Università Commerciale "Luigi Bocconi"
PhD School

PhD program in: Public Policy and Administration

Cycle: 36^o

Disciplinary Field (code): SECS-P/06

Essays on the Public Policy of Mobility

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PhD Thesis by

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Year: 2025

Abstract

This Ph.D. thesis explores the relationship between public policy and individual mobility across space and time, with a particular focus on vulnerable populations. The three chapters aim not only to assess the effects of public policies on citizens but also to uncover the mechanisms driving these effects. Although the primary context is Brazil, the insights offered are universal. The thesis begins with an examination of historical policies, specifically the Brazilian Nationalization Campaign of the 1930s and 1940s, which sought to assimilate immigrants. It investigates how these policies influenced the human capital development of immigrants and their descendants throughout the twentieth century. The second chapter shifts to contemporary issues, analyzing the impact of poverty alleviation programs, particularly the Conditional Cash Transfer program *Bolsa Família*, on the social mobility of low-income households in Brazil. It tracks labor market outcomes for children who were beneficiaries in 2005 and examines their continued reliance on social programs in adulthood (2015-2019). The final chapter looks to the future, addressing the challenges posed by climate change to vulnerable populations. It investigates how social benefits, particularly the *Bolsa Família* program, contribute to the resilience strategies of vulnerable agricultural producers in Brazil between 2015 and 2020.

Contents

1 Once Welcomed, Then Scapegoated: The Long-lasting Consequences of Assimilation Policies in the Wake of Mass Migration 11

1.1 Introduction . . . 12

1.2 Nation-Building through Assimilation and Education . . . 14

1.3 Historical Background . . . 16

1.3.1 Migration and Assimilation Policies . . . 17

1.3.2 Reforms in the educational system . . . 19

1.3.3 Diversity Among Immigrant Communities . . . 20

1.4 Data . . . 22

1.5 Short-term effects: assimilation and education policies . . . 24

1.5.1 Empirical strategy . . . 24

1.5.2 Short-term results . . . 28

1.6 Long-term effects and intergenerational consequences . . . 32

1.6.1 Empirical strategy . . . 32

1.6.2 Immigrant characteristics . . . 34

1.6.3 Long-term, intergenerational results . . . 36

1.6.4 Long-term results for different educational levels . . . 39

1.6.5 Robustness: results for Italians . . . 40

1.7 Discussion and Conclusion . . . 42

Appendices . . . 49

A Tables and Figures **49**

2 Social Mobility and CCT Programs: the Bolsa Família Program in Brazil **55**

2.1 Introduction 56

2.2 The Bolsa Família Program 58

2.3 Measuring Social Mobility 60

2.3.1 Emancipation from Social Programs as Social Mobility 61

2.3.2 Access to Formal Labor Market as Social Mobility 62

2.4 The target population 63

2.4.1 A characterization of the target population 63

2.5 Data 66

2.6 Sample and Representativeness 66

2.6.1 The *Bolsa Família* Sample 67

2.6.2 Sample Representativeness 68

2.7 Social Mobility indicators between 2005 and 2019 69

2.7.1 Emancipation from Social Programs 70

2.7.2 Emancipation from Social Programs in the territory 72

2.7.3 Access to the formal labor market 73

2.7.4 Access to the formal labor market in the territory 78

2.7.5 Correlation between the two indicators of social mobility 78

2.8 Formal employment characteristics 81

2.8.1 Characterizing the analysis 81

2.8.2 Labor income distributions 83

2.8.3 Occupation's characteristics 84

2.9 Determinants of social mobility in the municipalities 86

2.9.1 Methodology 86

2.9.2 Results . . . 88
2.10 Conclusion . . . 92
Appendices . . . 101

B Additional Graphics and Tables 101

3 Social Policy and Resilience: A Geospatial Analysis of Climate Change's Impact on Migration Among Vulnerable Agricultural Producers 115

