Influences of transition in age-education structure and internal migration on the labor market in Brazil

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Demographic transition and economic development

- **Age-education transitions** in Brazil provide a lot of variation in the male labor force (15–64 years) structure between 1970 and 2000.
- As expected, **previous results** indicate that older and better educated men have higher earnings.
- However, the distribution of the male population in age-education groups (**cohort size**) has a negative impact on earnings, with the greatest negative impacts for groups with more years of education.
- Since this analysis was done at the local level (502 areas), we develop a methodology that incorporates **internal migration dynamics** into the models.

Importance of internal migration

- **If there were no migration flows**:
  - The sending areas (which have lower relative earnings) would have even lower earnings.
  - The receiving areas (which have higher relative earnings) would experience increases in earnings.
- Our **hypothesis** is that, by controlling for migration flows, the negative impacts of age-education-group proportions on earnings will be even more negative than previous estimates.

Data and categories

- **Brazilian Censuses** microdata were aggregated into 502 micro-regions, yielding comparison across the censuses.
- **Time** (census years): 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).
- **Educational attainment** was classified in three groups according to years of schooling completed:
  - 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** in main occupation: converted to January 2002.

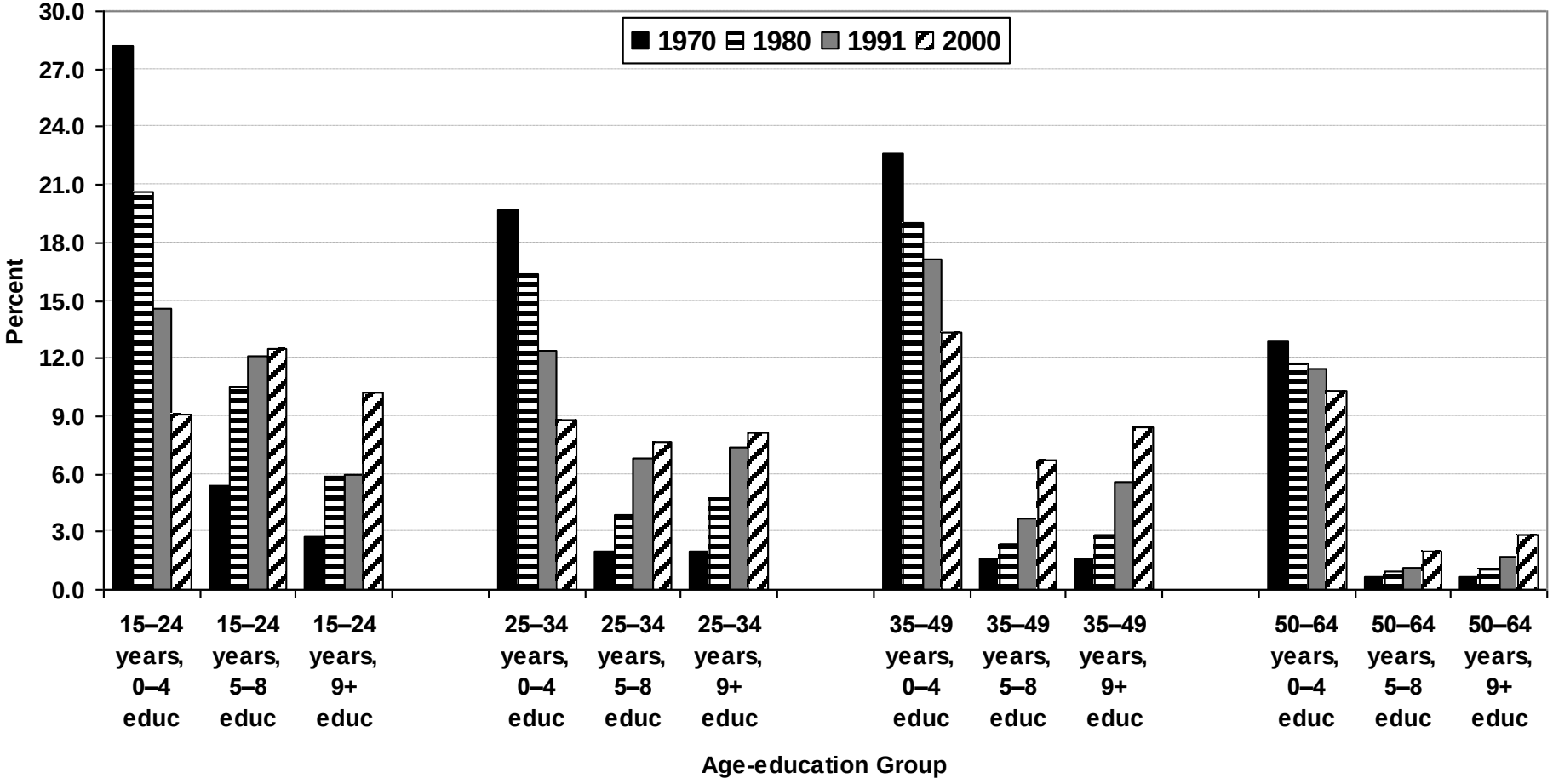
Estimation of models

- **Fixed-effects models** allow the estimation of coefficients that reflect relationships within 502 micro-regions between 12 age-education groups over time on labor outcomes.
- Regressions only include **males**.
- **Dependent variable:** the logarithm of the mean real income in main occupation in a group.
- **Independent variables:** age-education indicators (*G*), distribution of male population in age-education groups (*X*), distribution of migrants in age-education groups (*M*) interacted with time (θ); and area-time fixed effects (α):

$$log(Y_{git}) = \beta_0 + (\beta_1 G_{12} + \ldots + \beta_{11} G_{43})*\theta_t + (\gamma_1 X_{11} + \ldots + \gamma_{12} X_{43})*\theta_t +$$

