DEMOGRAPHIC CHANGE AND ECONOMIC DEVELOPMENT AT THE LOCAL LEVEL IN BRAZIL

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Background: Demographic Dividend

- Long, controversial, but unresolved debate about population growth and economic development.
- Bloom, Williamson, Mason and others find that taking age distribution into account matters.
- Looking at Asian countries through time, they found that economic development was associated with the shift toward lower dependency ratio.
- The same demographic shifts that took place in Asia are now taking place in Latin America, and in Brazil in particular.

Modeling Strategies

- We could look at three different sets of outcomes:
  - Enrollment in school or university.
  - Aggregate measures of income per capita.
  - Labor force outcomes including employment in the formal or informal sector and **wage earnings**.

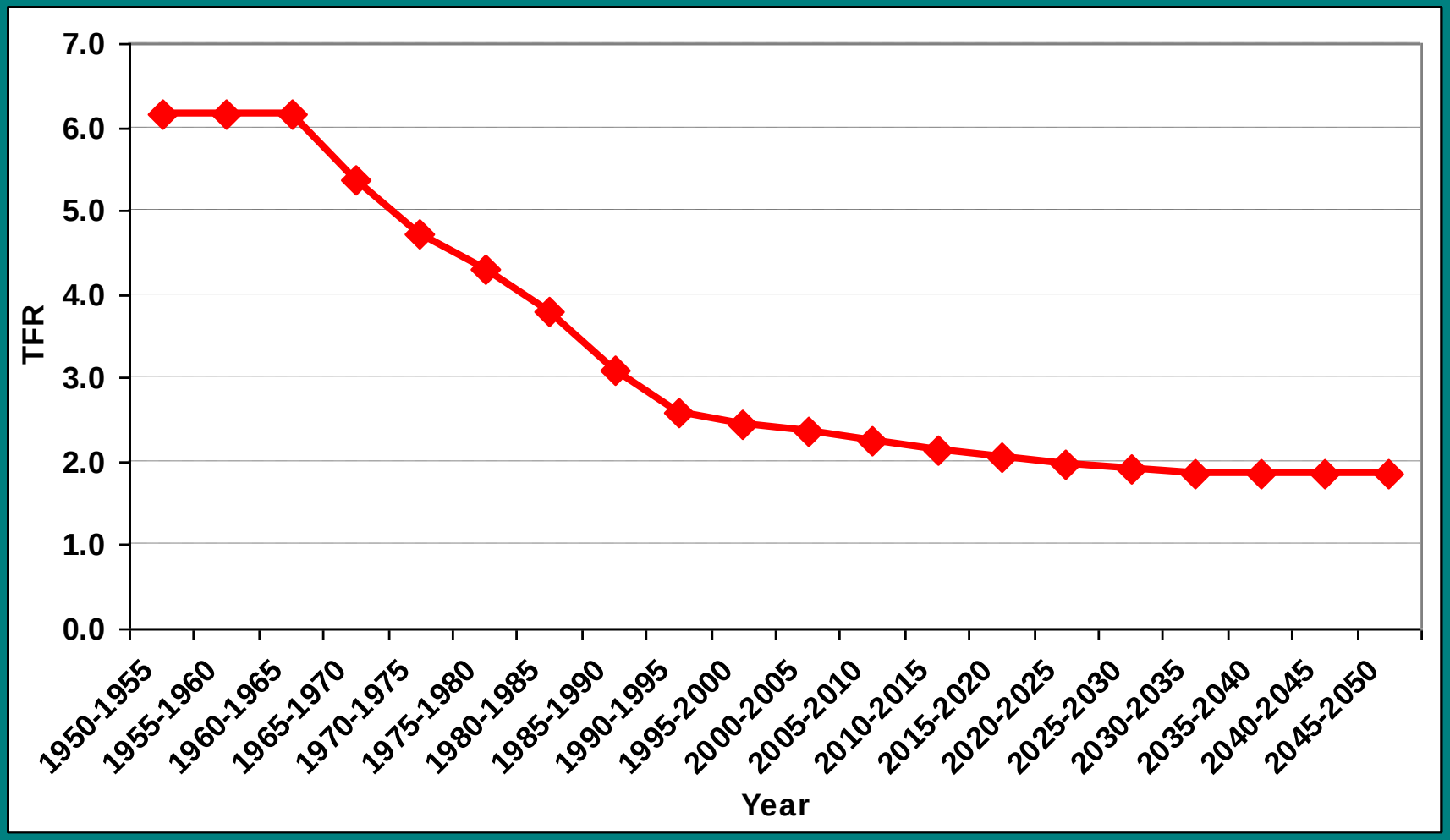
“Baby Boom” and Labor Market

- Cohorts born during the “baby boom” entered the American labor market between the end of the 1960s and the middle of the 1970s.
- Freeman (1979) indicated that the increase of younger workers decreased the income of this group comparing to the older workers.
- Welch (1979) concluded that there was a greater decrease in the income of workers with higher education and at the beginning of their career.
- Triest, Sapozhnikov and Sass (2006) show that changes in the age-education composition of the labor force will continue to influence the income structure.
- For Brazil and Mexico, Daniel Hamermesh proposed models to estimate the impact of changing age-education composition in the income of workers.

Demographic and Educational Transitions in Brazil

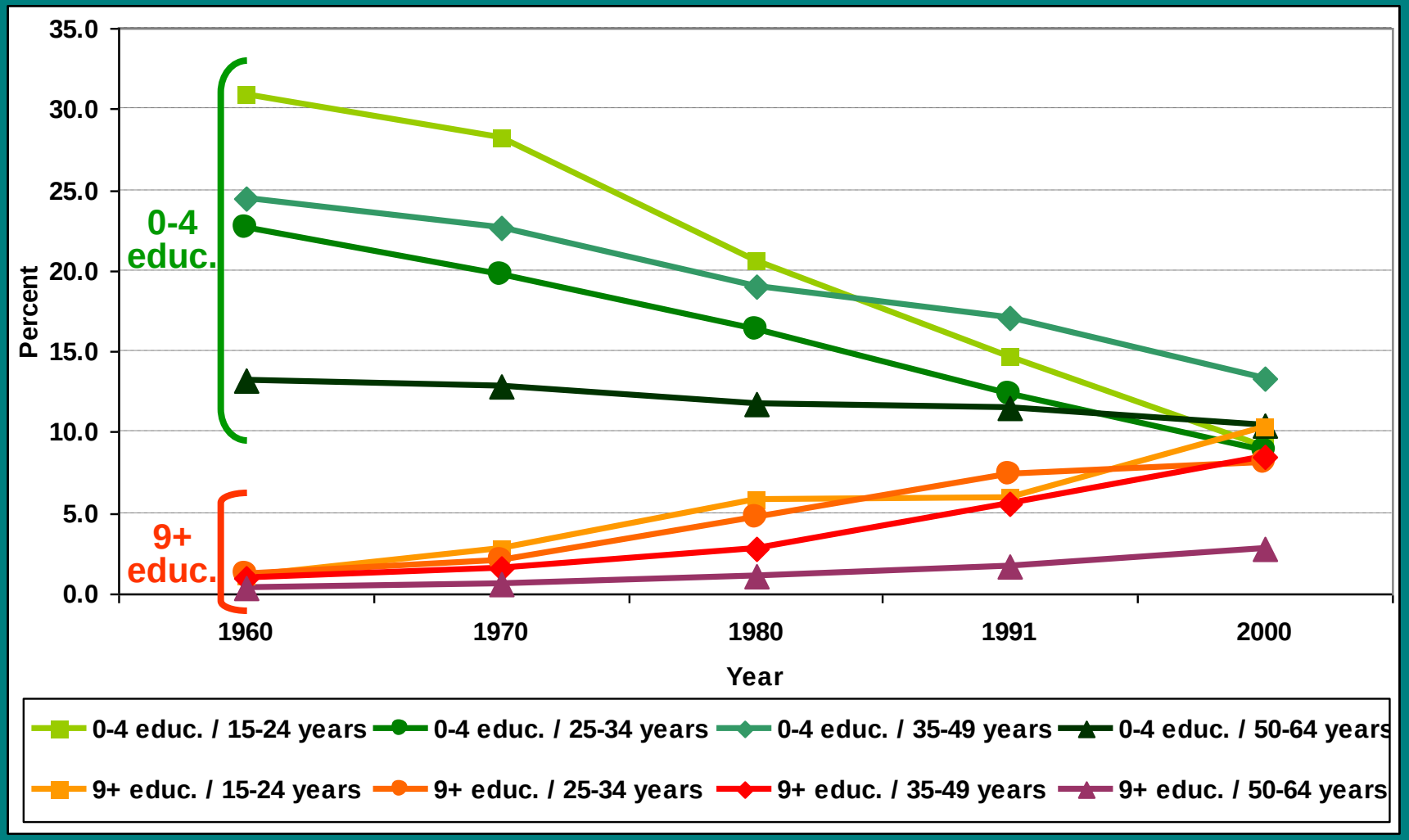
- Since the 1960s Brazilian fertility has declined sharply, with a consequent reduction of the population growth rate, as well as a change in age structure through time.
- Differences in the timing and speed of the fertility transition led to substantial differences in age distribution across states and municipalities at different points in time.
- During the same period, enrollment in primary and secondary schools increased substantially from very low levels, but with much regional variation.