3.1 Introduction . . . 116
3.2 Climate Change, Social Policy and Migration . . . 118
3.2.1 The Brazilian scenario . . . 118
3.3 Data . . . 120
3.3.1 *Cadastro Único* (CadÚnico) . . . 120
3.3.2 *Declaração de Aptidão ao Pronaf (DAP/Pronaf)* . . . 121
3.3.3 *CHIRPS: Climate Hazards Group InfraRed Precipitation with Station data* . . . 121
3.3.4 *Sistema Integrado de Informações sobre Desastres* (S2iD) . . . 122
3.3.5 *Garantia Safra* . . . 122
3.3.6 *Portal da Transparência* . . . 123
3.4 Methodology . . . 123
3.4.1 Retrieving the geographical coordinates of households' addresses . . . 125
3.4.2 Associating the Precipitation Index with Household Addresses . . . 126
3.4.3 A Standardized Historical Precipitation Measure . . . 127
3.5 Migration decisions . . . 129
3.6 Empirical Strategy . . . 130
3.7 Observed units . . . 132
3.8 Summary Statistics . . . 133
3.9 Results . . . 135

3.9.1 Any Members of Agricultural Producer Households 136
3.9.2 Benefit Holders in Agricultural Producer Households 139
3.9.3 Robustness: Poisson Panel Estimation 142
3.10 Conclusion 144
Appendices 150

C Additional Tables and Figures **151**
C.1 Geocoding - Households and Individuals 151
C.2 Summary Statistics - *CadÚnico* 152
C.3 Poisson Panel Statistics 152

Acknowledgements

I would like to thank my parents, Elberto Elias and Marinete, for their unconditional support and investment, as well as my brother, Vítor, and his wife, Caroline. I will be forever grateful for your love and support.

I would like to thank Bocconi University for the opportunity to attend their Ph.D. program. Special thanks to my peers, Elena, Gian Maria, Henrique, and Paolo - there couldn't have been a better group to share the challenges of the Ph.D. I would also like to express my gratitude to the administrative assistant, Silvia Acquati, and to my Ph.D. committee: my advisor, Prof. Dr. Maristella Botticini, who was the most thoughtful and insightful mentor; my co-advisor, Prof. Dr. Paolo Pinotti; and Prof. Dr. Vincenzo Galasso.

I would like to thank the Institute for Mobility and Social Development - IMDS, Rio de Janeiro; represented by its CEO, Dr. Paulo Tafner, and former research director, Dr. Sergio Guimarães Ferreira, for our fruitful collaboration. I would also like to extend my gratitude to Prof. Dr. Valdemar Neto from the Brazilian School of Economics and Finance (EPGE) at the Getulio Vargas Foundation (FGV-Rio).

I would like to thank the United Nations University World Institute for Development Economics Research (UNU-WIDER) and the Brazilian Ministry of Science and Technology (CNPq) for providing essential resources for my research.

To all my friends, partners, and collaborators: life is much more joyful when shared with you.

"The beautiful thing about learning is that nobody can take it away from you"

B.B. King

Introduction

This Ph.D. thesis investigates the connection between public policy and individual mobility across space and time. The three chapters together provide insights into how policies affect the social, spatial, and economic mobility of individuals.

The first chapter examines the long-term consequences of immigrant assimilation policies following the Mass Migration period in Brazil. Specifically, I focus on the Nationalization Campaign led by the Brazilian government, leveraging shifts in public sentiment towards immigrant communities triggered by external events such as the Great Depression and World War II. Once seen as valued contributors to the nation, immigrant communities were increasingly targeted as undesirable. Key policy changes included the closure of hundreds of immigrant-community schools, forcing school-age children to either attend distant Portuguese-speaking schools or remain uneducated. To assess the impact of these policies, I collected and structured archival data from various administrative sources spanning the twentieth century, allowing for an examination of both short- and long-term effects on the human capital of affected immigrants and their descendants. The short-term analysis reveals significant negative effects of the Nationalization Campaign on the educational outcomes of immigrant communities at the state, municipal, and individual levels. The long-term analysis highlights the enduring consequences, showing that immigrants who were school-age during the campaign experienced worse educational attainment later in life. These losses in human capital potential persisted into the second generation, suggesting an intergenerational effect. The cultural proximity between the

immigrant's country of origin and Brazil was a key factor. These findings offer important insights for the design of immigration and education policies, emphasizing the long-lasting impact of exclusionary assimilation practices on both individual and societal levels.

