

The geography of mobility

Evidence of intergenerational educational persistence and the
"Great Gatsby Curve" in Brazil

Tharcisio Leone

Free University of Berlin
School of Business and Economics
Institute for Latin American Studies

June 11, 2018

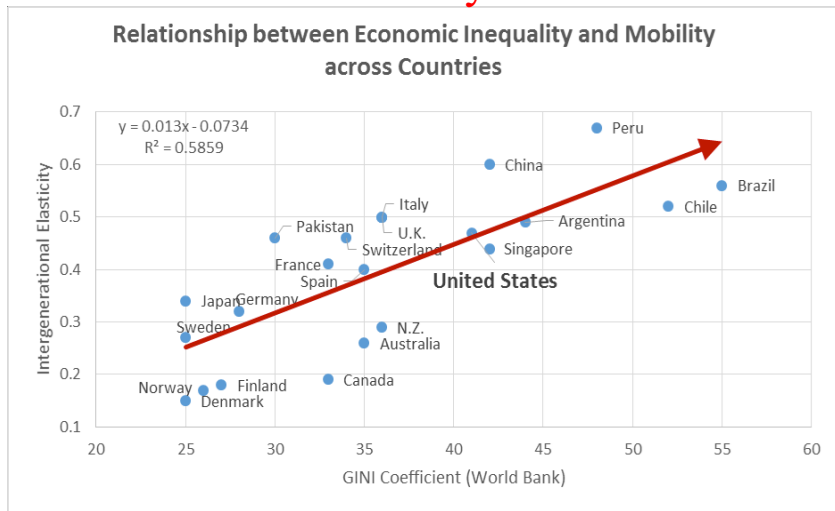
Outline

- 1 Introduction
- 2 Data
- 3 Estimating intergenerational mobility
- 4 The Great Gatsby Curve
- 5 Linking Inequality and school dropouts
- 6 Conclusion

Outline

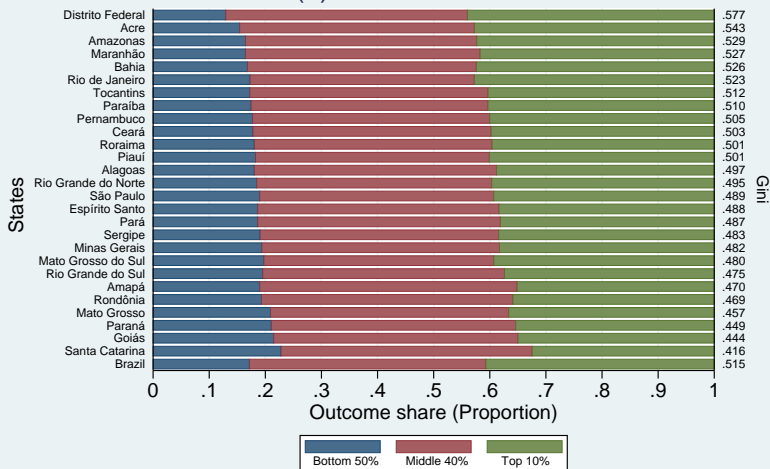
- 1 Introduction
- 2 Data
- 3 Estimating intergenerational mobility
- 4 The Great Gatsby Curve
- 5 Linking Inequality and school dropouts
- 6 Conclusion

“Great Gatsby Curve”



Source: Corak (2012)

(a) Income distribution



Note: Estimations based on per capita household income.
 Source: PNAD-2014, own estimates.