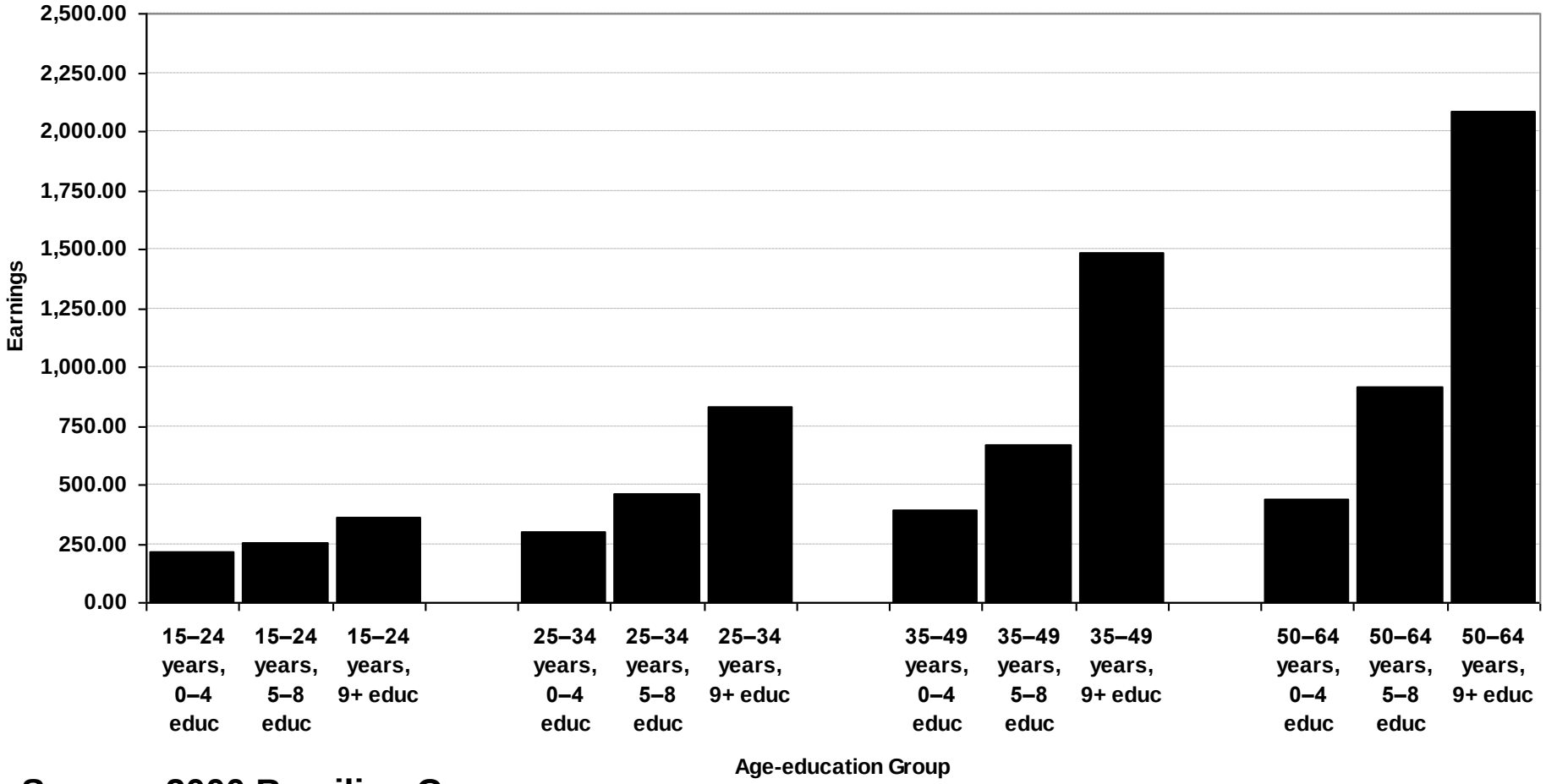
$$(\delta_1 M_{11} + \ldots + \delta_{12} M_{43})*\theta_t + \alpha_{it} + \varepsilon_{git}$$

Male population (15–64) by year and age-education group, 1970–2000 (%)



Source: 1970–2000 Brazilian Censuses.