Total Fertility Rate in Brazil, 1950-2050



Source: United Nations - http://esa.un.org/unpp (in August 16, 2006 - medium variant).

Percent of Male Population by Year and Age-Education Groups in Brazil, 1960-2000



Source: 1960-2000 Brazilian Censuses.

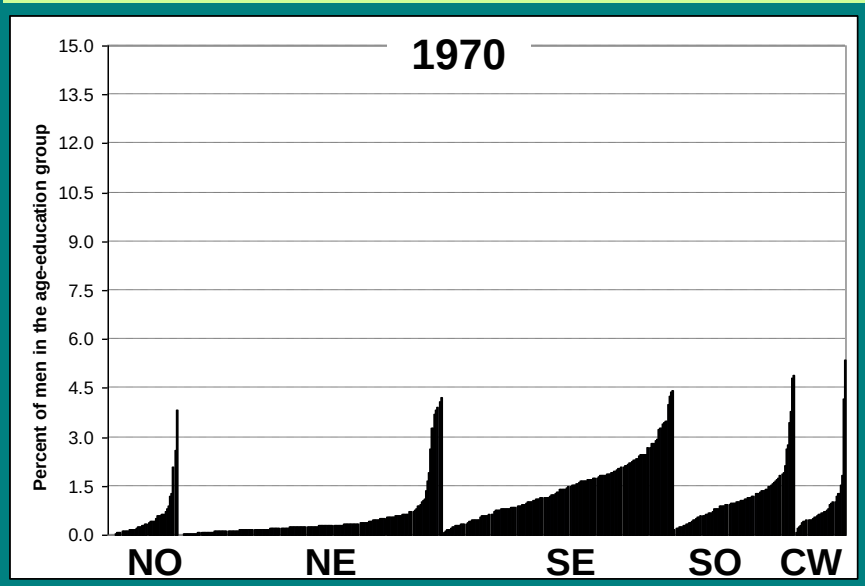
Data

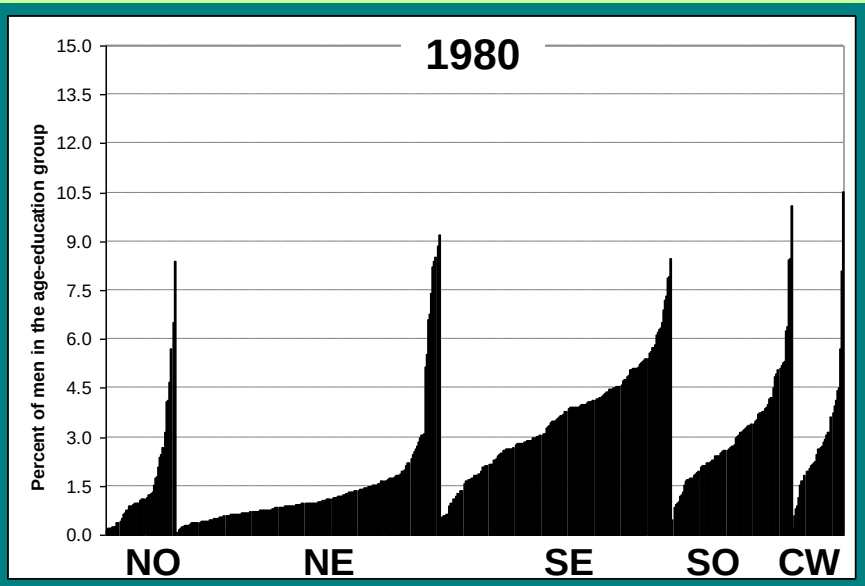
- Microdata from the 1960-2000 Brazilian Censuses.
- Census long forms are available for 25% (1960-1980) and 10% or 20% (1991-2000) of households.
- Long forms contain information on age, sex, education, occupation, income, and migration.
- Municipalities are aggregated to the microregion level, yielding 502 comparable areas across the five censuses.

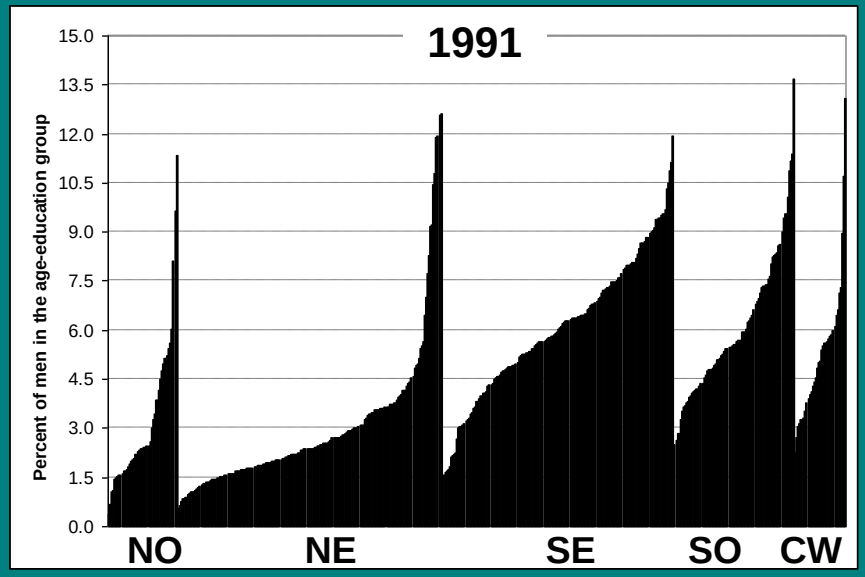
Categories

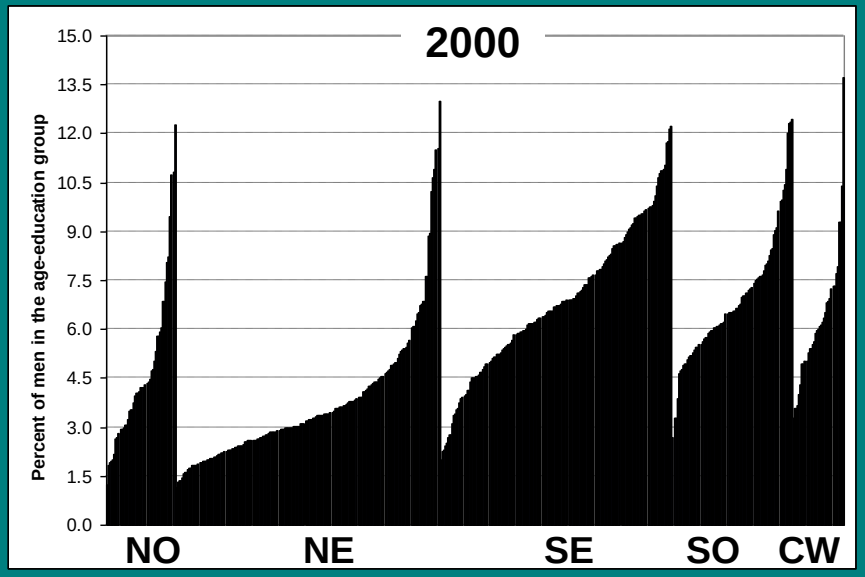
- Time refers to 1970, 1980, 1991, and 2000.
- Age is categorized in four groups:
  - Youth population (15-24).
  - Young adults (25-34).
  - Adults (35-49).
  - Mature adults (50-64).
- Education attainment was classified in three groups:
  - Illiterate people (0) and people in the first phase of elementary school (1-4).
  - Second phase of elementary school (5-8).
  - Secondary school (9-11) and some college (12+).