Research questions

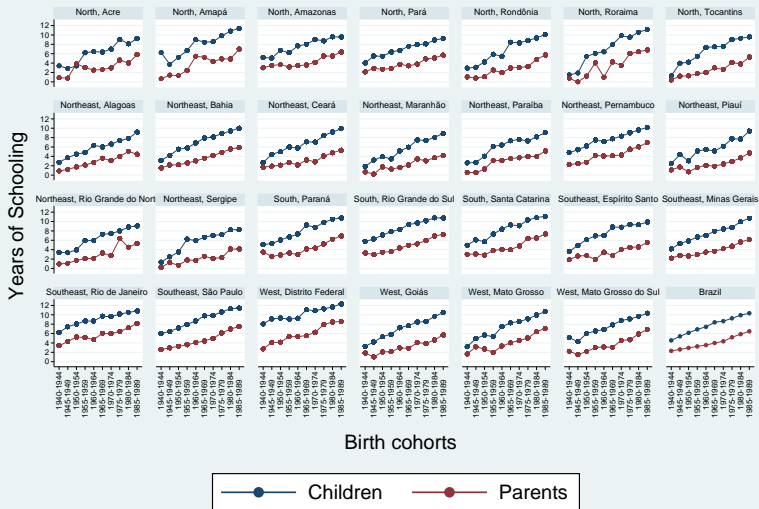
- 1 There is a variation in intergenerational educational mobility across Brazilian states?
- 2 What socioeconomic indicators are correlated with the mobility at state level?
- 3 Does the “Great Gatsby Curve” also hold true within a single country?
- 4 How higher income inequality leads to lower rate of mobility?
 - Investigation of one specific mechanism behind the correlation between inequality and mobility: School dropout rate.

Outline

- 1 Introduction
- 2 Data
- 3 Estimating intergenerational mobility
- 4 The Great Gatsby Curve
- 5 Linking Inequality and school dropouts
- 6 Conclusion

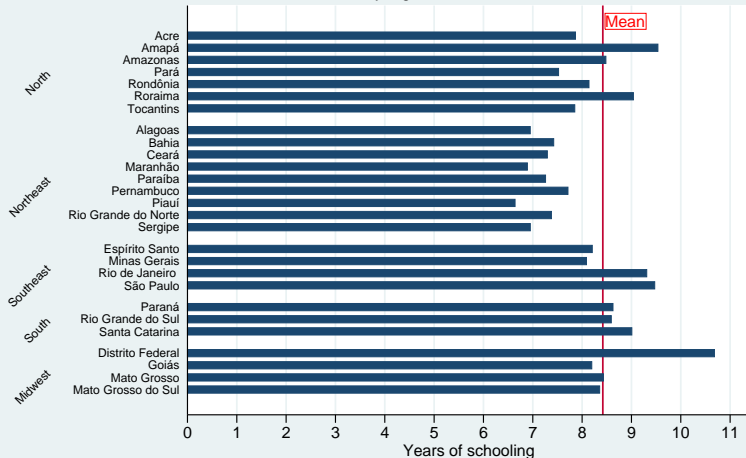
- ① Brazilian National Household Sample Survey (PNAD)
 - Mobility supplement 2014 (46,051 individuals)
- ② Main variables for the investigation
 - Number of years of schooling
 - Level of education
 - School Dropout rate
 - Income inequality
- ③ Variable construction
 - Only individuals born between 1940 and 1989
 - The most educated parent
 - 25/10 Ratio for income inequality
 - Economic Marginalization
- ④ Further variables
 - Individual characteristics (gender, birth cohort, race, locality of residence and living with both parents at age 15)

(a) Average years of schooling



Average Education

by region and states in Brazil



Source: PNAD-2014, own estimates.

Outline

- 1 Introduction
- 2 Data
- 3 Estimating intergenerational mobility**
- 4 The Great Gatsby Curve
- 5 Linking Inequality and school dropouts
- 6 Conclusion

Estimating intergenerational mobility

1. Transition matrix

- Probability of children from parents with the educational attainment j to achieve the education level i .
- Provide a overview about the direction of the mobility.

2. Linear regression model

- Summarize the grade of persistence between parents' and children's educational attainment.
- Take into account the changes over time in the education inequality.

Transition matrices

- 1 Classification of educational outcomes Education of children (generation t) and parents (generation $t + 1$) into four categories: no school certificate, primary, secondary and tertiary education.