Mean real monthly earnings in main occupation of male population (15–64) by age-education group, 2000



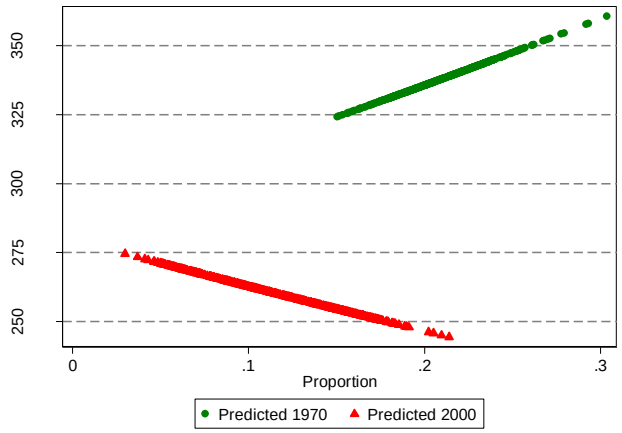
Source: 2000 Brazilian Census.

Obs.: Nominal income was converted to base 1 in January 2002, taking into account changes in currency and inflation.

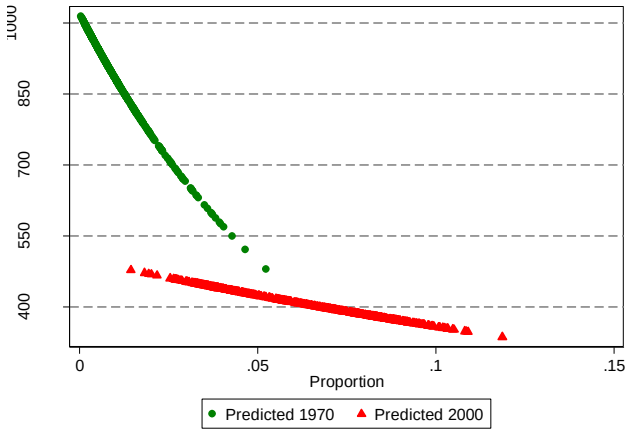
Effects of male proportions in 502 micro-regions (X_{11}–X_{43}) on earnings, 1970 and 2000