Percent of Men with 25-34 Years of Age and 9+ Years of Schooling in Brazilian Microregions, 1970-2000 Censuses

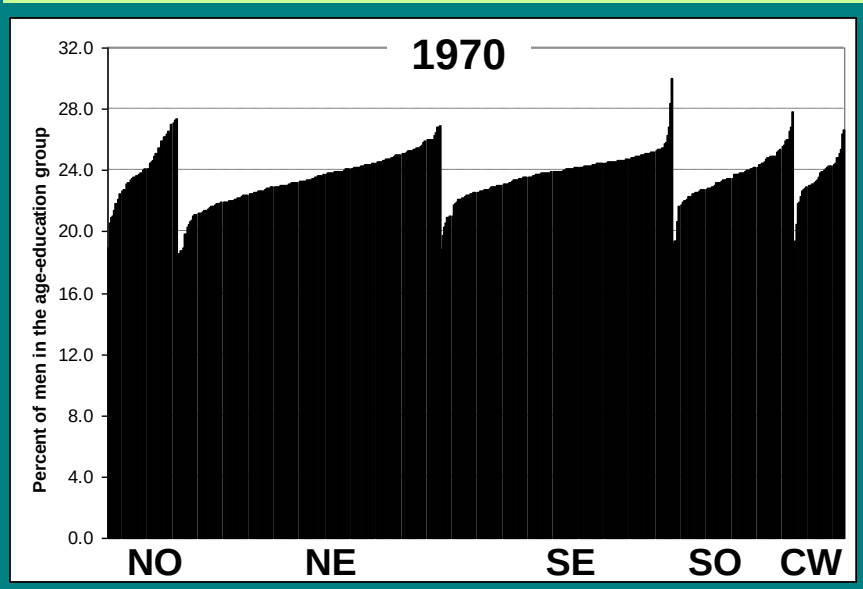


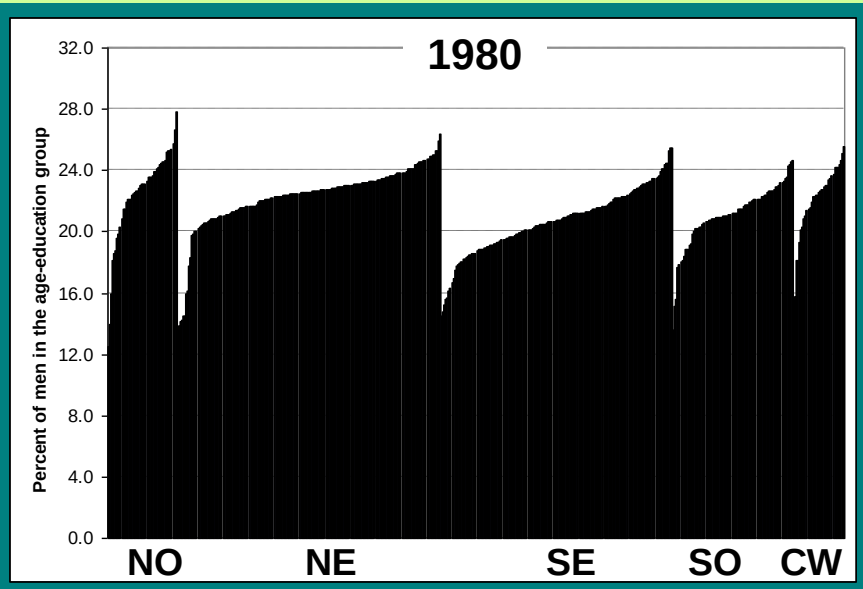


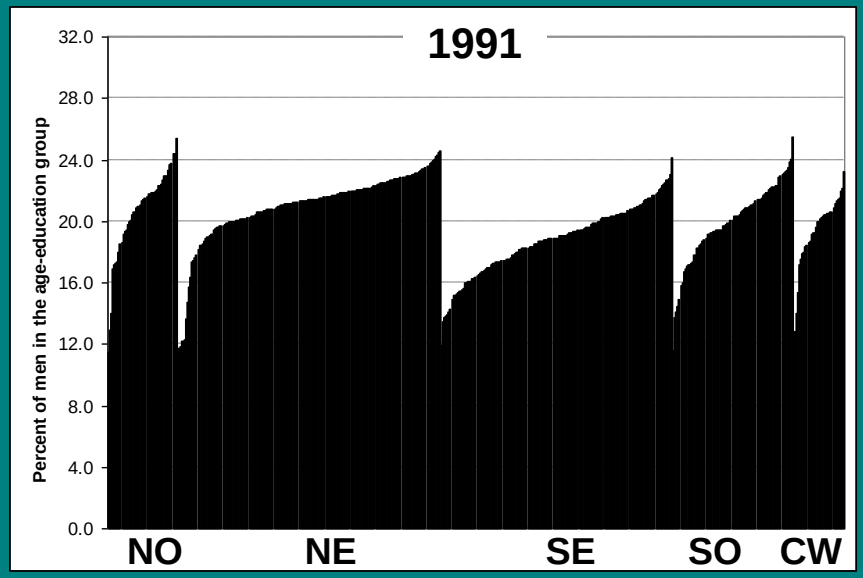


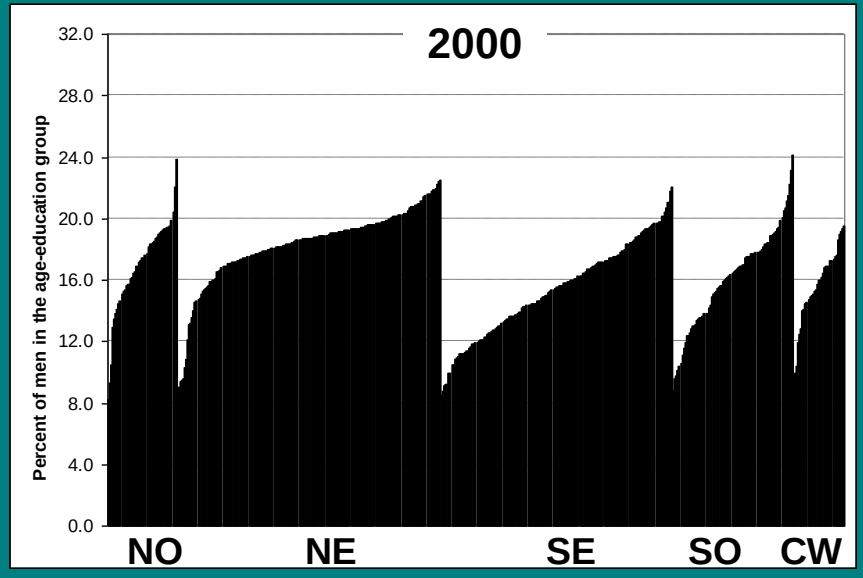


Percent of Men with 35-49 Years of Age and 0-4 Years of Schooling in Brazilian Microregions, 1970-2000 Censuses