- 2 Estimation of matrices

A transition matrix is a process $\{X_0, X_1, X_2, \dots\}$ with number of states S , where S has size \mathbb{R} (possibly infinite) such that:

$$p_{ij} = \mathbb{P}(X_{t+1} = j \mid X_t = i) \quad \text{for } i, j \in S, \quad t = 0, 1, 2, \dots \quad (1)$$

with two important properties:

$$\forall i, j \in \mathbb{R}, \quad P(i, j) \geq 0, \quad \text{and}$$

$$\sum_{j=1}^N p_{ij} = \sum_{j=1}^N \mathbb{P}(X_{t+1} = j \mid X_t = i) = \sum_{j=1}^N \mathbb{P}_{\{X_t=i\}}(X_{t+1} = j) = 1$$

③ Measure of intergenerational mobility

- Immobility Ratio:

$$ImR = \frac{Tr(\mathbb{P})}{S} = \frac{\sum_{i=1}^N \rho_{ij}}{S}$$

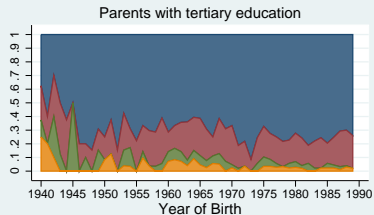
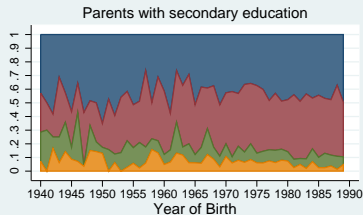
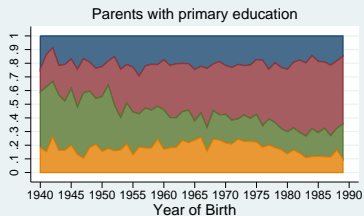
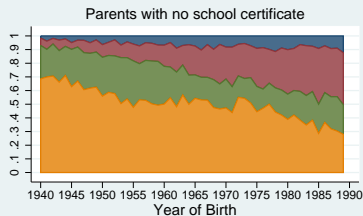
- Upward and Downward Mobility:

$$UpM = Pr(X_t > l \mid X_{t+1} = l) \quad \text{and} \quad DoM = Pr(X_t < l \mid X_{t+1} = l)$$

- Prais–Shorrocks-Indicator:

$$M_{PS}(\mathbb{P}) = \frac{S - Tr(\mathbb{P})}{S - 1} \quad \text{with} \quad M_{PS} \in [0, 1]$$

Descendants predicted probabilities of education attainment



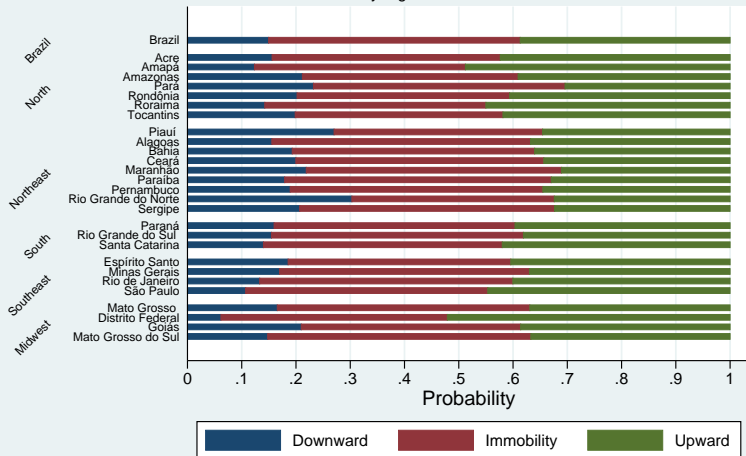
Source: PNAD-2014, own estimates.



