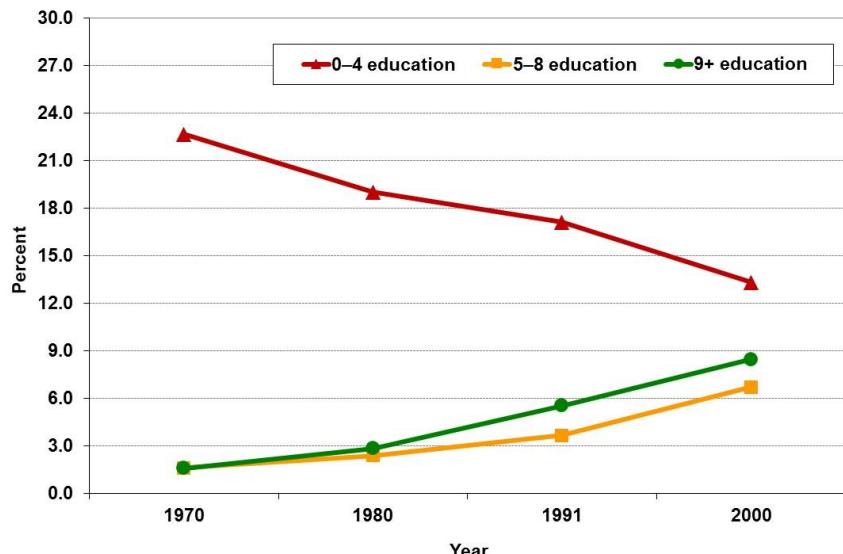
**15–24**



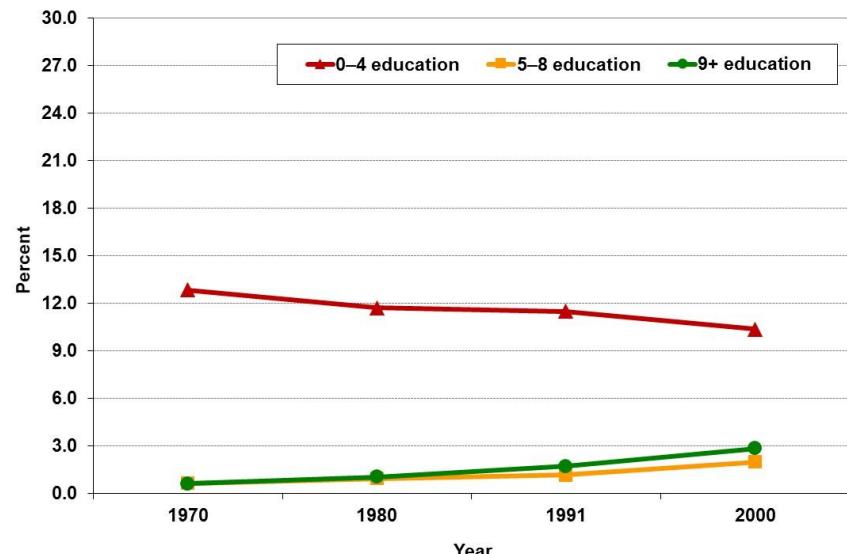
**25–34**



**35–49**

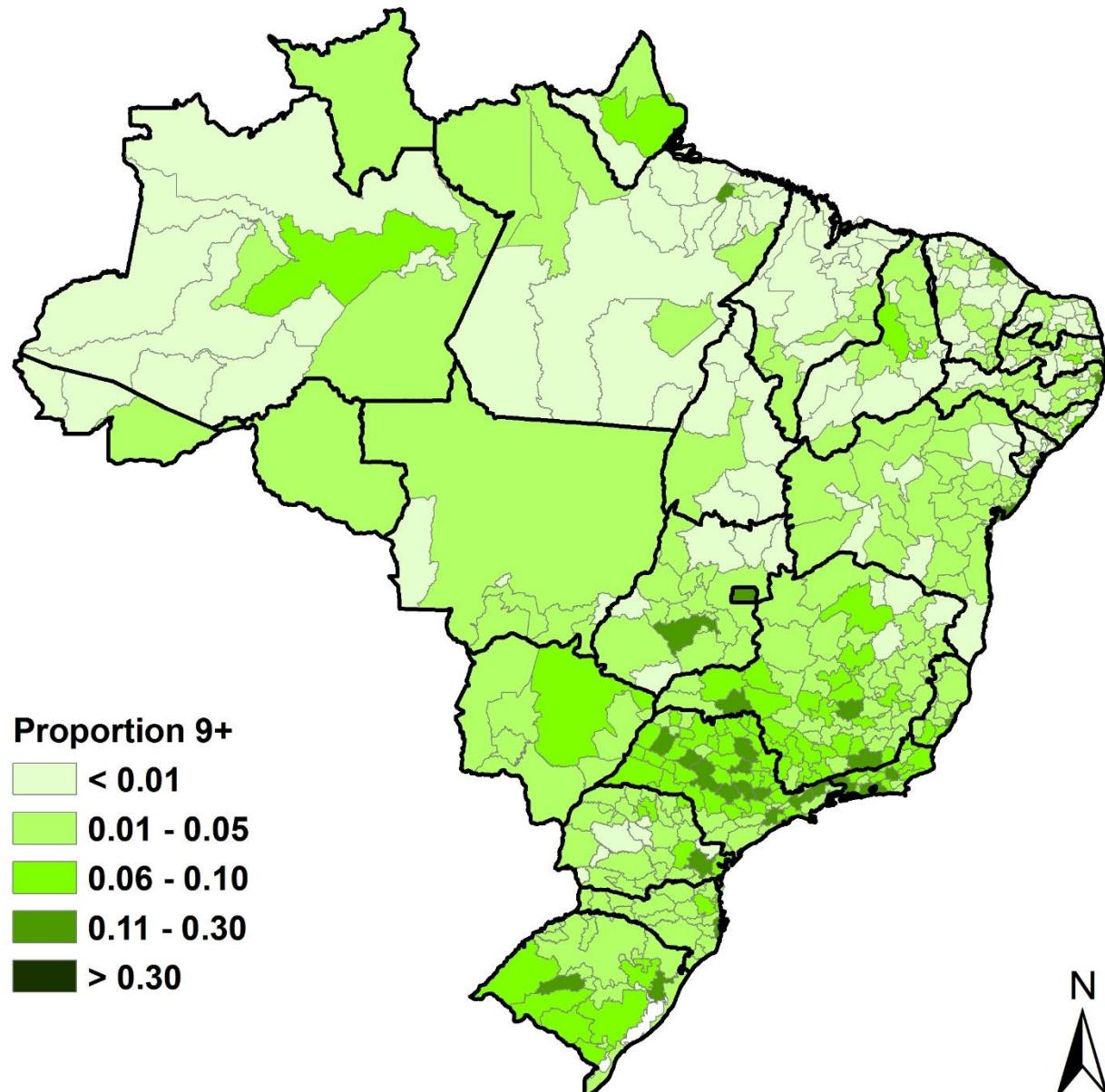


**50–64**

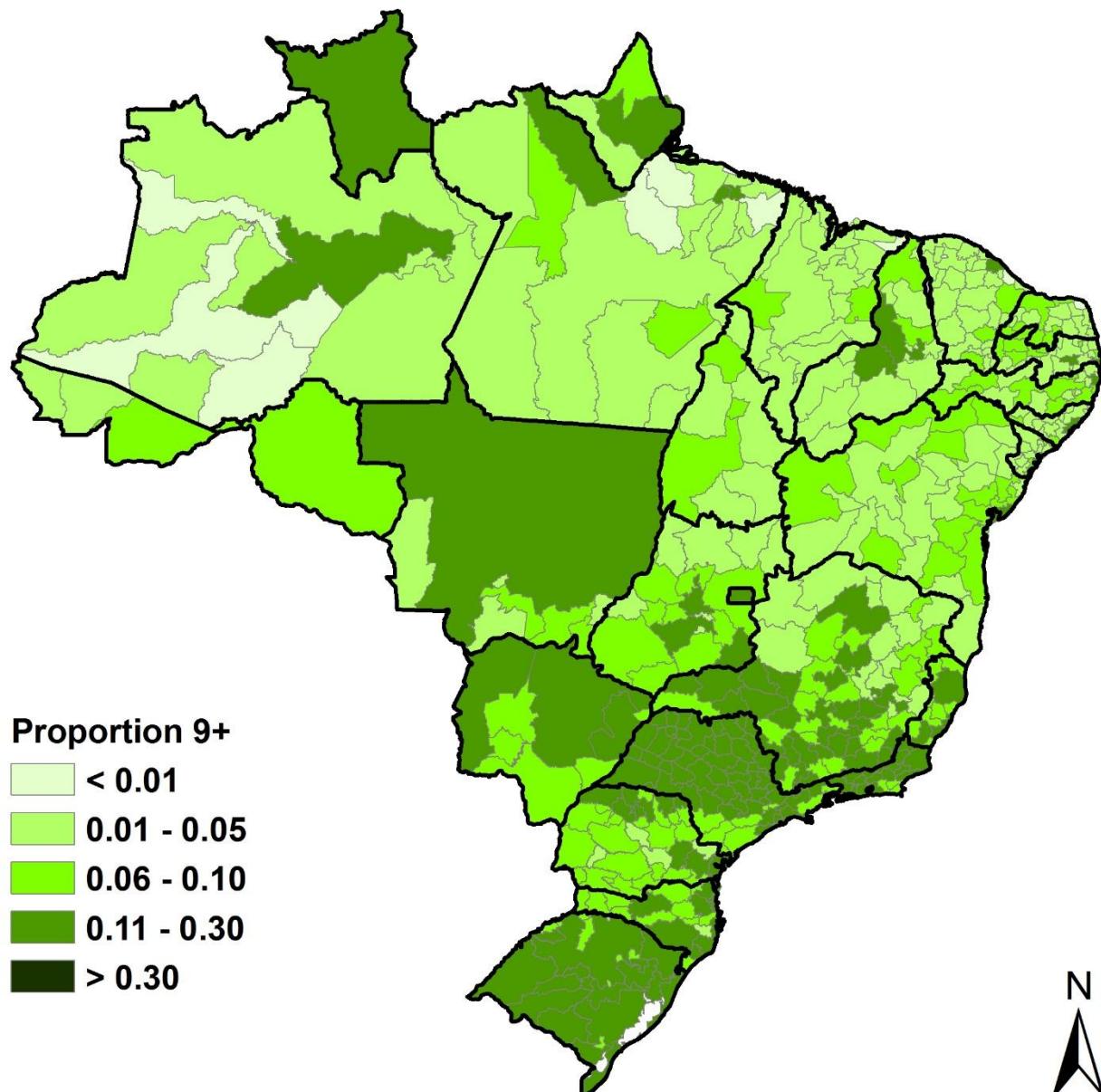