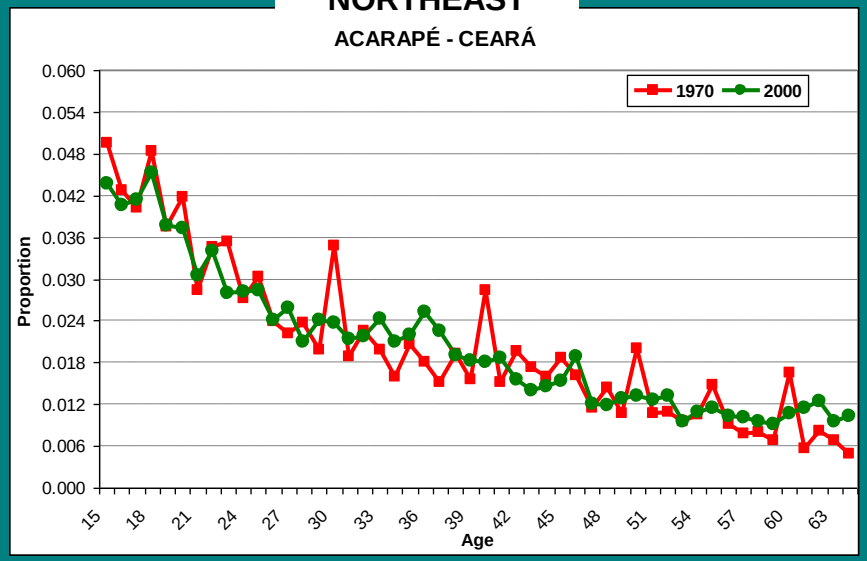




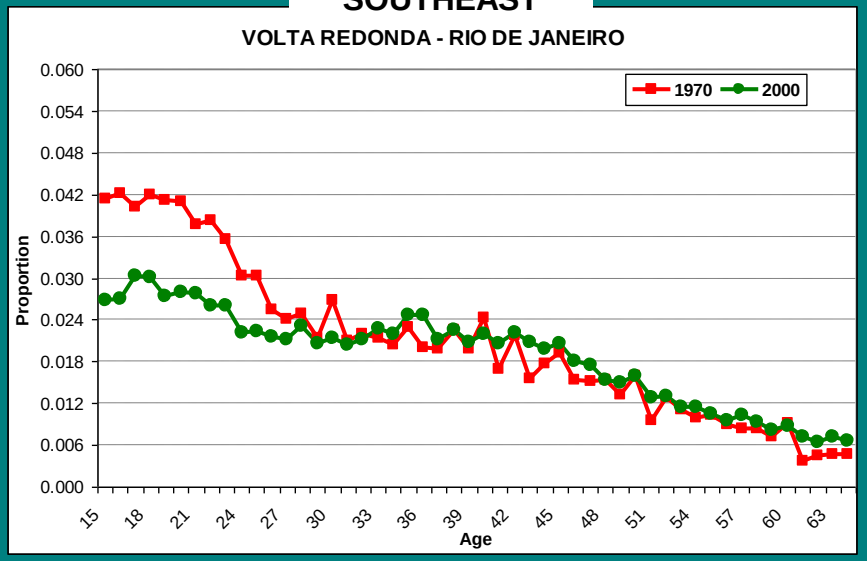


Changes in the Male Age Distribution in Selected Brazilian Microregions, 1970 and 2000 Censuses

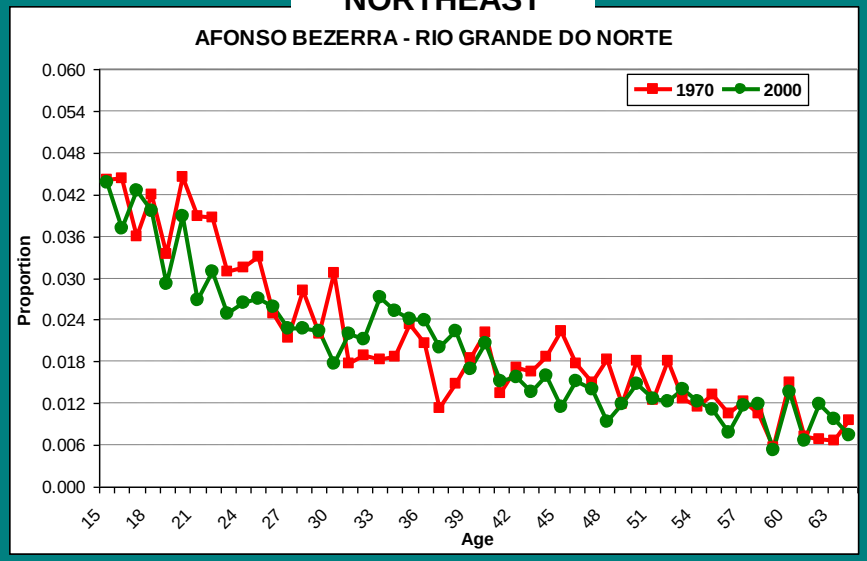
NORTHEAST



SOUTHEAST



NORTHEAST



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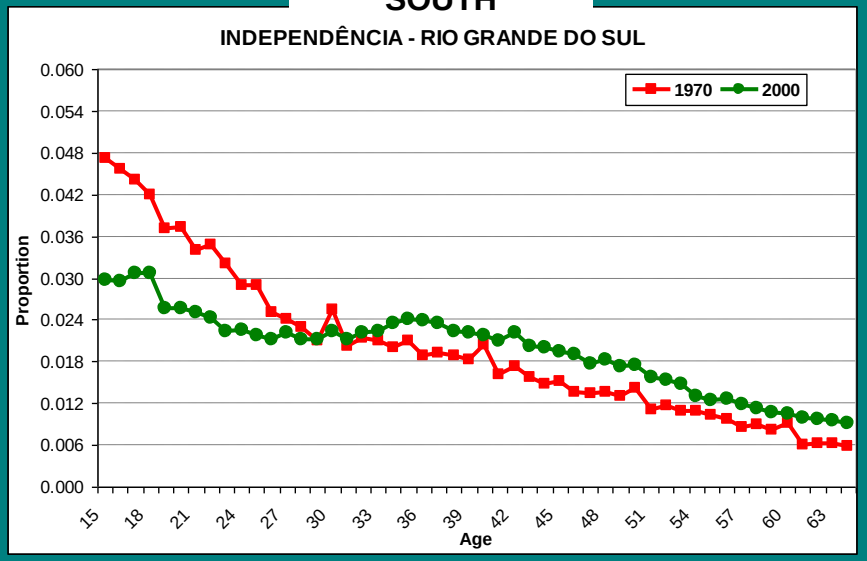
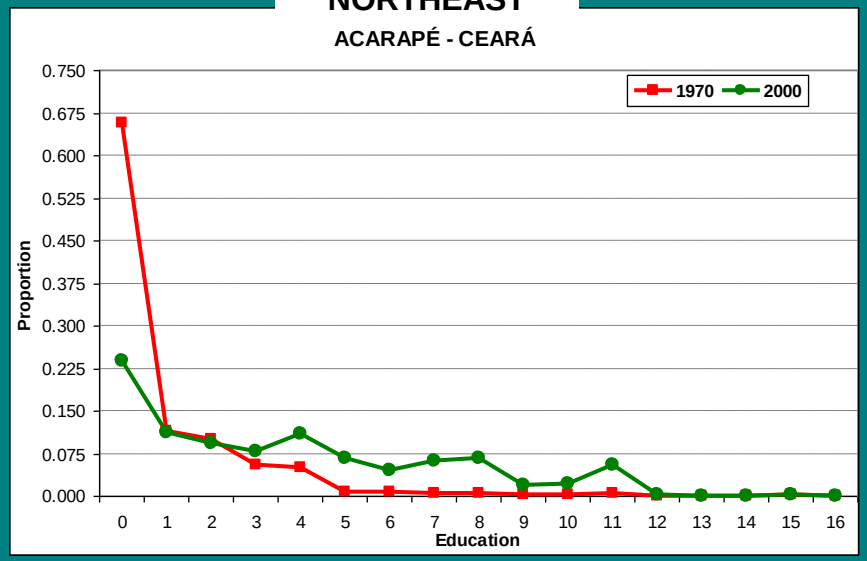


Changes in the Male Education Distribution in Selected Brazilian Microregions, 1970 and 2000 Censuses

NORTHEAST



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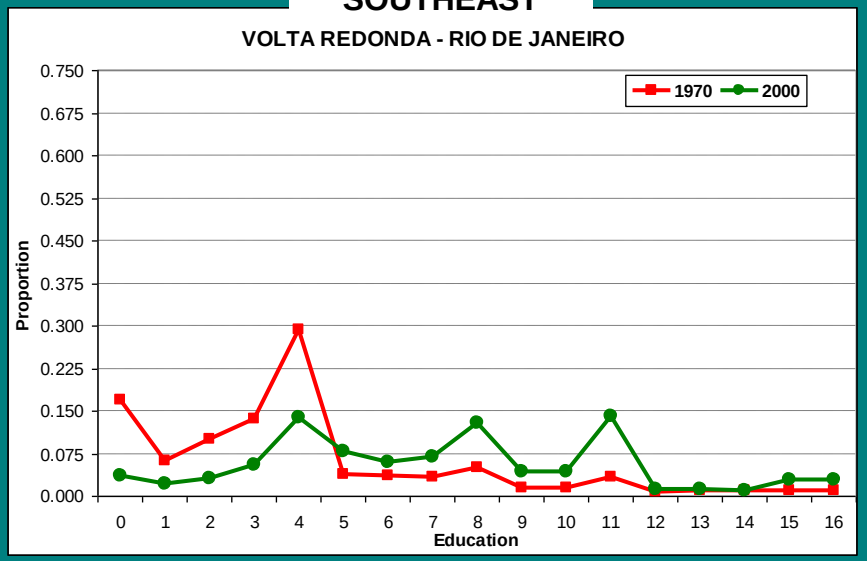