Transition matrices

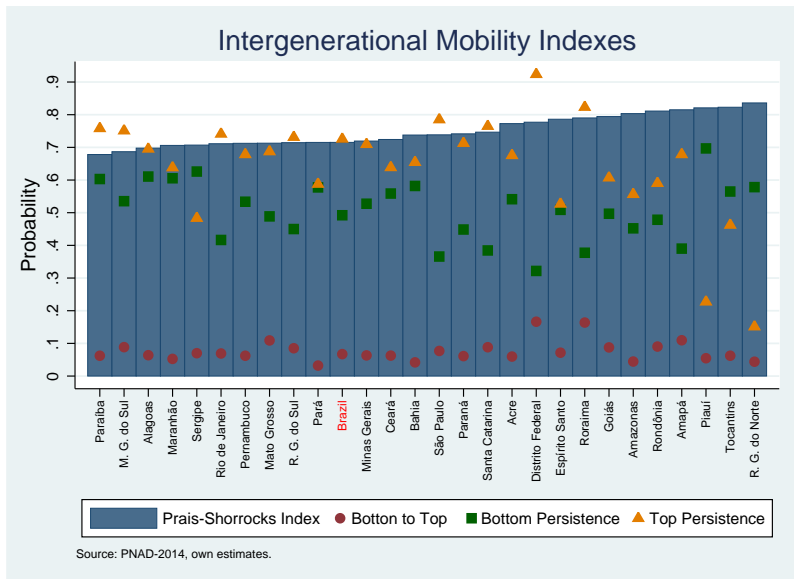
Intergenerational Education Mobility

by regions and states in Brazil



Source: PNAD-2014, own estimates.

Transition matrices



Linear regression model

- The association between the education of children and parents is given by:

$$educ_{is}^c = \alpha + \beta educ_{is}^p + \epsilon_i \quad \text{for } i = 1, 2, \dots, N \quad (2)$$

- Normalisation of coefficient β by the corresponding standard deviation:

$$\hat{\beta} = \rho_s^{cp} \frac{\sigma_s^p}{\sigma_s^c}, \quad \text{with} \quad \sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2} \quad (3)$$

Linear regression model

- From equations (2) and (3) the resulting model can be summarized as:

$$\frac{educ_{is}^c}{\sigma_s^c} = \delta + \rho \left(\frac{educ_{is}^p}{\sigma_s^p} \right) + \epsilon_i \quad \text{with} \quad \rho \in [0, 1] \quad (4)$$

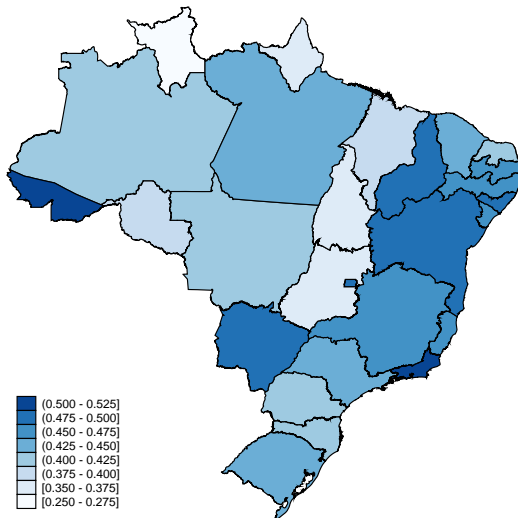
- Inclusion of a vector X with controls variables and some interaction terms:

$$\frac{educ_{is}^c}{\sigma_s^c} = \delta + \rho \frac{educ_{is}^p}{\sigma_s^p} + \eta \left(\frac{educ_{is}^p}{\sigma_s^p} \times UF_i \right) + \lambda UF_i + \gamma (X_i \times UF_i) + \epsilon_{is} \quad (5)$$

with:

- Control variables: Gender, year of birth and race
- Dummy variables UF present the state of residence

Intergenerational persistence in education



Source: PNAD-2014, own estimates.

Outline

- 1 Introduction
- 2 Data
- 3 Estimating intergenerational mobility
- 4 The Great Gatsby Curve**
- 5 Linking Inequality and school dropouts
- 6 Conclusion

The Great Gatsby Curve

Interim result

- The chances of attaining intergenerational educational mobility vary a very great deal from one state to another in Brazil.