# Proportion with 9+ years of schooling, 1970

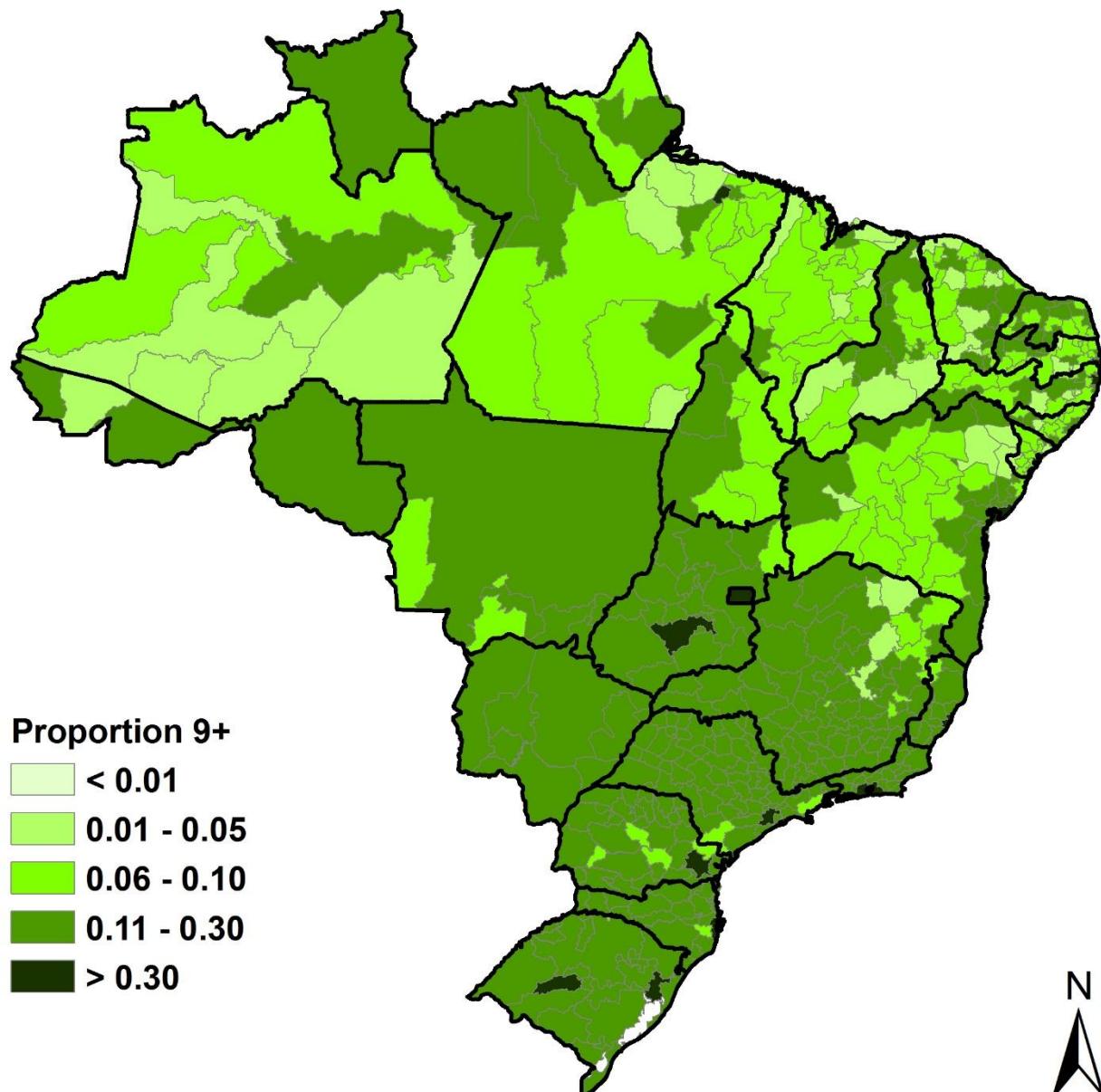
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# Proportion with 9+ years of schooling, 1980