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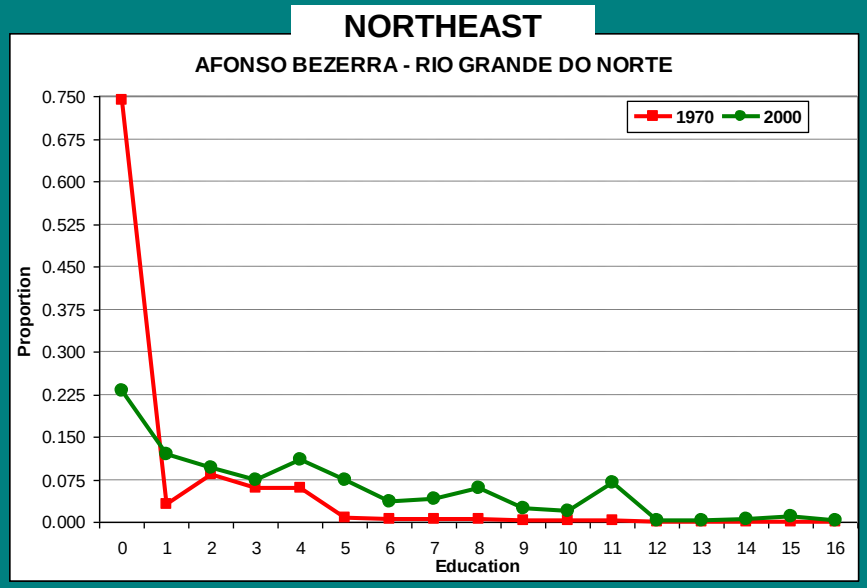

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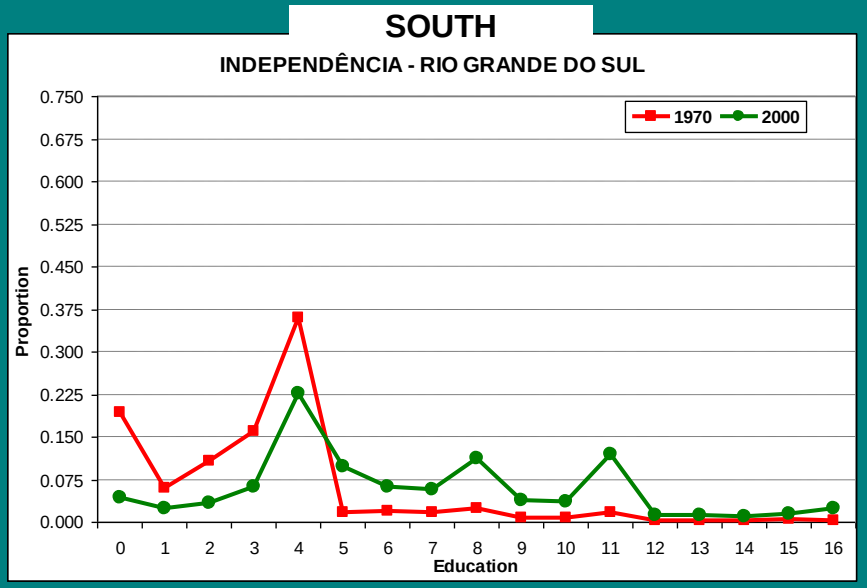


Estimation of Models

- Fixed-effects models allow the estimation of coefficients that reflect relationships within microregions over time on labor outcomes.
- We start with the logarithm of the mean nominal income in a group.
- Areas with less than 25 people receiving income were not included in the regression.
- For now, results were generated without weights.
- Regressions only include males.

Equation 1

- **EQUATION 1:** within each area (i), at each time (t), we have averages of income predicted by the proportion of people for each one of the age-education cells (c). Giving 12 regressions of the following form:

$$W_{itc} = \beta_0 + \beta_1 X_{itc} + \upsilon_i + \theta_t + \varepsilon_{itc}, \quad i = 1 \ldots K; \; t = 1 \ldots T$$

- **POOLED OF EQUATION 1:** one single regression, including 3 dummies for year, 11 dummies for age-education groups, and 12 proportions of people in each one of the age-education groups.
- See how the data looks in the following slide...

Equation 1 (x)
Pooled of Equation 1 (x11-x43)

	kreise6~2000	group	year	x	x11	x12	x13	x21	x22	x23	x31	x32	x33	x41	x42
1	110006	11	1970	.2906697	.2906697	0	0	0	0	0	0	0	0	0	0
2	110006	12	1970	.040875	0	.040875	0	0	0	0	0	0	0	0	0
3	110006	13	1970	.0078876	0	0	.0078876	0	0	0	0	0	0	0	0
4	110006	21	1970	.2199742	0	0	0	.2199742	0	0	0	0	0	0	0
5	110006	22	1970	.0213758	0	0	0	0	.0213758	0	0	0	0	0	0
6	110006	23	1970	.0120807	0	0	0	0	0	.0120807	0	0	0	0	0
7	110006	31	1970	.2638107	0	0	0	0	0	0	.2638107	0	0	0	0
8	110006	32	1970	.0177399	0	0	0	0	0	0	0	.0177399	0	0	0
9	110006	33	1970	.0087087	0	0	0	0	0	0	0	0	.0087087	0	0
10	110006	41	1970	.1083744	0	0	0	0	0	0	0	0	0	.1083744	0
11	110006	42	1970	.0056592	0	0	0	0	0	0	0	0	0	0	.0056592
12	110006	43	1970	.0028442	0	0	0	0	0	0	0	0	0	0	0
13	110006	11	1980	.2805105	.2805105	0	0	0	0	0	0	0	0	0	0
14	110006	12	1980	.0814266	0	.0814266	0	0	0	0	0	0	0	0	0
15	110006	13	1980	.0208811	0	0	.0208811	0	0	0	0	0	0	0	0
16	110006	21	1980	.201793	0	0	0	.201793	0	0	0	0	0	0	0
17	110006	22	1980	.0356043	0	0	0	0	.0356043	0	0	0	0	0	0
18	110006	23	1980	.0267598	0	0	0	0	0	.0267598	0	0	0	0	0
19	110006	31	1980	.2087358	0	0	0	0	0	0	.2087358	0	0	0	0
20	110006	32	1980	.0160514	0	0	0	0	0	0	0	.0160514	0	0	0
21	110006	33	1980	.0106481	0	0	0	0	0	0	0	0	.0106481	0	0
22	110006	41	1980	.1100731	0	0	0	0	0	0	0	0	0	.1100731	0
23	110006	42	1980	.005275	0	0	0	0	0	0	0	0	0	0	.005275
24	110006	43	1980	.0022413	0	0	0	0	0	0	0	0	0	0	0
25	110006	11	1991	.1942821	.1942821	0	0	0	0	0	0	0	0	0	0
26	110006	12	1991	.1235172	0	.1235172	0	0	0	0	0	0	0	0	0
27	110006	13	1991	.0357523	0	0	.0357523	0	0	0	0	0	0	0	0
28	110006	21	1991	.1632134	0	0	0	.1632134	0	0	0	0	0	0	0
29	110006	22	1991	.068244	0	0	0	0	.068244	0	0	0	0	0	0
30	110006	23	1991	.0521046	0	0	0	0	0	.0521046	0	0	0	0	0
31	110006	31	1991	.1860954	0	0	0	0	0	0	.1860954	0	0	0	0
32	110006	32	1991	.0258831	0	0	0	0	0	0	0	.0258831	0	0	0
33	110006	33	1991	.0321895	0	0	0	0	0	0	0	0	.0321895	0	0
34	110006	41	1991	.1093446	0	0	0	0	0	0	0	0	0	.1093446	0

Effects of Year Dummies, Age-Education Group Dummies, and Proportions of People in Age-Education Groups in the Logarithm of the Monthly Nominal Income: Brazil, 1970-2000+

VARIABLES	COEFFICIENTS
Constant	-23.85***
1970	---
1980	3.62***
1991	19.49***
2000	29.05***
-- Dummies for age-education groups:	
15-24 years; 0-4 years of schooling (G11)	---
15-24 years; 5-8 years of schooling (G12)	0.60***
15-24 years; 9+ years of schooling (G13)	0.99***
25-34 years; 0-4 years of schooling (G21)	0.42***
25-34 years; 5-8 years of schooling (G22)	1.22***
25-34 years; 9+ years of schooling (G23)	1.81***
35-49 years; 0-4 years of schooling (G31)	0.82***
35-49 years; 5-8 years of schooling (G32)	1.59***
35-49 years; 9+ years of schooling (G33)	2.17***
50-64 years; 0-4 years of schooling (G41)	0.80***
50-64 years; 5-8 years of schooling (G42)	1.70***
50-64 years; 9+ years of schooling (G43)	2.24***
-- Proportions of people in age-education groups:	
Proportion with 15-24 years; 0-4 years of schooling (G11)	-0.07
Proportion with 15-24 years; 5-8 years of schooling (G12)	-3.34***
Proportion with 15-24 years; 9+ years of schooling (G13)	-4.98***
Proportion with 25-34 years; 0-4 years of schooling (G21)	-0.37**
Proportion with 25-34 years; 5-8 years of schooling (G22)	-5.91***
Proportion with 25-34 years; 9+ years of schooling (G23)	-5.48***
Proportion with 35-49 years; 0-4 years of schooling (G31)	-1.11***
Proportion with 35-49 years; 5-8 years of schooling (G32)	-7.19***
Proportion with 35-49 years; 9+ years of schooling (G33)	-3.15***
Proportion with 50-64 years; 0-4 years of schooling (G41)	-1.45***
Proportion with 50-64 years; 5-8 years of schooling (G42)	-16.40***
Proportion with 50-64 years; 9+ years of schooling (G43)	-0.40

+ Pooled of Equation 1.