25–34 years

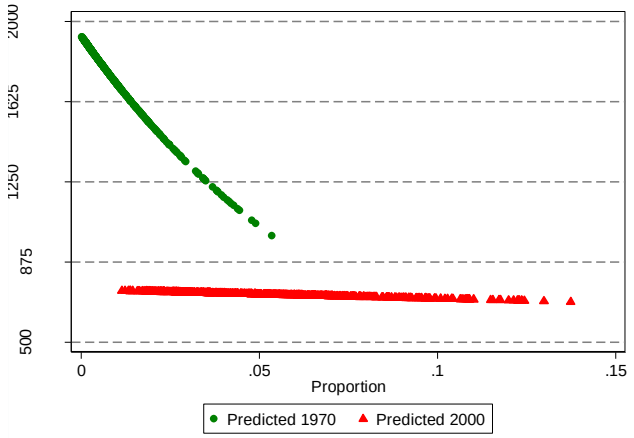
0–4 education



5–8 education

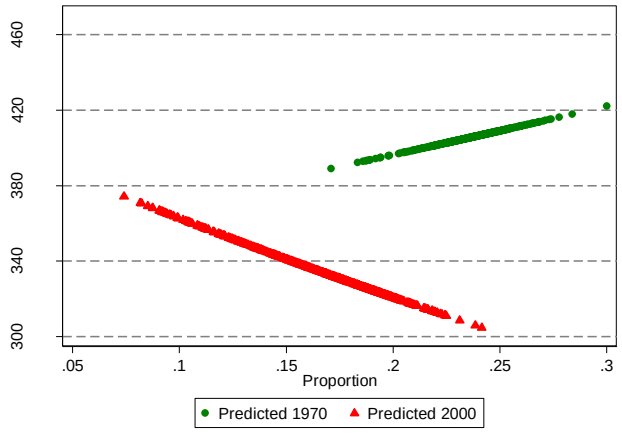


9+ education

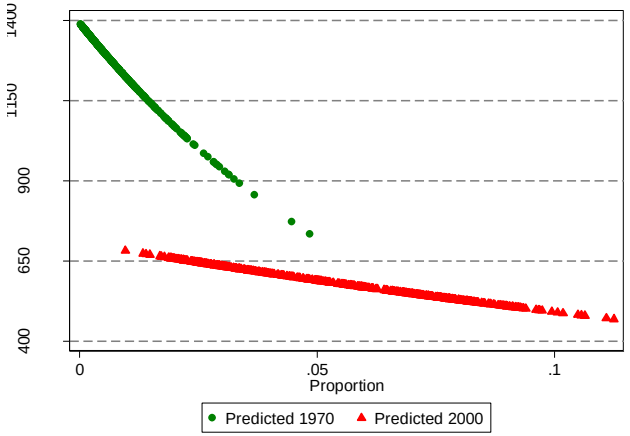


35–49 years

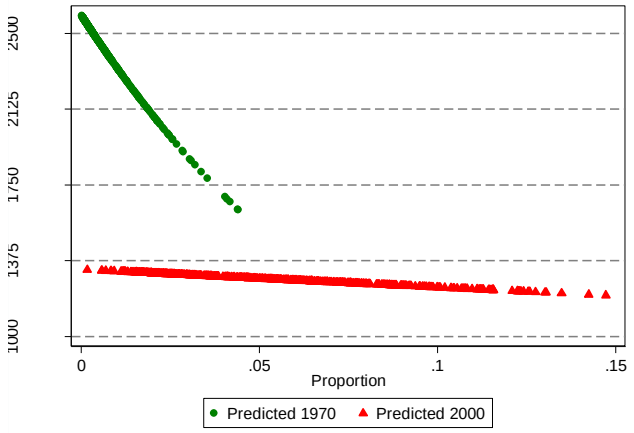
0–4 education



5–8 education



9+ education



Endogeneity problem

- After controlling for migration, the negative impacts of **cohort size** (X_{11}–X_{43}) are not always more negative than previous estimates.
- This might be an indication that migration flows cannot just be introduced as independent (exogenous) variables.
- These flows **explain** earnings in an area, and **are also influenced** by the availability of jobs and levels of income in sending and receiving areas (Oliveira and Jannuzzi 2005).
- In order to control for this simultaneity problem, a methodological approach was developed by integrating techniques to estimate the **level** (Stillwell 2005) and **pattern** (Rogers and Castro 1981) of migration.

Estimating level of migration

- **Gravity models** take into account distances among areas, and are used to control for migration flows (Stillwell 2005).
- **Poisson regression** uses migrants between region *i* and region *j* (M_{ij}); pop. at the beginning of the period (P_i); pop. at the end of the period (P_j); and distance among regions (d_{ij}):

$$M_{ij} = exp(b_0 + b_1 log\ P_i + b_2 log\ P_j + b_3 log\ d_{ij}) + \varepsilon_{ij}$$

- Since flows between areas (502*501=251,502) have low number of migrants, it was selected the **20-24 age group** to estimate the level of migration.
- A model was estimated for each year (1991 and 2000) and education group, using information on municipality of residence five years before the census.
- **Result:** populations at the beginning and end of the period have positive effects; and distance has a negative impact.

Estimating age pattern of migration

- Migration patterns are obtained by estimating **migration rates by age groups**.
- The estimation of migration rates for combinations of micro-regions and year would generate low results.
- The solution is to estimate rates for the flows among the major-regions (North, Northeast, Southeast, South and Central-West) in each year (1991 and 2000): 5*5*2=50.
- Information on **municipality of residence five years before the census** was used.
- **Age-specific in-migration rates (*ASIR*$_{x,ij}$)** by age group were estimated, considering populations (*K*) in regions of origin (*i*) and destination (*j*):

$$ASIR_{x,ij} = \sum(K_{x,ij}) / t^{*}\sum\{[(K_{x,j.} + K_{x,jj}) + (K_{x,j})]/2\}$$

Modeling age pattern of migration

- After the estimation of in-migration rates by age group, the mathematical models proposed by Rogers and Castro (1981) were implemented to these rates.

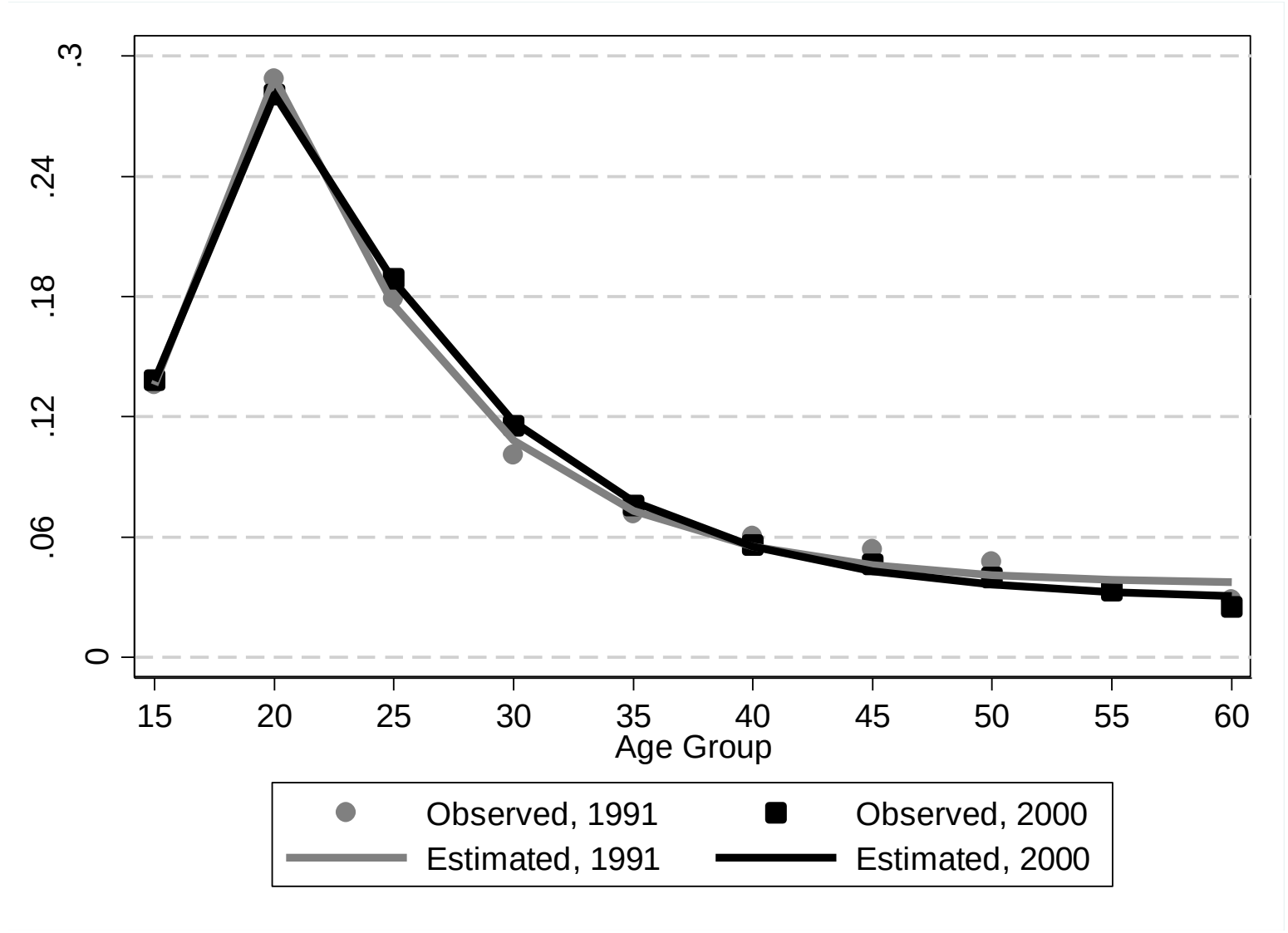
- Rogers and Jordan (2004) indicate that migration flows are usually modeled with the following equation:

$$S(x) = a_1 * exp(-\alpha_1 x) + a_2 * exp\{-\alpha_2(x-\mu_2) - exp[-\lambda_2(x-\mu_2)]\} + c$$

- This equation has a negative exponential curve in the first age groups, followed by a parabola on labor ages, and a constant term on post-labor ages.

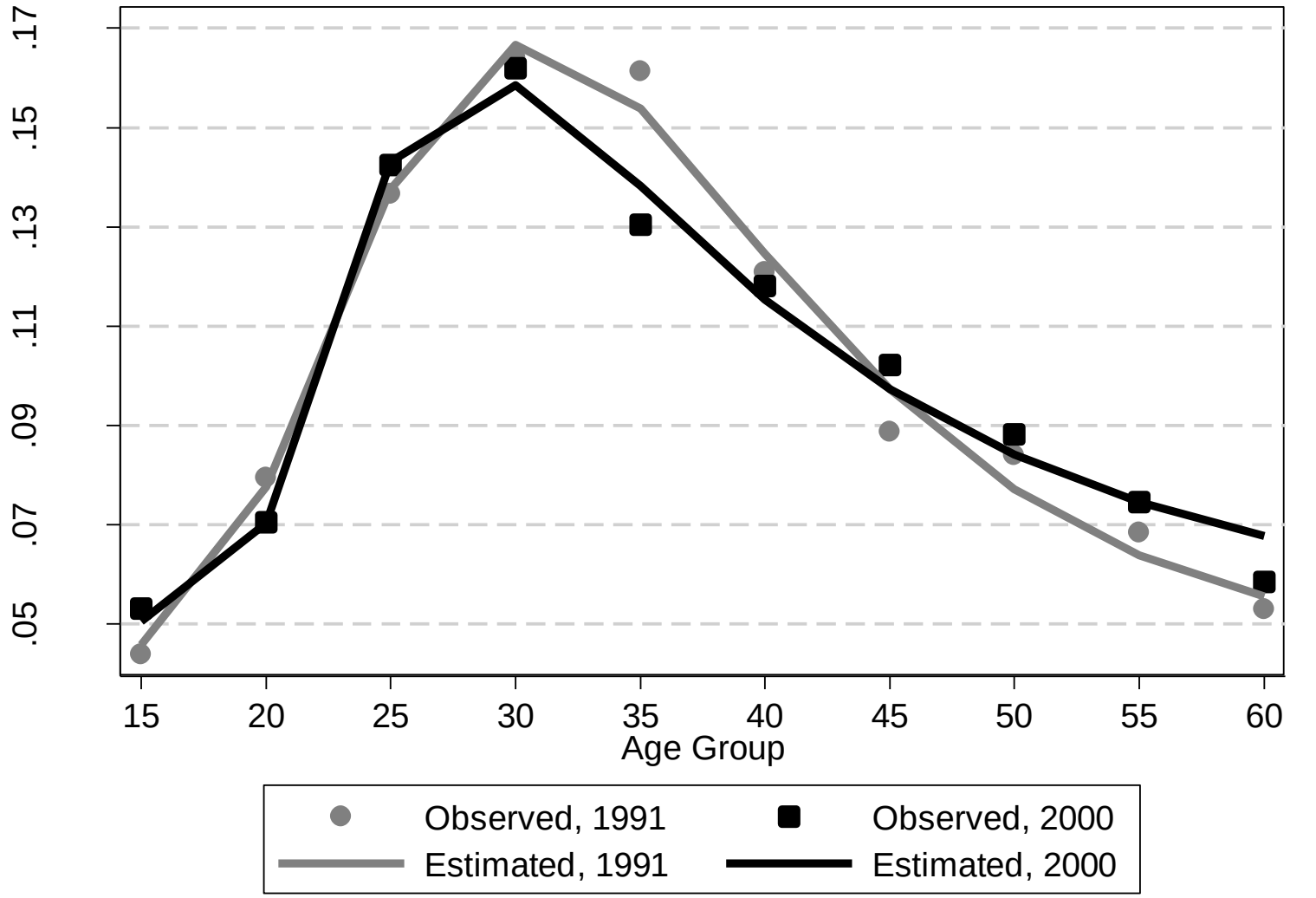
- For this exercise, rates were modeled only for those between 15 and 64 years of age.