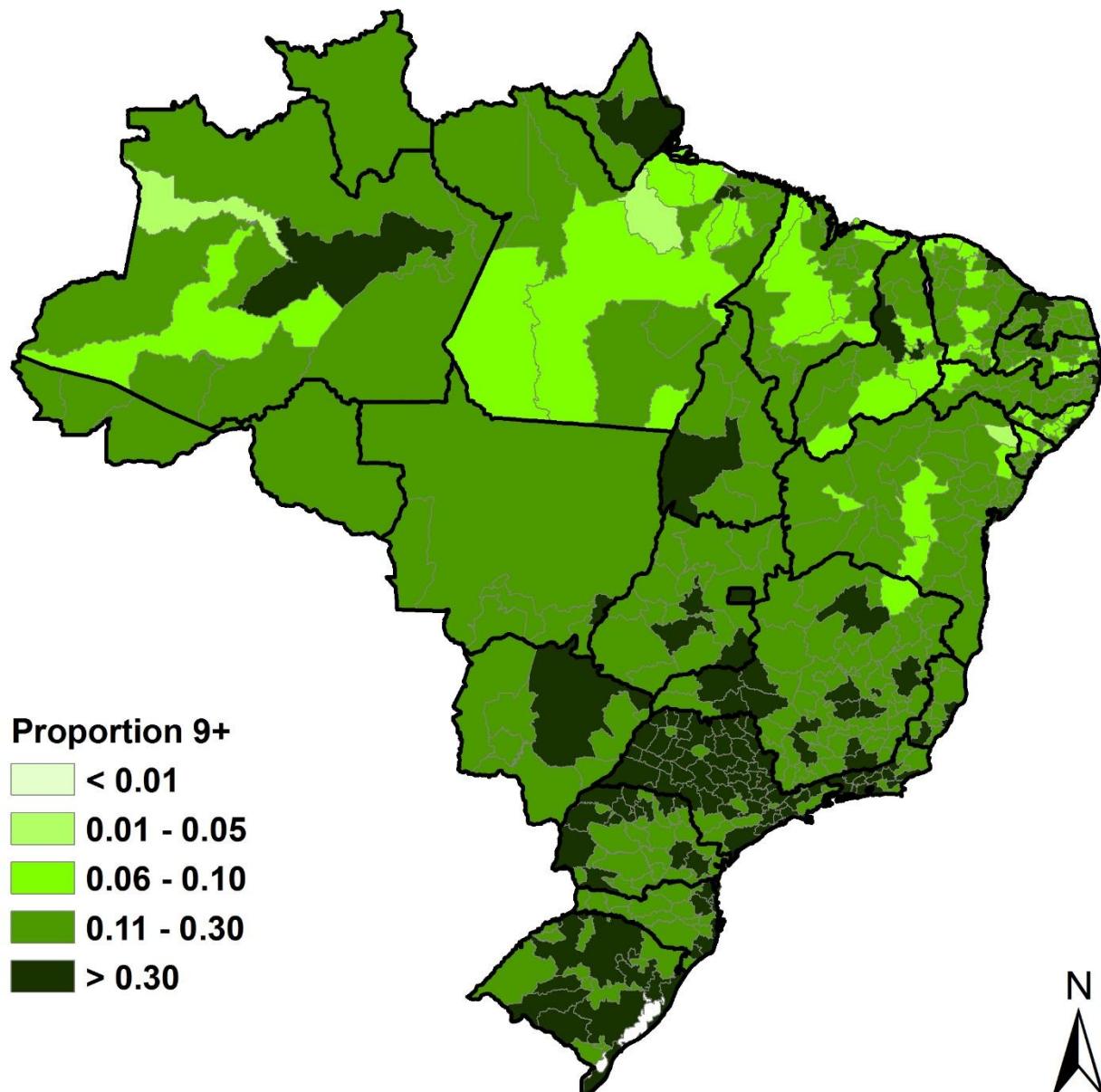


# Proportion with 9+ years of schooling, 1991

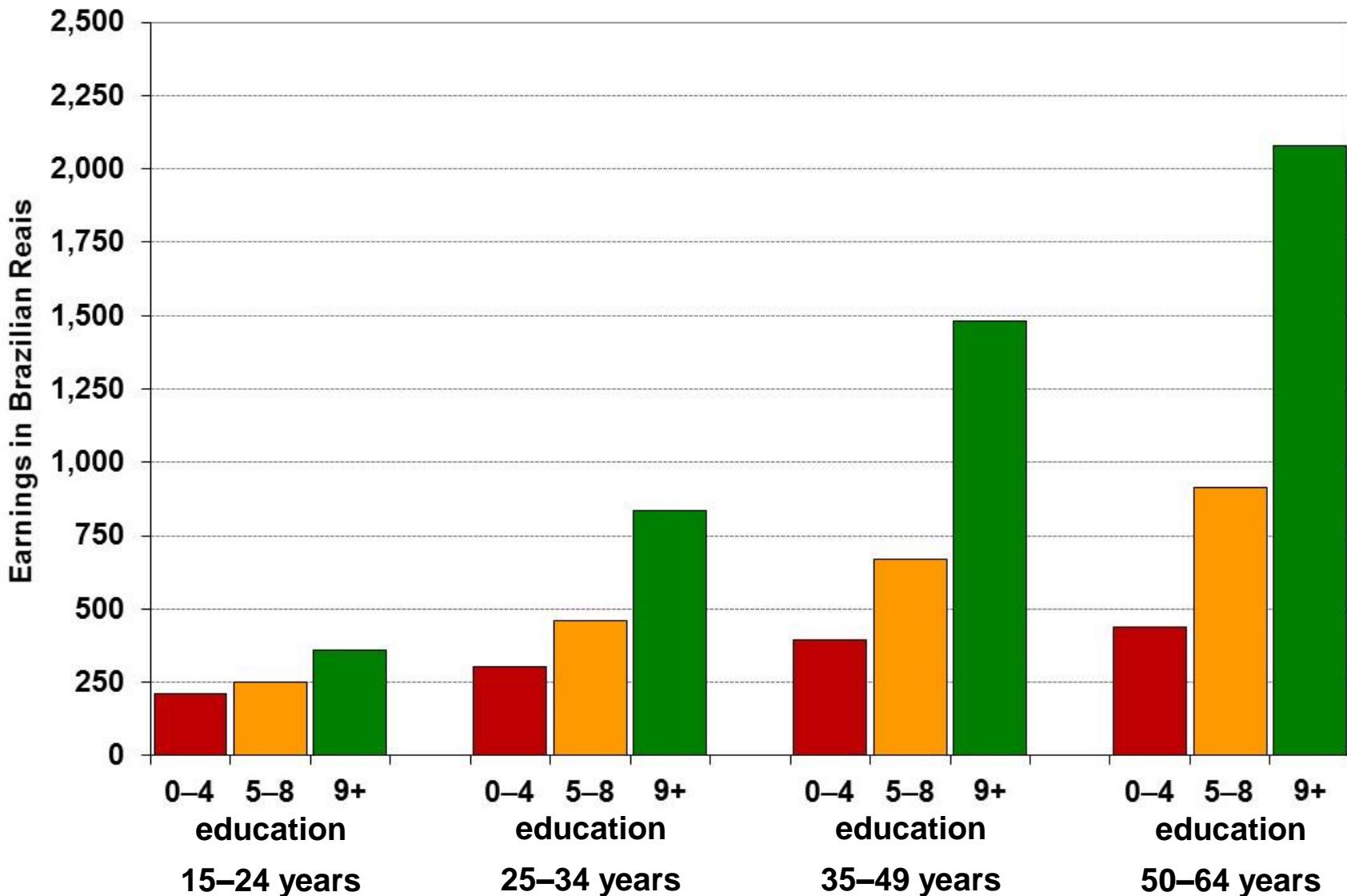