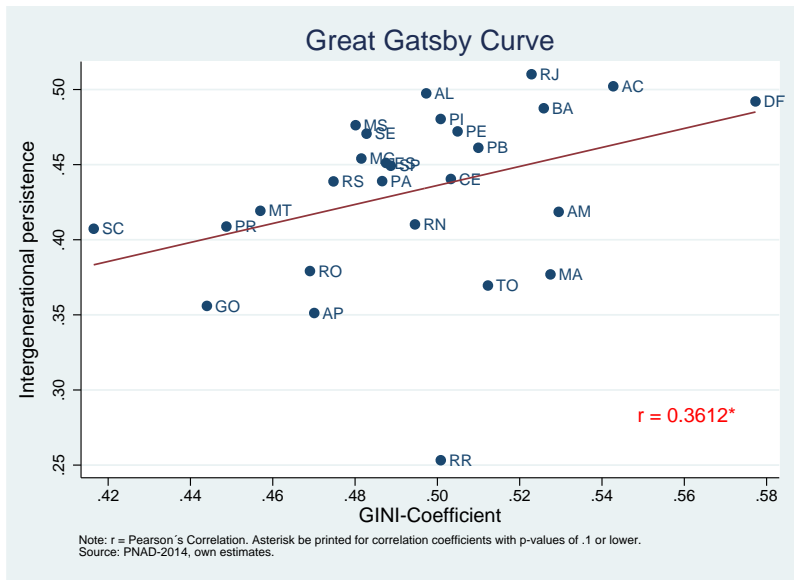
Next steps

- Investigation of why the mobility ranges so widely within a single country.
- Correlation of mobility with income inequality at state level.

Model of Solon (2004)

- Family (parents and children) as an intergenerational decision maker.
- Higher-income parents have (1) a higher capacity to invest in the human capital of their children, and (2) a higher incentive for this investment.

Correlating intergenerational mobility



Outline

- 1 Introduction
- 2 Data
- 3 Estimating intergenerational mobility
- 4 The Great Gatsby Curve
- 5 Linking Inequality and school dropouts**
- 6 Conclusion

Linking Inequality and school dropouts

Interim results

- The level of intergenerational mobility ranges across Brazilian states
- The "Great Gatsby Curve" holds true within a single country (States with greater income disparity tend to have lower levels of education mobility between generations)

Next steps

- Change from an analysis of intergenerational mobility via correlation hypothesis to an investigation of the determinants
- The link between inequality and school dropout rate
- Economic marginalization: Children with very low expected earnings premium
- Marginalization arises as a consequence of higher income inequality

Linking Inequality and school dropouts

Research question

- Have children from low socioeconomic backgrounds who live in states with high income inequality levels a greater chance to drop out the school system?
- The empirical probit model can be write as:

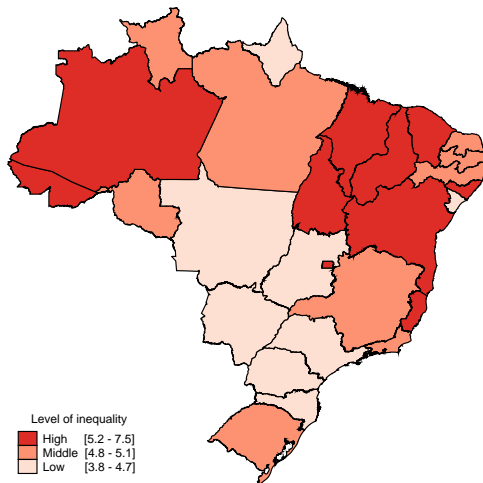
$$\begin{aligned} EduOutcome_{isc} = & \pi_0 + \pi_1 (IlliteP_{is} \times ratio_s) + \pi_2 (NoEducP_{is} \times ratio_s) \\ & + \pi_3 IlliteP_{is} + \pi_4 NoEducP_{is} + \pi_5 ratio_s \\ & + \gamma_1 male_{is} + \gamma_2 rural_{is} + \gamma_3 bothP_{is} + \gamma_4 race_{is} + \gamma_5 birthc_{is} + \epsilon_{is} \end{aligned}$$

where:

- *EduOutcome*: Primary school dropout, secondary school dropout and concluded (tertiary) education system.
- *Ratio*: Ranking in income inequality (measured by the 25 to 10 ratio).
- Proxy for Marginalization: *IlliteP* for illiterate parents and *NoEducP* for parents with no primary education.