Observed and estimated proportional ASIR, Northeast to Southeast, 1991 and 2000



Source: 1991 and 2000 Brazilian Censuses.

Observed and estimated proportional ASIR, Southeast to Northeast, 1991 and 2000



Source: 1991 and 2000 Brazilian Censuses.

Integrating level and pattern of migration

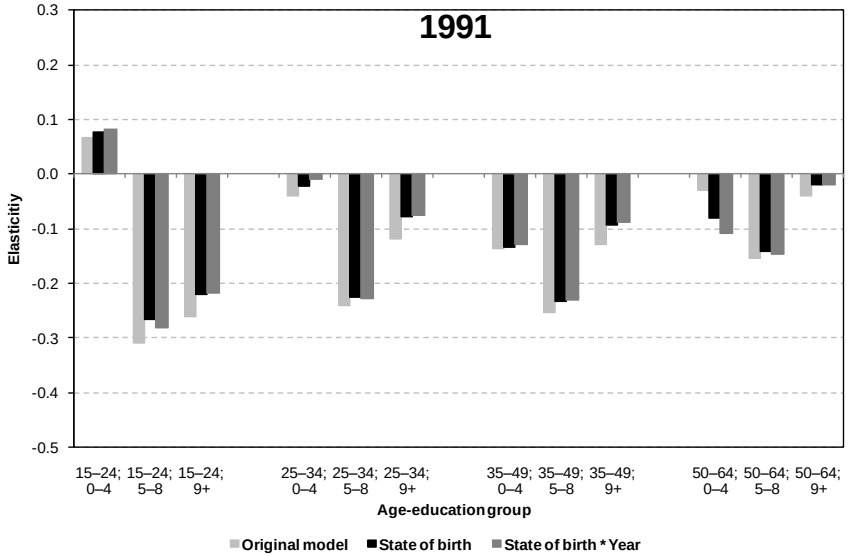
- The **level of migration** for men aged 20–24 years between the 502 micro-regions by education group (0–4, 5–8, and 9+) and year (1991 and 2000) was estimated.
- The **pattern of migration** was estimated by modeling the age-specific in-migration rates ($ASIR_{x,ij}$) for each population flow among the five major-regions by year.
- Then, the **ratio** between the level of migration and the *ASIR* for the 20–24 age group was calculated.
- The ratio was then multiplied by each $ASIR_{x,ij}$ of the other age groups, considering the education group, area and year.
- Finally, a measure of **force of migration** was estimated for each micro-region, age-education group and year.

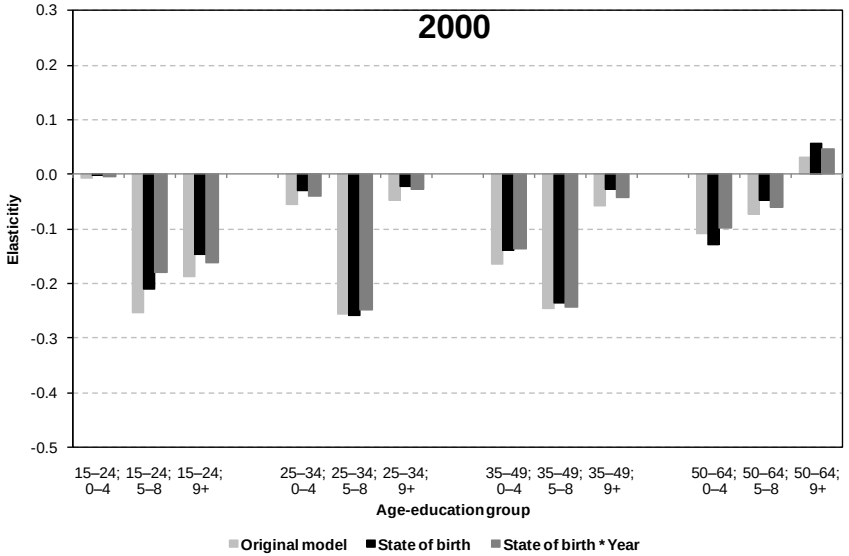
New regression models

- **Original model** (1970-2000 & 1991-2000): age-education*year; proportion by age-education*year.
- **Migration model 1** (1970-2000 & 1991-2000): original model; state of birth; state of birth*year.
- **Migration model 2** (1970-2000 & 1991-2000): original model; time of residence; time of residence*year.
- **Migration model 3** (1991-2000): original model; residence five years before the census; residence five years before the census*year.
- **Migration model 4** (1991-2000): original model; adjusted migration; adjusted migration*year.
- The elasticities for the 1991-2000 models...