# Proportion with 9+ years of schooling, 2000

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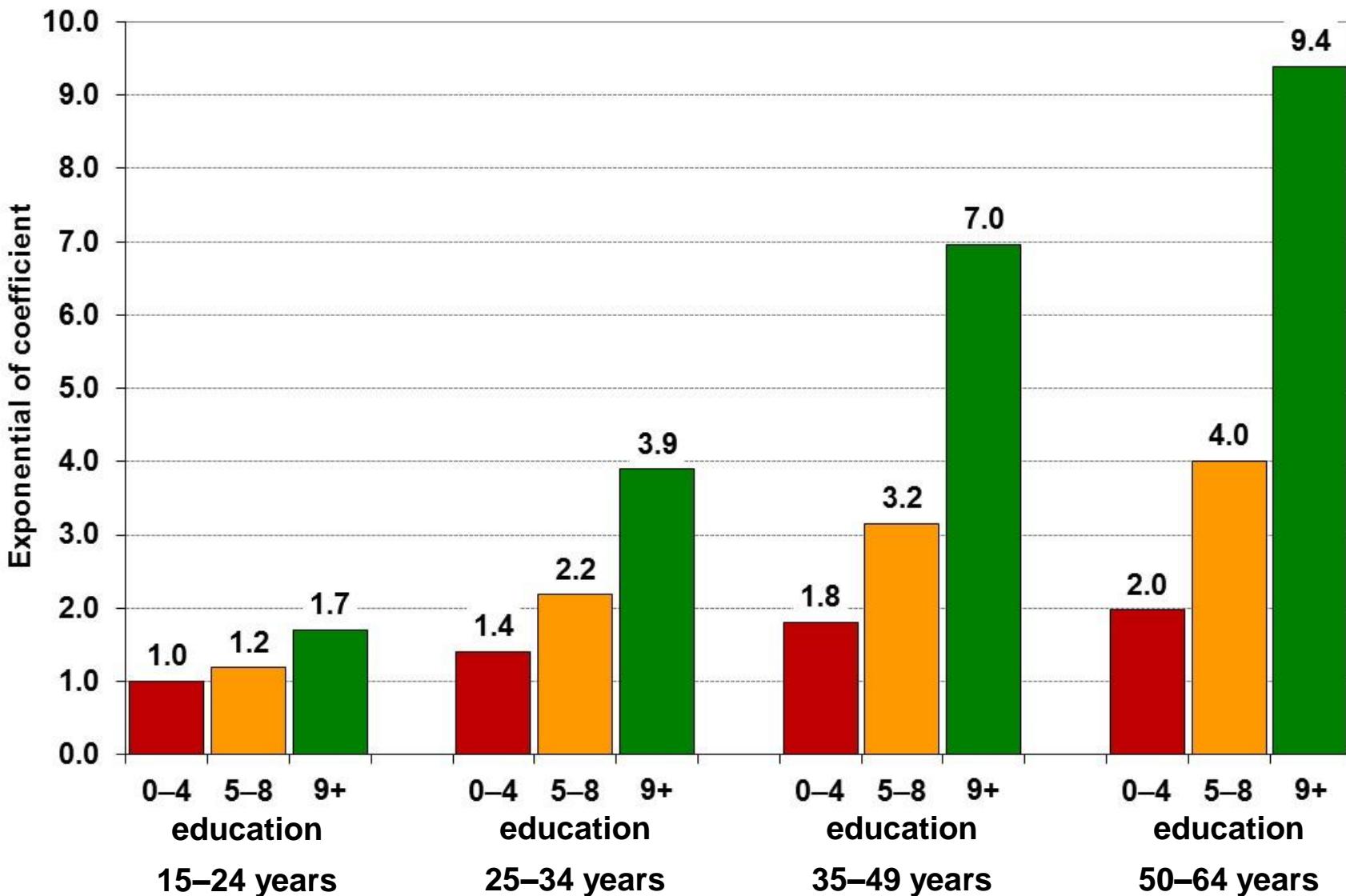