The second chapter presents new evidence on the long-term relationship between social policy and mobility, focusing on determinants for low-income Brazilian households. More precisely, the first cohorts of beneficiaries of the Conditional Cash Transfer (CCT) *Bolsa Família* Program (BFP); children aged between 7 and 16 in 2005, who were tracked for over a decade, until 2019. We use individual-level administrative data to analyze two indicators of social mobility: (i) future emancipation from federal government social programs, and (ii) access to the formal labor market. We observe that formerly vulnerable children, beneficiaries of the CCT, find themselves in better socioeconomic conditions in adulthood. While 64% of them, aged between 21 and 30 years in 2019, were no longer beneficiaries of federal government social programs, 45% accessed the formal labor market at least once between 2015 and 2019. We also compare the characteristics of the formal employment they access with those of non-BFP beneficiaries during the same period. They have worse employment conditions, although better than informal positions typical of their parents. Furthermore, we investigate the association between local sociodemographic characteristics and individual social mobility. We find significant territorial heterogeneity associated with differences in better health and education infrastructures, and local economic activity.

The third chapter analyzes how social policies influence the coping strategies of vulnerable agricultural households affected by climate change. We examine how extreme drought-induced income shocks interact with Brazil's *Bolsa Família* Program to shape migration decisions among vulnerable agricultural households. Moving beyond traditional analyses based on administrative units, we introduce a novel methodology that tracks individual migration both within and between municipalities, using high-resolution precipitation data (0.05^o by 0.05^o) and geographical coordinates of households' addresses.

Analyzing a panel of millions of individuals from 2015 to 2020, we find that short-distance moves within municipalities are five times more common than long-distance migrations. Social benefits play a central role in shaping these patterns: individuals exposed to extreme droughts (top 1%) tend to use the benefits to facilitate migration, while those facing less intense but still severe droughts (top 10–1%) are more likely to remain in place, using benefits to cope locally. These effects remain consistent when restricting the analysis to benefit holders and are robust across different model specifications, including a Poisson panel model. On the other hand, the buffering role of social programs tends to keep vulnerable individuals in areas with poorer socioeconomic infrastructure compared to their migrating counterparts.

Chapter 1

Once Welcomed, Then Scapegoated: The Long-lasting Consequences of Assimilation Policies in the Wake of Mass Migration

1.1 Introduction

The Age of Mass Migration (1850-1930) has attracted growing scholarly attention, especially as immigration remains one of the most debated issues in the twenty-first century. Understanding the patterns of migration, particularly how millions of Europeans and Asians settled in the Americas, offers valuable insights into many of the challenges migrants and host societies face today. This historical context is particularly relevant from a policy perspective, as the debates over integration and assimilation continue to shape immigration policies in the present day (OECD, 2017).

This research examines the lingering consequences of assimilation policies following Mass Migration, with a particular focus on the experiences of immigrants. More specifically, how changes in the educational system impacted the human capital development of school-age immigrants and their descendants. To investigate these effects, I exploit the timing of key historical events — namely the Great Depression and World War II — and concurrent shifts in Brazilian government policies, including immigration regulations. By comparing groups of states, municipalities, and individuals, I assess the varying effects of these policies. These groups are distinguished based on the historical presence of immigrants from specific origins and the timing of their arrival in Brazil.