Correlating intergenerational mobility

(b) Ratio 25/10 of income distribution



Notes:

(i) Estimations based on per capita household income.

(ii) Ratio represents the relation between average income at the 75th and 10th percentiles.

Source: PNAD-2014, own estimates.

Correlating intergenerational mobility

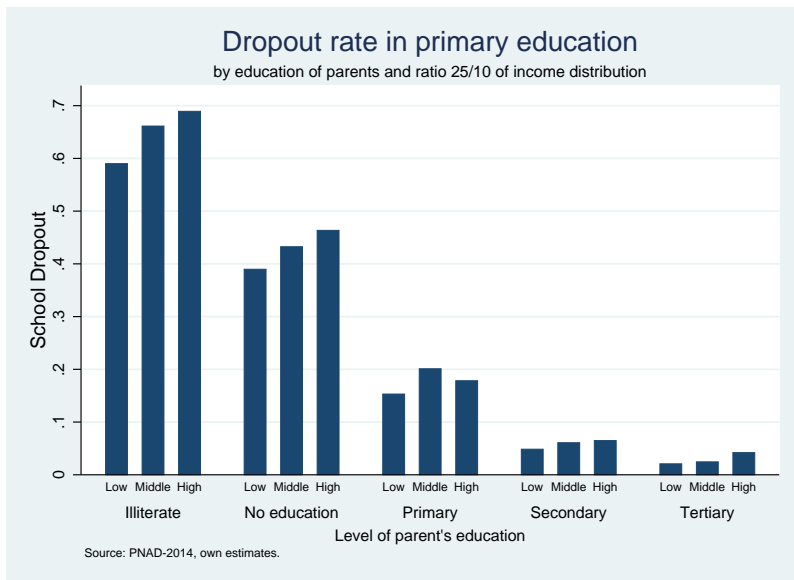


Table 1: The impact of Inequality on School Dropout.

VARIABLES	(PSD)	(SSD)	(CTE)
	Primary school dropout	Secondary school dropout	Concluded tertiary education
Illiterate Parents * Ratio 25/10	0.0321	0.0206	0.0809
Parents with no school certificate * Ratio 25/10	0.0609**	0.0676**	-0.0489
Illiterate Parents	0.319	0.367*	-0.908***
Parents with no school certificate	0.468***	0.458***	-0.535***
Ratio 25/10	0.00416	-0.103***	0.122***
Male	0.176***	0.197***	-0.220***
Rural	0.691***	0.748***	-0.710***
Living with both parent	-0.183***	-0.135***	0.143***
White (reference)	-	-	-
Black	0.164***	0.239***	-0.404***
Mixed (white/black)	0.320***	0.316***	-0.452***
Asian	-0.438***	-0.433***	0.654***
Indigenous	0.297**	0.164	-0.0841
1980 - 1989 (reference)	-	-	-
1970 - 1979	0.415***	0.351***	-0.0547*
1960 - 1969	0.489***	0.512***	-0.0763**
1950 - 1959	0.463***	0.819***	-0.120***
1940 - 1949	0.724***	1.121***	-0.266***
Constant	-1.590***	-0.569***	-0.926***
Observations	35,555	35,305	34,109

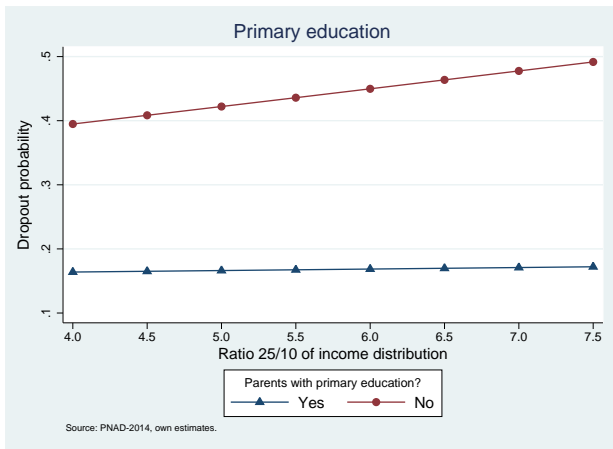
Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: PNAD-2014, own estimates.