# Mean real monthly earnings in main occupation, 2000



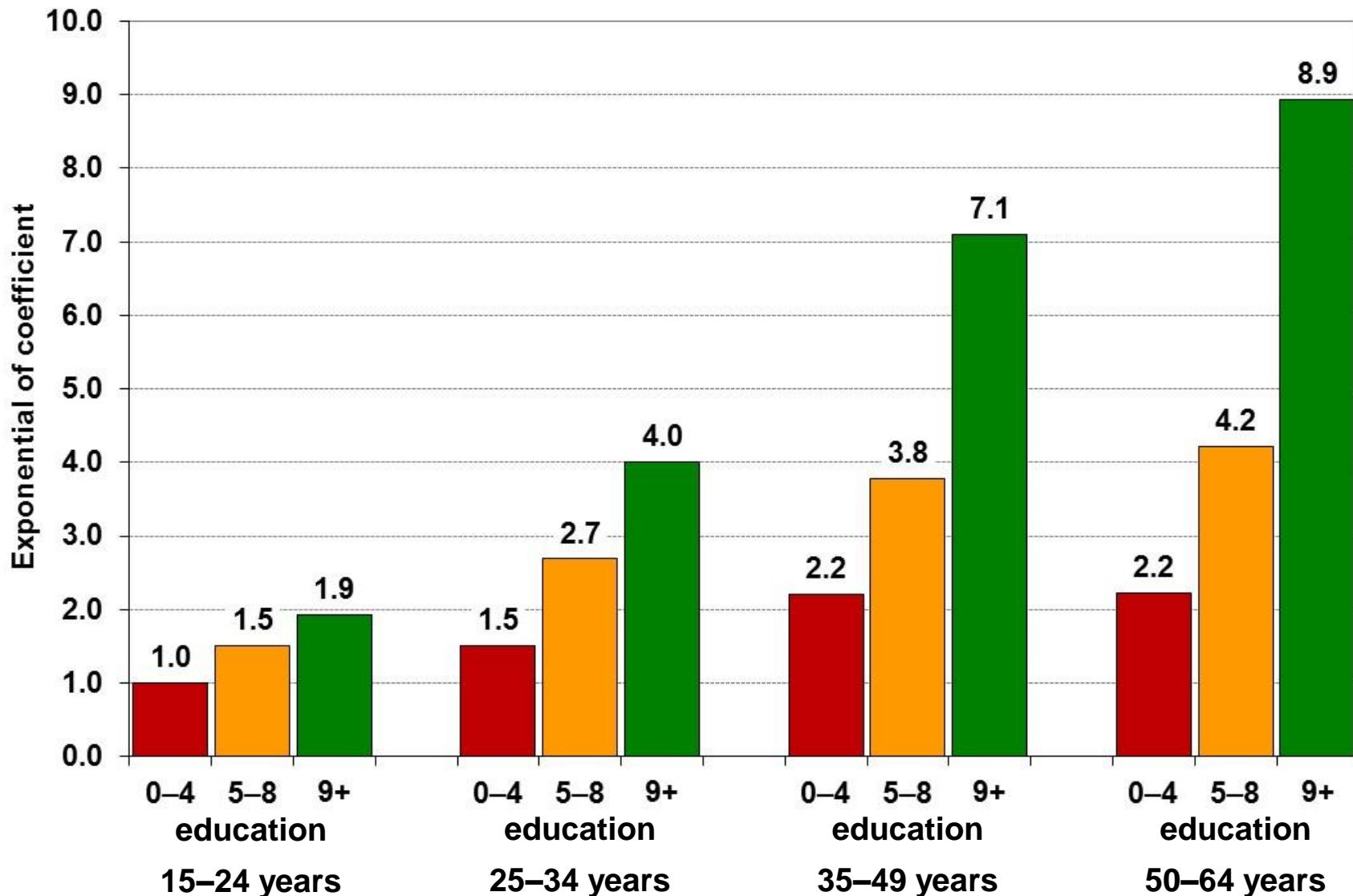
# Estimating the impacts of relative group size on male earnings