In the short term, the assimilation policies of the Nationalization Campaign (NC) had significant negative effects on the number of private schools (a proxy for immigrant-community schools), student enrollment, and teacher employment at the state level. As a result, municipalities with higher concentrations of targeted immigrant populations and a greater number of schools in rural areas - typically where immigrant communities were located - experienced lower literacy rates and reduced completion rates for both primary and secondary education between the 1940 and 1950 Censuses. Additionally, immigrant workers faced higher unemployment rates, while the participation of immigrant teachers in local labor markets increased after the implementation of the NC.

In the long term, immigrants of school age during the Nationalization Campaign were compared to a similar group of immigrants who arrived in Brazil after the campaign. At the time of their arrival, there were no significant differences between the two groups. Results from individual-level analyses using data from the 1991, 2000, and 2010 Censuses show a significant negative effect of exposure to the Nationalization Campaign on the educational attainment of both targeted immigrants and their descendants, suggesting the presence of an intergenerational mechanism.

A key element of the identification strategy is the variation in cultural proximity between immigrant groups from different origins, as observed in Fouka et al. (2021), Tabellini (2019), and Lecce et al. (2022). The Nationalization Campaign sought to promote a specific vision of nationalism, centered on the Portuguese language and Catholicism. Historical evidence suggests that immigrants from more culturally distant backgrounds faced greater challenges in adapting to the imposed norms, sometimes resulting in backlash. For example, Japanese and German immigrant communities experienced more severe consequences from the assimilation policies than Italian communities, particularly in the cultural and educational dimensions.

Similar to the Brazilian Nationalization Campaign, most nation-building processes throughout history implemented assimilation policies, with educational system reforms playing a central role in these efforts (Alesina et al., 2021). Authoritarian regimes, in particular, had strong incentives to promote such policies,[1] including measures aimed at fostering trust between minority groups, the broader population, and national institutions (Alesina and La Ferrara, 2002). However, cultural persistence remained a key feature of this process (Giuliano and Nunn, 2021; Bisin and Verdier, 2000; Bisin et al., 2021; Carvalho and Koyama, 2016). The analysis of the Brazilian case contributes to the broader understanding of these processes, particularly from the perspective of immigrant experiences.

[1] "... the diminishing returns to controlling the citizenry through force increases the marginal return to indoctrination." (John R. Lott, 1999)

As a result, this research contributes to the growing body of literature on assimilation policies within the context of educational system reforms, such as the imposition of a national language of instruction (Fouka, 2020; Lleras-Muney and Shertzer, 2015; Clots-Figueras and Masella, 2013; Eriksson, 2014). Unlike previous studies, however, the Brazilian case provides a unique opportunity to examine these reforms within the broader framework of the Nationalization Campaign, which led to the closure of hundreds of immigrant community schools. During Getúlio Vargas's dictatorship, government policies forced thousands of immigrants and their descendants either to leave the educational system or struggle to adapt to the public one. Furthermore, changes in cultural and religious traits are connected with the differences in educational attainment across generations (Botticini and Eckstein, 2012; Squicciarini, 2020; Becker and Woessmann, 2009). Finally, it contributes to the intergenerational analysis of educational inequality (Abramitzky et al., 2021; Torche and Ribeiro, 2010; Bloome et al., 2018).

The remainder of the paper is organized as follows. Section 1.2 presents how assimilation policies are connected to nation-building processes by reforms of the educational system. Then, Section 1.3, the Brazilian historical context. Section 1.4, the data used for the analysis. Section 1.5 the short-term analysis and results. Section 1.6, the long-term, intergenerational analysis and results. Finally, Section 1.7 a discussion about the findings and conclusions.