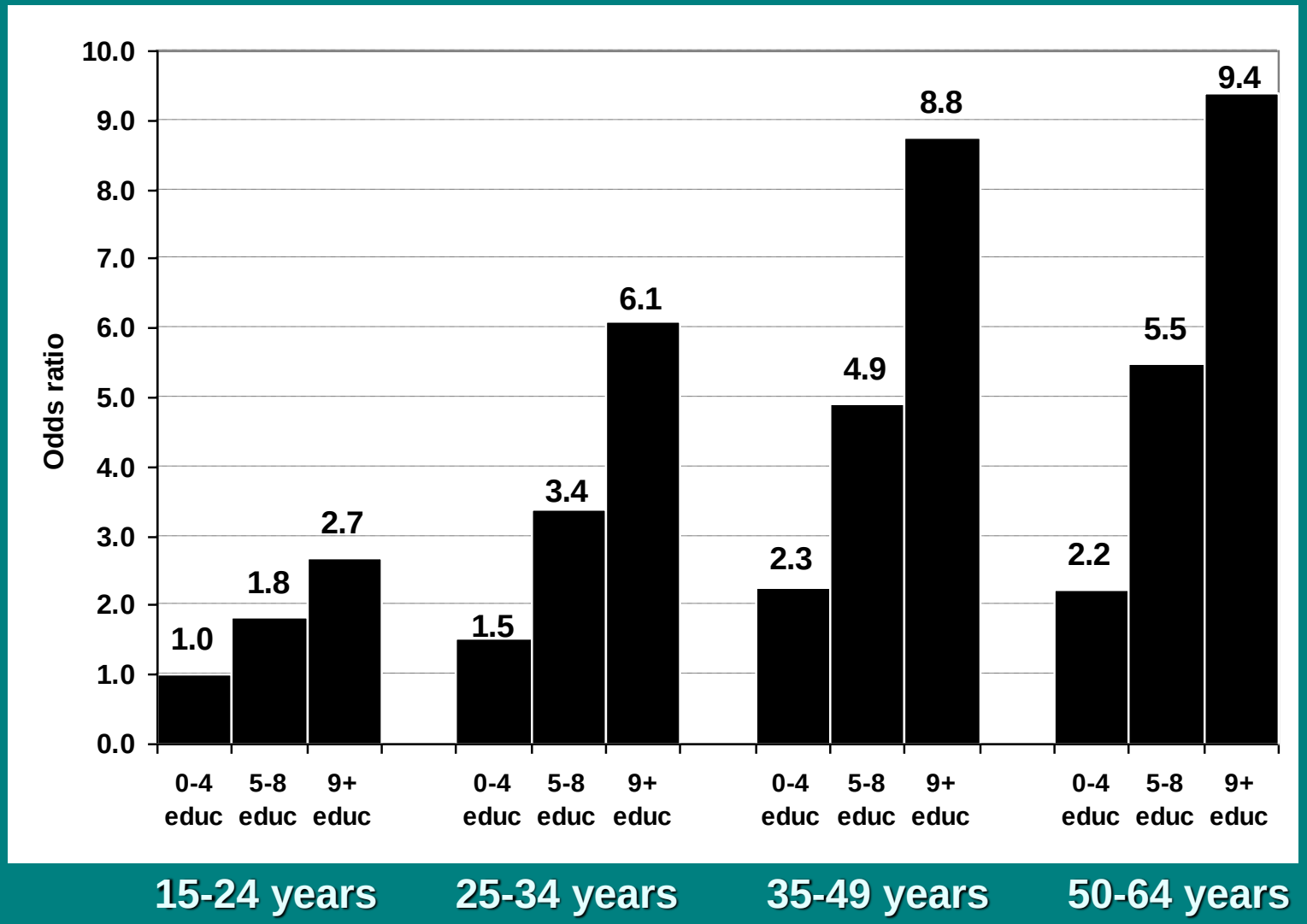
* Significant at p<.05.

** Significant at p<.01.

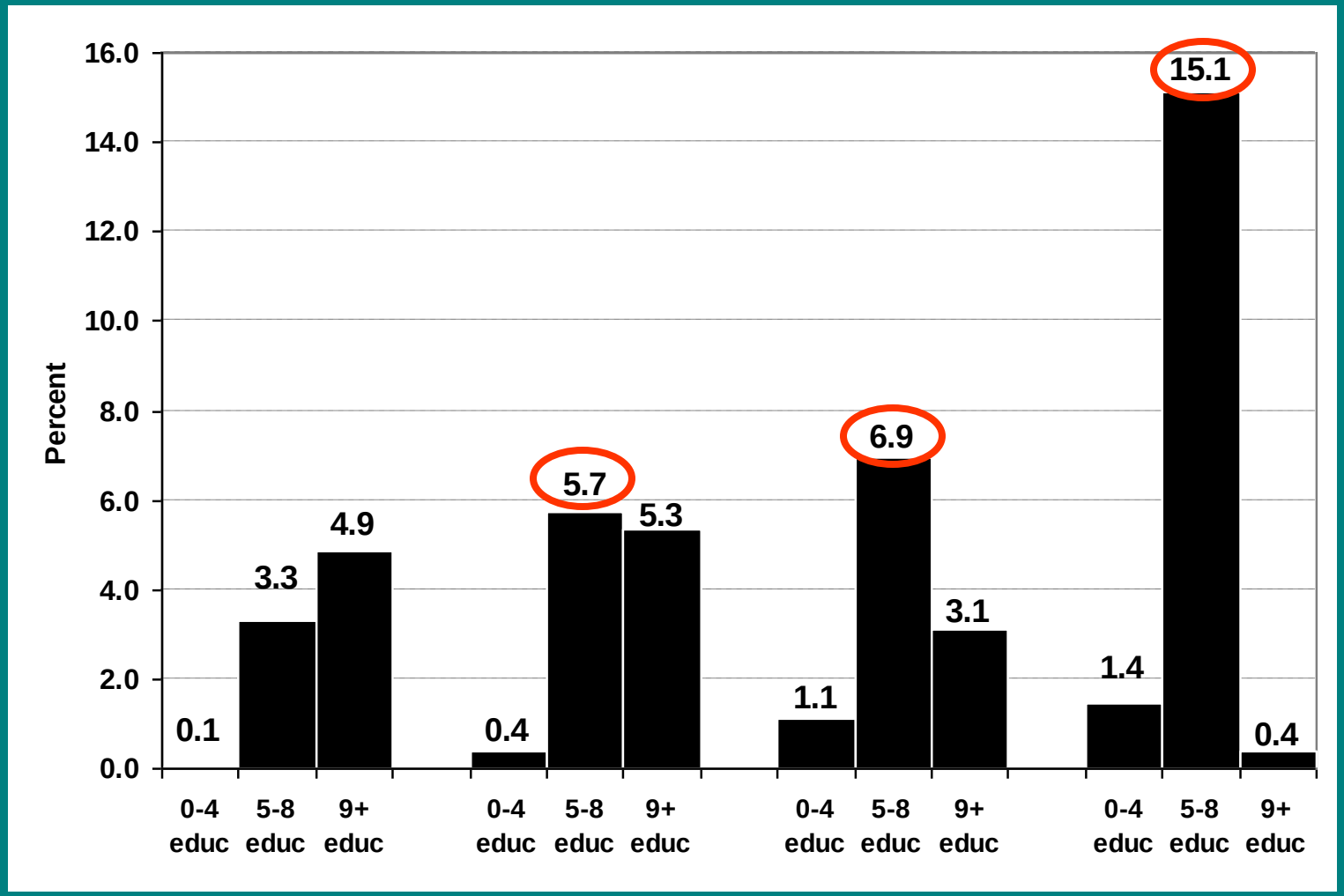
*** Significant at p<.001.