- **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 ( $G_{11}$ – $G_{43}$ )<sup>23</sup> on earnings from baseline model, 2000



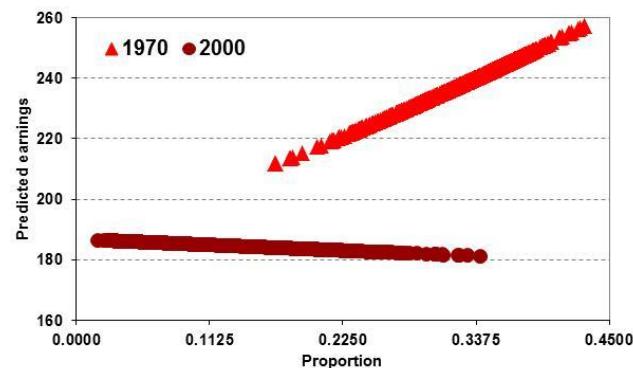
# Effects of age-education indicators ( $G_{11}$ – $G_{43}$ )<sup>24</sup> on earnings from composition model, 2000



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

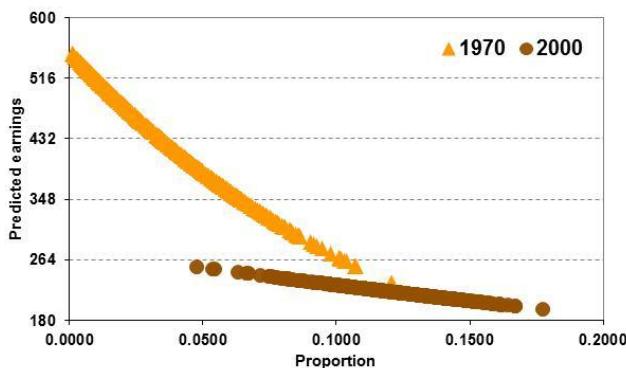
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## 0–4 education