1.2 Nation-Building through Assimilation and Education

Demographic considerations in the founding of the *polis* have been a subject of interest since the time of Plato and Aristotle.[2] The degree of similarity among citizens is often linked to social cohesion and institutional stability. In fact, Plato suggests in the *Republic*

[2]For instance, in the *Laws*, the *Republic*, and the *Statesman*.

that the *polis* should begin by shaping the education of children. Not surprisingly, most nation-building processes throughout history have systematically relied on assimilation policies (Hall, 1992; Hobsbawm, 1992), with educational system reforms playing a central role (Alesina et al., 2021). Newly formed national governments, particularly authoritarian ones, have strong incentives to indoctrinate the population (John R. Lott, 1999), fostering trust in national institutions and among citizens (Alesina and La Ferrara, 2002).

Cultural changes, however, are complex processes characterized by persistence (Giuliano and Nunn, 2021). In some contexts, citizens may even resist these changes, even in areas like education (Carvalho and Koyama, 2016). The degree of similarity between mainstream culture and that of minority groups plays a crucial role in such resistance (Fouka et al., 2021; Tabellini, 2019; Lecce et al., 2022). Moreover, genetic proximity can also influence cultural dynamics and play a role in understanding processes such as immigrant integration (Arbatli et al., 2020; Spolaore and Wacziarg, 2009). In cases of forced assimilation, genetic and cultural similarities may act as mediating factors, helping to explain the mechanisms through which mainstream policies targeted minority communities.

The Brazilian Nationalization Campaign was driven by assimilation policies targeting immigrant communities, with the goal of strengthening the national government through the promotion of a homogeneous sense of nationalism, in contrast to the previously fragmented political landscape. Central to these efforts were reforms in the educational system, including a ban on immigrant community schools. The significance of this analysis lies in understanding how these policies affected the human capital development of different groups across generations (Becker and Tomes, 1986; Cunha and Heckman, 2007). First, because the human capital linked to immigrant settlements has been shown to have significant effects on economic development (Rocha et al., 2017; Becker et al., 2011). Second, because intergenerational cultural transmission also plays a crucial role in human capital accumulation (Bisin and Verdier, 2000; Bisin et al., 2021). Ultimately, this analysis addresses differences in life trajectories, particularly in terms of intergenerational social

mobility and inequality (Abramitzky et al., 2021; Torche and Ribeiro, 2010; Bloome et al., 2018).

Similar to other nation-building processes and immigrant assimilation policies—such as the 1920s immigrant quotas in the U.S. and efforts across many European countries—Brazil implemented restrictive immigration measures alongside aggressive assimilation policies. What sets the Brazilian case apart is the specificity and rigorous enforcement of these measures under the Nationalization Campaign, spearheaded by the dictatorial regime of Getúlio Vargas. The intensity and scope of Brazil's approach would be expected to have lasting impacts on human capital formation.

1.3 Historical Background

The Mass Migration of the nineteenth and twentieth centuries brought a diverse range of ethnic groups to the Americas (Acosta Arcarazo, 2018; Sánchez-Alonso, 2019; Fitzgerald and Cook-Martín, 2014). Brazil alone received nearly 5 million European and Asian immigrants between 1819 and 1947, making it one of the largest migration episodes in modern history (Balderas and Greenwood, 2010). However, during the first half of the twentieth century, both external and internal contexts underwent dramatic changes. The Great Depression and the World Wars reshaped the economic and political landscape, and shifts in public sentiment toward immigrant communities led to a reversal of attitudes. Immigrants who had once been welcomed were suddenly scapegoated for the political and economic crises.

Immigrant groups settled in the economically developing regions of southern Brazil, establishing largely autonomous communities, particularly in remote rural areas. They were instrumental in settling the western parts of southern states such as São Paulo and Santa Catarina. One of the key institutions of these communities was their schools, which served as the primary sites for transmitting the original language and cultural heritage

to new generations. This was especially important, as the Brazilian educational system hardly reached these rural areas (Kreutz, 2010). As a result, immigrant communities were able to preserve and pass on their cultural heritage for decades, including their language, religion, and traditions. For example, the 1940 Brazilian Census recorded 644,255 German-speaking and 458,093 Italian-speaking inhabitants. Differences in language and cultural traits were often seen as key factors influencing the ease or difficulty of integration into Brazilian society.