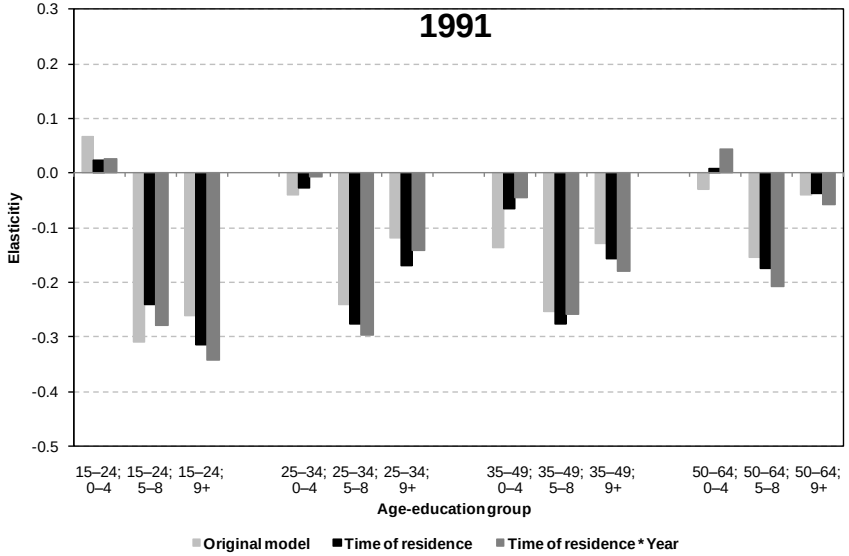
Estimated elasticities of proportions in age-education groups, 1991 and 2000

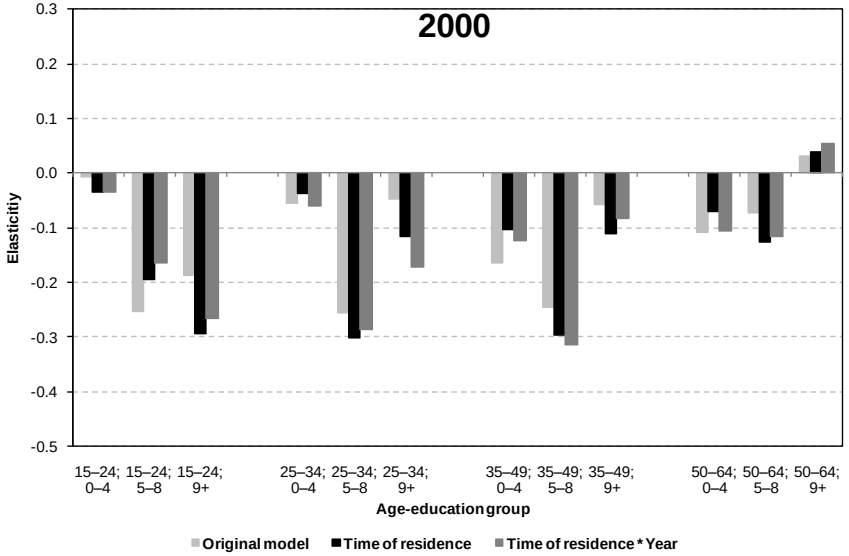
STATE OF BIRTH





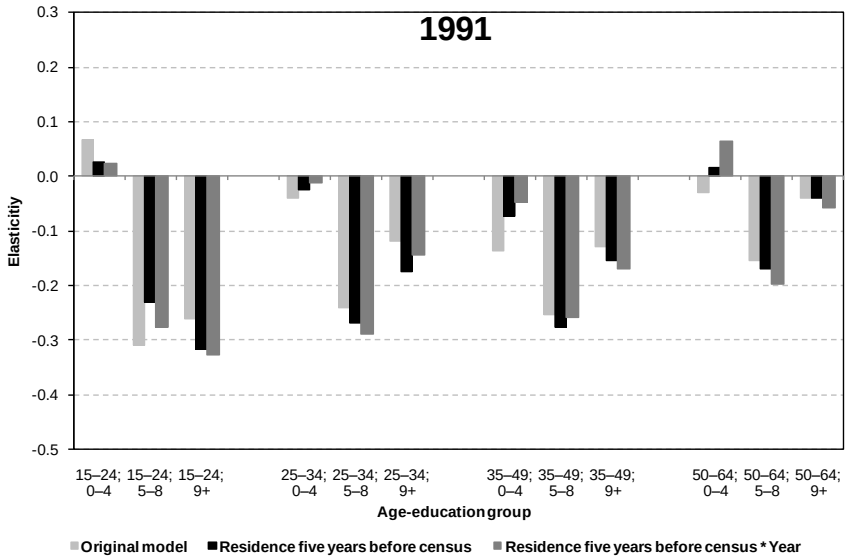
TIME OF RESIDENCE (LESS THAN 5 YEARS IN THE MUNICIPALITY)