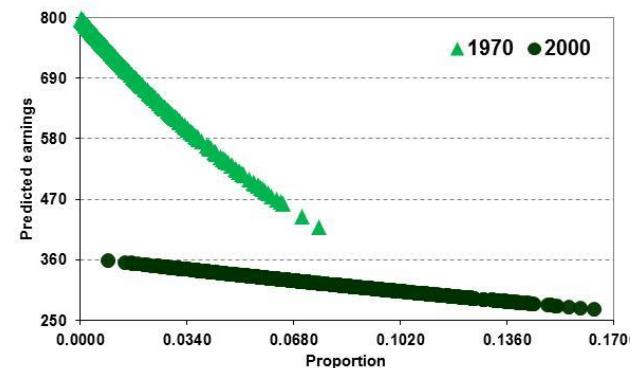


## 15–24 years

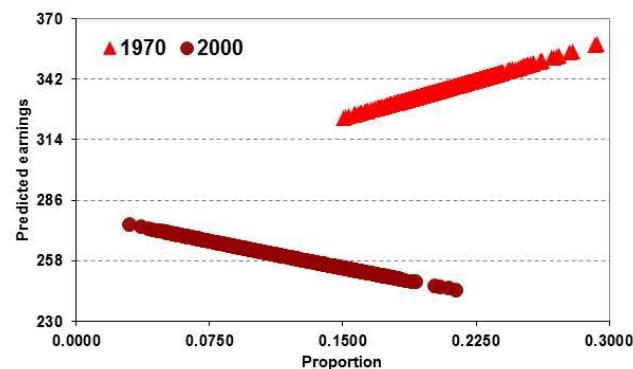
## 5–8 education



## 9+ education

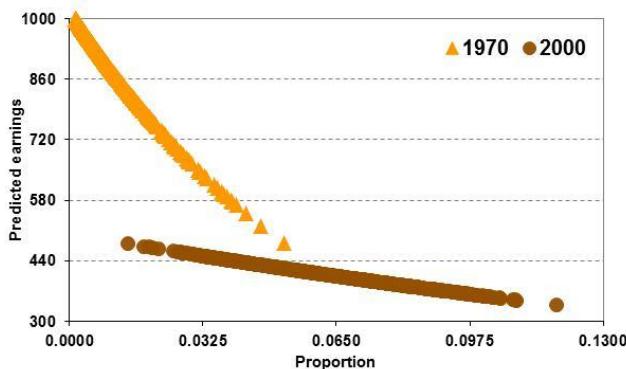


## 0–4 education

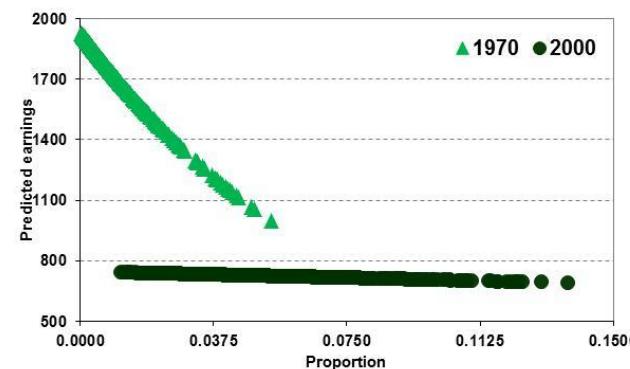


## 25–34 years

## 5–8 education



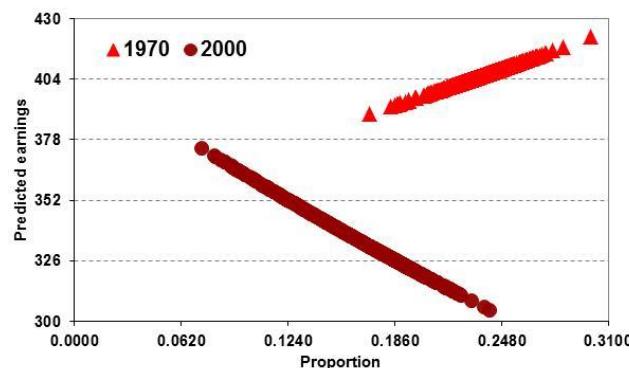
## 9+ education



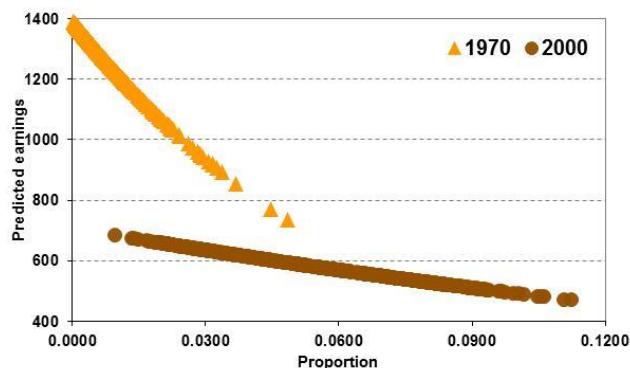
# Effects of group proportions in 502 micro-regions ( $P_{31}$ – $P_{43}$ ) on earnings, 1970 and 2000

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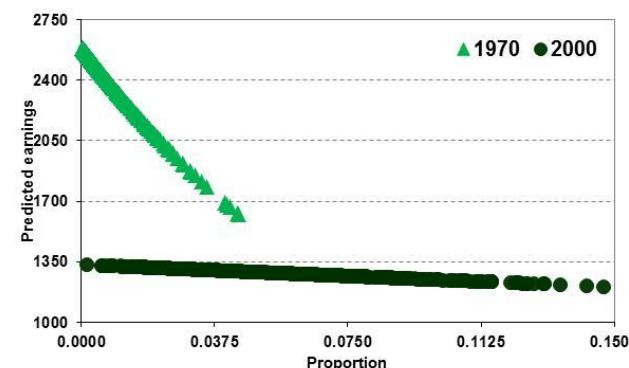
## 0–4 education