In the aftermath of the First World War, however, the situation shifted as in most Western countries. Concerns about immigrants and their communities began to grow among the Brazilian population. In response to this public scrutiny, the Brazilian government began to introduce changes to immigration laws, including quotas, and implemented assimilation policies, particularly within the educational system. Initially, some local restrictions were imposed on immigrant communities, but these were rarely enforced due to the fragmented political landscape at the time. As a result, Kreutz (2000) estimates that in the 1930s, there were still approximately 2,500 immigrant community schools in Brazil, out of a total of 35,247 schools (7%). These included 1,579 German, 396 Italian, 349 Polish, and 178 Japanese schools.

In the 1930s, a political revolution brought Getúlio Vargas to power, and after a coup d'état in 1937, he consolidated a dictatorial regime in Brazil. This period was marked by the strengthening of national institutions, with significant investments in state capacity, increased government intervention, and restrictions on individual liberties.

1.3.1 Migration and Assimilation Policies

The Great Depression led to an unprecedented economic crisis. Brazil's economy, heavily dependent on coffee exports, saw the value of coffee drop by 70% during this period. In response, Vargas, like many other politicians, began to blame immigrants for the economic downturn, accusing them of taking jobs from "Brazilians". Immigrants, who had once been

welcomed as a labor force to replace enslaved workers, became scapegoats for the political and economic turmoil Brazil faced in the 1930s and 1940s.

This led to significant changes in immigration laws during the 1930s. The first major step was the Presidential Decree No. 19,482, issued on December 12, 1930, known as the "Two-Thirds Act". This law restricted the entry of "third-class" foreigners into Brazil and mandated that national companies or commercial firms employ at least two-thirds Brazilian workers. In 1934, immigration policy became even stricter with the adoption of immigrant quotas. These quotas imposed nationality-based limits on the number of foreigners allowed to enter Brazil. According to the new legislation, only the equivalent of 2% of the immigrants from each nationality over the previous 50 years could be allowed to settle in the country. As a result, immigrants from countries with long-standing ties to Brazil, such as Italy and Portugal, were granted higher quotas.

This process reached its peak in 1938, when the Brazilian dictatorship began to implement a series of nationalization policies and impose severe restrictions on immigrants. The Presidential Decree No. 3,010, issued on August 20, 1938, mandated that the number of native Brazilians should exceed the number of foreigners in regions with significant immigrant populations. It also stipulated that newly founded settlements must be ethnically diverse, meaning they should include both immigrants from various nationalities and Brazilians. As a result, communication within these settlements could only occur in Portuguese, and Brazilians were encouraged to move to these immigrant communities.

After this period, much of the immigration policy remained unchanged, meaning that immigrants with similar characteristics continued to arrive in Brazil. I use this continuity to compare earlier immigrant groups, who were subject to the Nationalization Campaign, with those who arrived later in order to assess the effects of the policy. The year 1963 is chosen as the upper limit for this comparison, as the military coup of 1964 brought the armed forces to power and led to significant changes in the institutional arrangements that characterized the previous period.

1.3.2 Reforms in the educational system

Vargas sought to unify the Brazilian population around his national government, which was built on an ideal of national citizenship. As part of this effort, one of the key instruments of the Nationalization Campaign was the reform of the educational system. The campaign accelerated a process that had begun in 1931 with the Francisco Campos Reform and culminated in the Capanema Reform of 1942.[3] More specifically, the campaign led to the closure of hundreds of immigrant community schools, mandated the exclusive use of Portuguese in schools, and restricted immigrants' access to the educational labor market. [4] Over time, it also banned foreign-language newspapers, radio broadcasts, books, and even religious and cultural ceremonies in any language other than Portuguese.