Focus on the marginal effects at a point \tilde{x} :

- How change in primary school dropout is related to change in the ratio 25/10 ?

$$\left. \frac{\partial E(\text{EduOutcome}|\mathbf{x})}{\partial \mathbf{x}} \right|_{\mathbf{x}=\tilde{\mathbf{x}}} = \left. \frac{\partial F(\mathbf{x}\beta)}{\partial \mathbf{x}} \right|_{\mathbf{x}=\tilde{\mathbf{x}}} = f(\tilde{\mathbf{x}}\beta)\beta$$



Focus on the marginal effects at a point \tilde{x} :

- How change in educational outcome is related to change in the proxy for economic marginalization ?

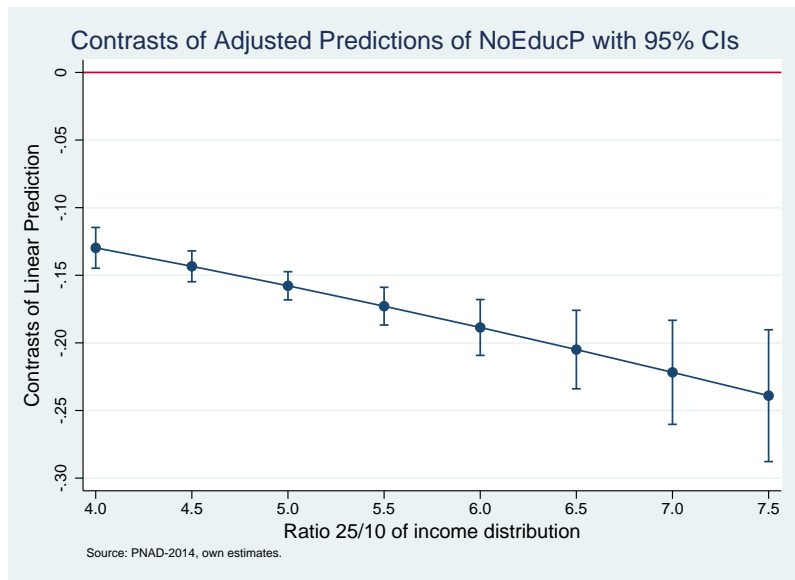
$$\left. \frac{\partial E(\text{EduOutcome}|\mathbf{x})}{\partial \mathbf{x}} \right|_{\mathbf{x}=\tilde{\mathbf{x}}} = \left. \frac{\partial F(\mathbf{x}\boldsymbol{\beta})}{\partial \mathbf{x}} \right|_{\mathbf{x}=\tilde{\mathbf{x}}} = f(\tilde{\mathbf{x}}\boldsymbol{\beta})\boldsymbol{\beta}$$

Table 2: Contrasts on School Dropout, by education of parents.

VARIABLES	(PSD)	(SSD)	(CTE)
	Primary school dropout	Secondary school dropout	Concluded tertiary education
Illiterate Parents (1 vs 0)	0.172*** (0.0104)	0.180*** (0.0114)	-0.0812*** (0.00650)
Parents with no education (1 vs 0)	0.253*** (0.00651)	0.305*** (0.00719)	-0.154*** (0.00523)

Notes: (i) Robust standard errors in parentheses; (ii) All other predictors at their mean value; (iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: PNAD-2014, own estimates.

Contrasts in tertiary education



Outline

- 1 Introduction
- 2 Data
- 3 Estimating intergenerational mobility
- 4 The Great Gatsby Curve
- 5 Linking Inequality and school dropouts
- 6 Conclusion

Conclusion

- Intergenerational persistence in education varies substantially across Brazilian states.
- Statistically significant association between intergenerational mobility and income inequality and expected earnings return to human capital.
- Confirmation of the "Great Gatsby curve" at a national level.
- Children born in families with no education are more likely to leave the school early if they are living in states where the gap between the bottom and middle of income distribution is wider.

Thank you for your attention !

More Information?

Questions?

Suggestions?

Please contact me:

Tharcisio Leone

ttleone13@zedat.fu-berlin.de