Source: 1970-2000 Brazilian Censuses.

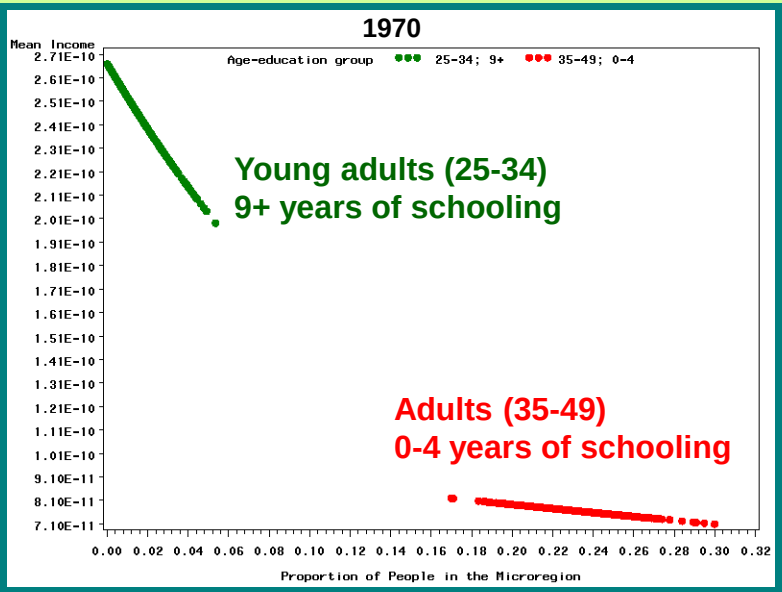
Odds Ratios of the Effects of Age-Education Group Dummies in the Logarithm of the Monthly Nominal Income: Brazil, 1970-2000

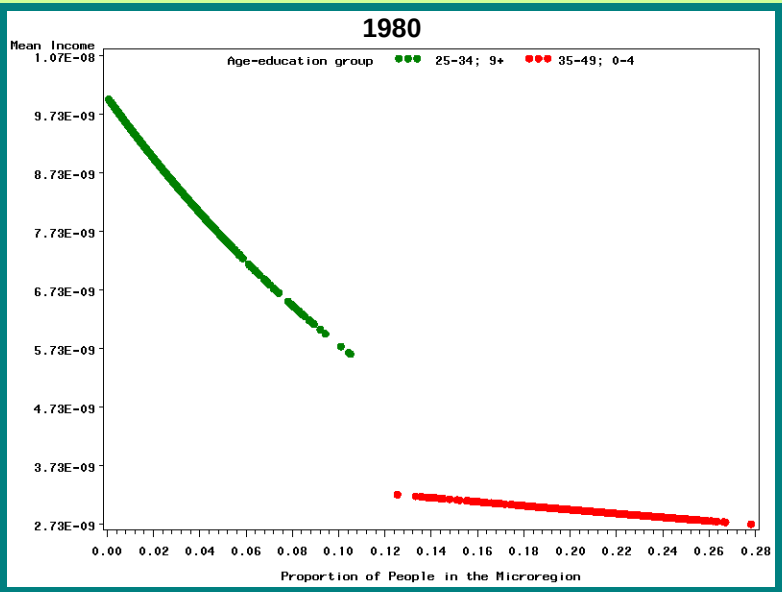


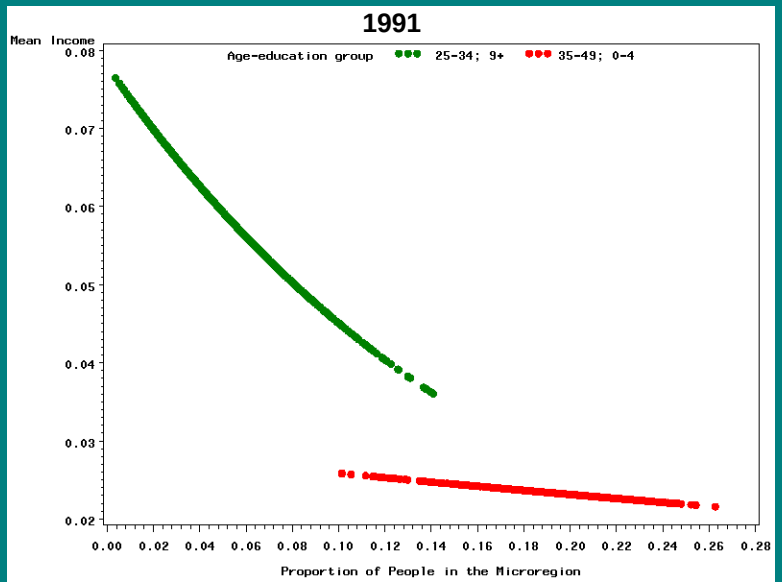
Percent Change in the Logarithm of the Monthly Nominal Income as a Result of One-Percent Change of People in Age-Education Groups: Brazil, 1970-2000

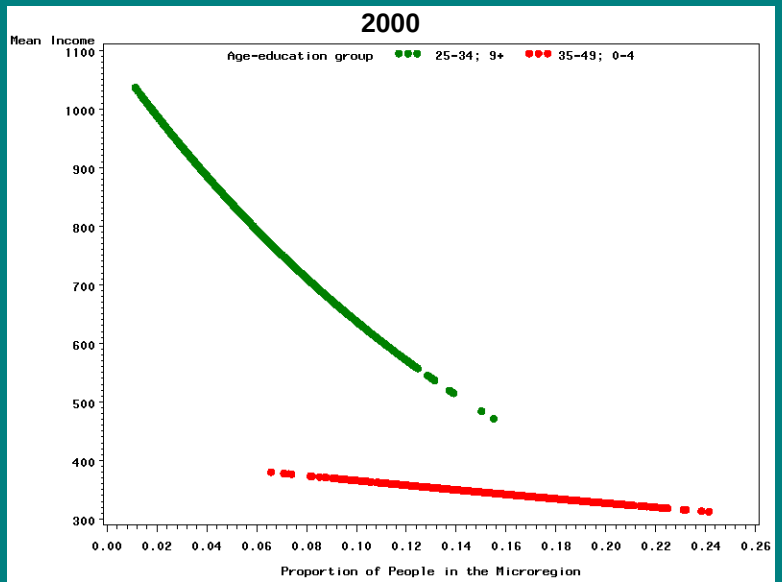


Predicted Mean Monthly Nominal Income by Proportion of People in Brazilian Microregions, 1970-2000









Equation 1'

- **EQUATION 1':** equals Equation 1, adding interactions of proportion of people in age-education group with 3 dummies for year.

$$W_{itc} = \beta_0 + \beta_1 X_{itc} + \beta_3 \theta_t X_{itc} + \upsilon_i + \theta_t + \varepsilon_{itc} , \quad i = 1 \ldots K; \; t = 1 \ldots T$$

- **POOLED OF EQUATION 1':** one single regression, including 3 dummies for year, 11 dummies of age-education groups, 12 proportions of people in each one of the age-education groups, and interactions of those proportions with 3 time dummies (12x3=36 coefficients).