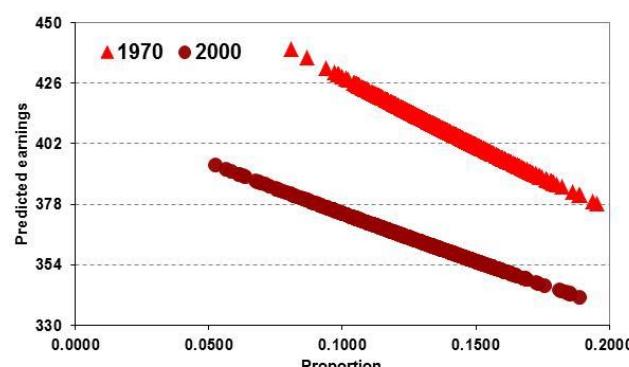
## 35–49 years 5–8 education



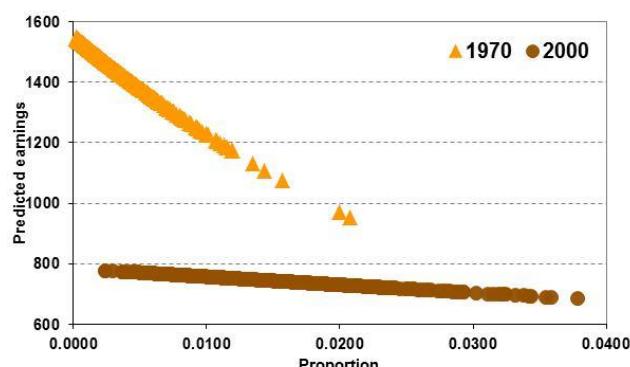
## 9+ education



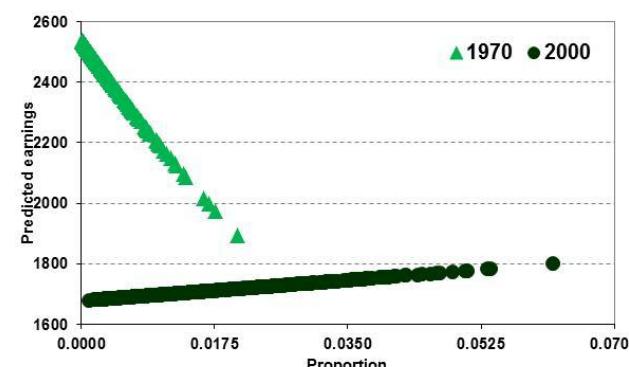
## 0–4 education



## 50–64 years 5–8 education



## 9+ education



# Inter-micro-regional migration

- Need to consider impact of internal migration on earnings.
- Migration generates **spatial-economic equilibrium**.
- **Without migration:**
  - Sending areas would have even lower earnings.
  - Receiving areas would have even higher earnings.
- **Hypothesis:** negative impacts of proportions on earnings would be more negative when controlling for migration.

# Reverse causality

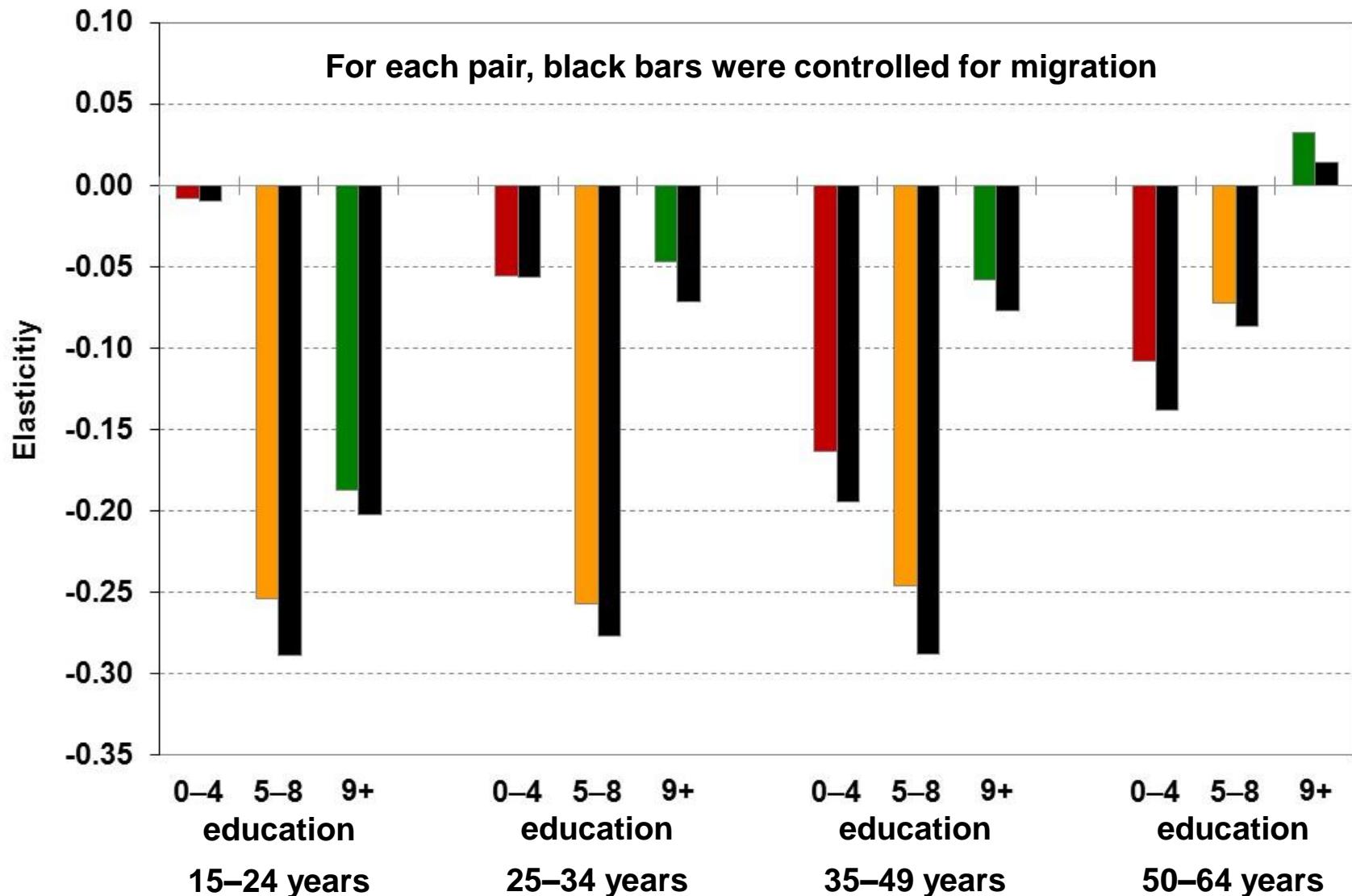
Migration  $\longleftrightarrow$  Earnings

- In-migration increases competition and affects earnings.
- Availability of jobs and income levels influence migration.
- An exogenous measure of migration was estimated.
- Data on municipality of residence five years before the census (1991 and 2000) was used.
- Submitted for publication in ***Space Populations Societies***.

# New results, controlling for migration

- The new exogenous measures of migration were included in the models as independent variables.
- In general, the coefficients of group proportions ( $P_{11}$ – $P_{43}$ ) became more negative than the previous estimates.
- **A strategy was developed to compare previous results with new results:**
  - Coefficients of male proportions in age-education groups were multiplied by the national distribution in 2000.

# Estimated elasticities of proportions in age-education groups ( $P_{11}$ – $P_{43}$ ), 2000



# 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.
- **Control for migration:** influence of cohort size is stronger.
- **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
  - ***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.