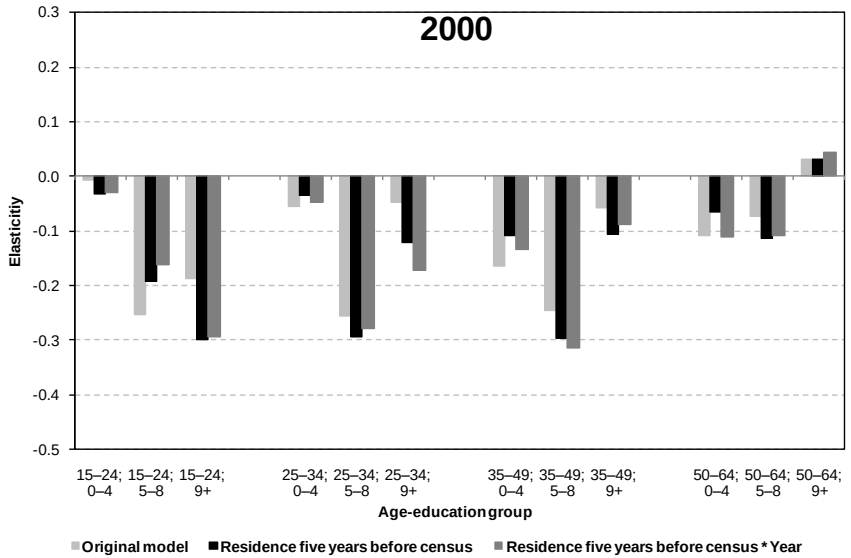




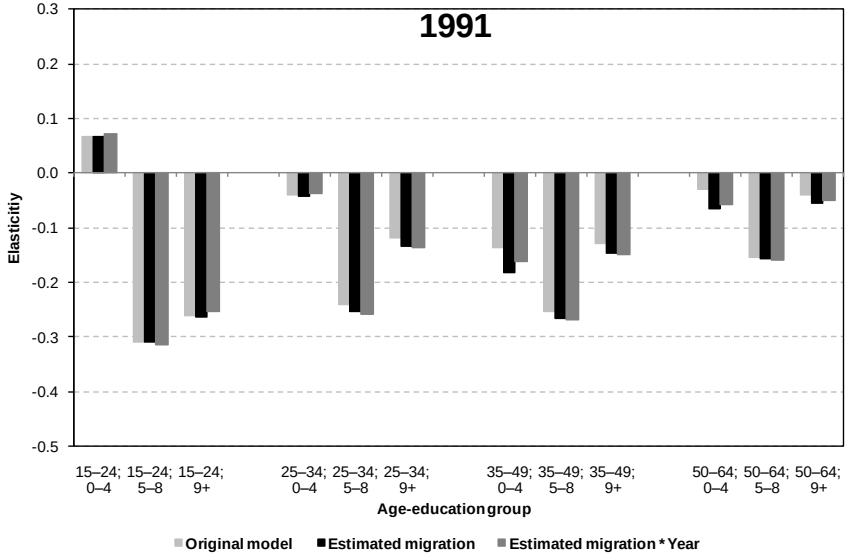
Estimated elasticities of proportions in age-education groups, 1991 and 2000

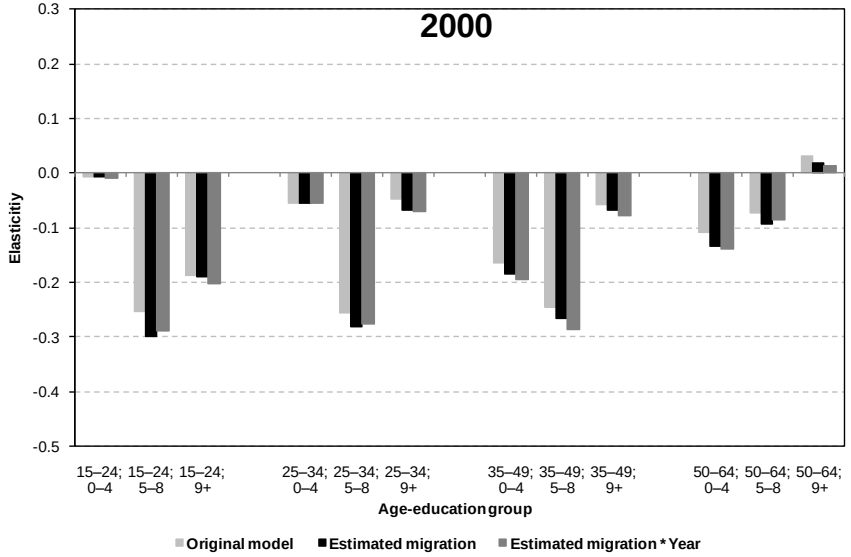
RESIDENCE FIVE YEARS BEFORE THE CENSUS





ADJUSTED MIGRATION





Final considerations

- Findings follow the **initial hypothesis**, which suggested that, after controlling for migration flows, negative impacts of cohort size on earnings are even more negative than estimates that did not take population flows into account.

- The inclusion of internal migration has consistent results only after **adjusting the level and pattern** of flows.

- These strategies were designed in such a way that they can be used in **further studies**, when new data become available, as well as in other countries with the requisite migration data.