Effects of Year Dummies, Age-Education Group Dummies, Proportions of People in Age-Education Groups, and Interactions with Year in the Logarithm of the Monthly Nominal Income: Brazil, 1970-2000+

VARIABLES	COEFFICIENTS	Interactions with year: 1980	1991	2000
Constant	-23.66***			
1970	---			
1980	3.53***			
1991	19.27***			
2000	28.79***			
-- Dummies for age-education groups:				
15-24 years; 0-4 years of schooling (G11)	---			
15-24 years; 5-8 years of schooling (G12)	0.52***			
15-24 years; 9+ years of schooling (G13)	0.91***			
25-34 years; 0-4 years of schooling (G21)	0.43***			
25-34 years; 5-8 years of schooling (G22)	1.11***			
25-34 years; 9+ years of schooling (G23)	1.69***			
35-49 years; 0-4 years of schooling (G31)	0.74***			
35-49 years; 5-8 years of schooling (G32)	1.51***			
35-49 years; 9+ years of schooling (G33)	2.12***			
50-64 years; 0-4 years of schooling (G41)	0.74***			
50-64 years; 5-8 years of schooling (G42)	1.60***			
50-64 years; 9+ years of schooling (G43)	2.24***			
-- Proportions of people in age-education groups:		1980	1991	2000
Proportion with 15-24 years; 0-4 years of schooling (G11)	-0.78***	0.37***	0.94***	1.36***
Proportion with 15-24 years; 5-8 years of schooling (G12)	-5.28***	0.90**	3.45***	3.24***
Proportion with 15-24 years; 9+ years of schooling (G13)	-5.37***	-0.74	2.55***	2.05***
Proportion with 25-34 years; 0-4 years of schooling (G21)	-1.60***	0.96***	1.40***	1.71***
Proportion with 25-34 years; 5-8 years of schooling (G22)	-6.94***	0.24	3.21***	3.44***
Proportion with 25-34 years; 9+ years of schooling (G23)	-1.97*	-2.13*	-0.43	-1.49
Proportion with 35-49 years; 0-4 years of schooling (G31)	-1.95***	1.00***	1.60***	1.67***
Proportion with 35-49 years; 5-8 years of schooling (G32)	-9.03***	1.06	3.49**	4.34
Proportion with 35-49 years; 9+ years of schooling (G33)	-5.02***	-1.17	4.05***	3.68**
Proportion with 50-64 years; 0-4 years of schooling (G41)	-3.27***	1.61***	2.79***	3.60***
Proportion with 50-64 years; 5-8 years of schooling (G42)	-9.15**	-2.20	0.25	1.81
Proportion with 50-64 years; 9+ years of schooling (G43)	-17.03***	1.25	18.85***	20.27***

+ Pooled of Equation 1'.

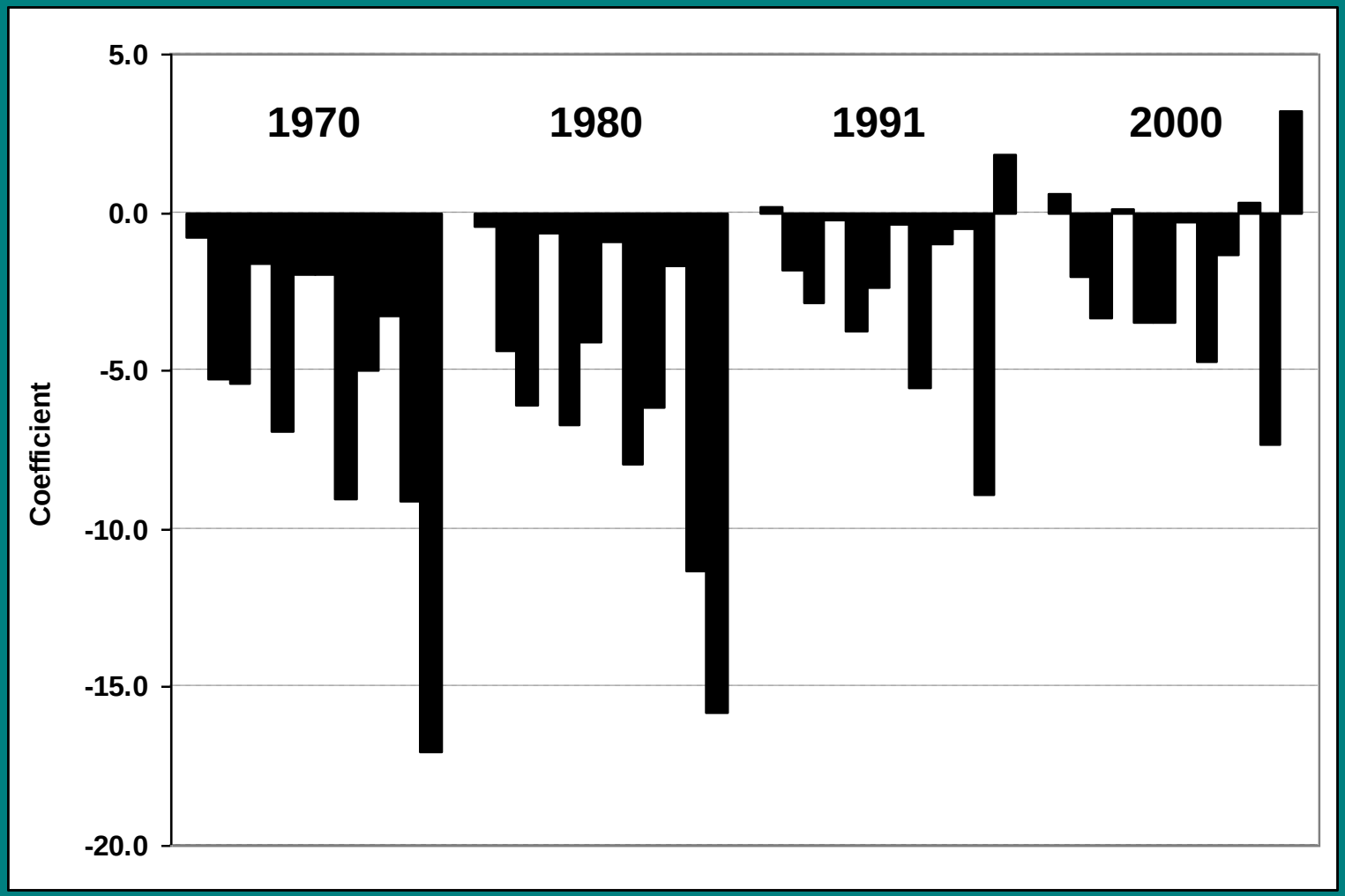
* Significant at p<.05.

** Significant at p<.01.

*** Significant at p<.001.

Source: 1970-2000 Brazilian Censuses.

Effects of Interactions of Proportions of People in Age-Education Groups with Year Dummies in the Logarithm of the Monthly Nominal Income: Brazil, 1970-2000



Equation 2

- **EQUATION 2:** allows for cross-effects.

$$W_{itc} = \beta_0 + \beta_1 X_{itc} + \beta_2 X_{itc'} + \upsilon_i + \theta_t + \varepsilon_{itc}\ ,\ \ i = 1\ldots K;\ t = 1\ldots T$$

- **POOLED OF EQUATION 2:** one single regression, including 3 dummies for year, 11 dummies for age-education groups, and proportions of people in each one of the age-education-neighbor groups for each one of the age-education groups (11x12=132 coefficients).

Equation 2'

- **EQUATION 2':** equals Equation 2, adding interactions of proportion of people in age-education-neighbor groups with 3 dummies for year.

$$W_{itc} = \beta_0 + \beta_1 X_{itc} + \beta_2 X_{itc'} + \beta_3 \theta_t X_{itc} + \beta_4 \theta_t X_{itc'} + \upsilon_i + \theta_t + \varepsilon_{itc} ,$$

$$i = 1 \ldots K; \; t = 1 \ldots T$$

- **POOLED OF EQUATION 2':** one single regression, including 3 dummies for year, 11 dummies for age-education groups, proportions of people in each one of the age-education-neighbor groups for each one of the age-education groups (11x12=132 coefficients), and interactions of those proportions with three dummies for year (132x3=396 coefficients).

Internal Migration

- The use of a smaller unit of analysis (microregion) makes it important to account for internal migration in the estimation of models.
- Main migration streams are from areas of higher fertility rates to those of lower fertility, which might reduce the differential in birth rates between areas.
- However, migration might also increase the difference in dependency ratios since migrants are concentrated in the working ages.
- And, of course, migration responds to differences in wages.

Migration Variables

- Available in 1960-2000 Brazilian Censuses:
  - State or country of birth.
  - Number of years of residency in the municipality.
  - State or country of previous residence.
- Greenwood and Sweetland (1972) used aggregate proxy variables that are likely to enter into the decision of migrate.
- Borjas (2003) measures the impact of immigrant share variable on labor market outcomes of native workers.
- Since internal migration in Brazil is influenced by availability of jobs and levels of income, it could not be simply introduced as an exogenous variable.

Future Activities

- Run more complex models, and figure out what to do with so many coefficients...
- Figure out how to use migration information, and model migration...
- Incorporate women...
- Adapt income information in 1960 Census...
- In Mexico, not only income matters, but also informal sector (Alba et al. 2006):
  - 30% of labor force has critical occupation conditions.
  - High-quality jobs have to be created.