Historical accounts suggest that the dictatorial regime was able to brutally enforce assimilation policies, leading to lasting consequences for the population, even after Vargas's dictatorship ended in 1945. Articles in local newspapers from the time, along with retrospective interviews, provide evidence of the use of force by military and public agents to ensure strict compliance with the nationalization decrees.[5] In the following years, the rhetoric surrounding the Second World War also played a role in justifying actions against immigrant communities and their schools.[6] An official statement by a prominent army general at the time captures this sentiment: "It is better to raise ignorant people than traitors.".[7] Immigrant communities, particularly Italian, German, and Japanese, who had the largest number of immigrant community schools in the 1930s were especially targeted (Kreutz, 2000). Figure A.1 in Appendix A shows a newspaper from the city of Caxias do

[3]The Francisco Campos and Capanema Reforms not only altered the structure and content of the Brazilian educational system, prioritizing patriotism and vocational subjects, but also established a new institutional framework, including the creation of the National Board of Education.

[4]Starting with Decree No. 406 of May 1938, the Nationalization Campaign explicitly prohibited immigrant community schools, culminating in Decree No. 1545 of August 1939.

[5]Kreutz (2010) provides evidence of physical harm and arrests of principals and teachers who defied the campaign's directives, alongside increased activity by local educational inspectors.

[6]In 1942, Brazil entered the war against the Axis powers.

[7]General Meira de Vasconcellos: "Antes criarmos ignorantes que criarmos traidores" cited in Bethlem. H. 1939. *O Vale do Itajaí. Jornadas de Civismo.*

Sul, state of Rio Grande do Sul, reporting the 1942 prohibition of German, Italian, and Japanese language use in public spaces.

Ultimately, the educational system reforms led to a significant reconfiguration of the school system in these regions, replacing immigrant community schools with standard public schools. While immigrant community schools typically provided secular education, Brazilian public schools were hindered by inadequate infrastructure and an outdated educational system (Kreutz, 2000). As a result, we would expect that the assimilation policies had both quantitative and qualitative negative effects on the learning outcomes of immigrant children (Squicciarini, 2020).

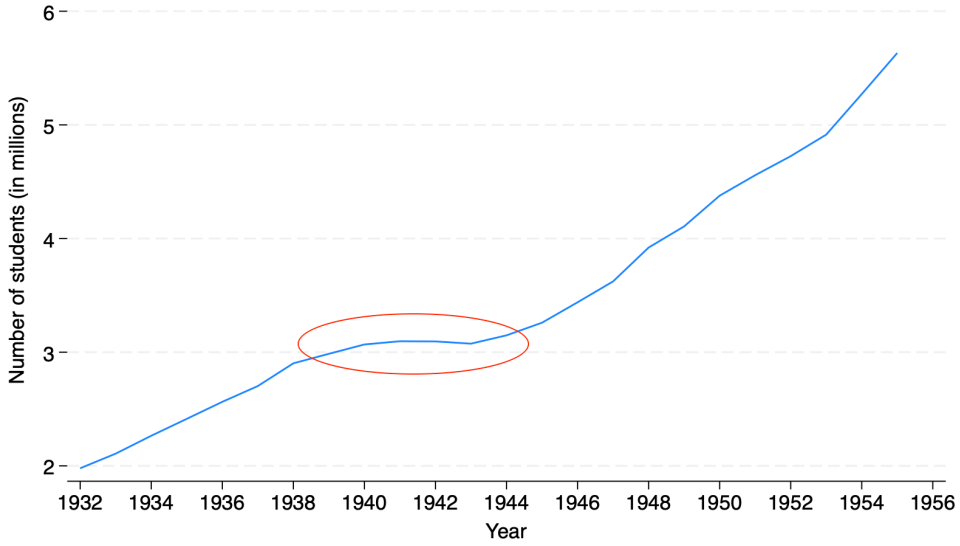
The historical accounts are corroborated by data. Figure 1.1 shows the number of primary education students in Brazil from 1932 to 1955. A clear structural break is evident in the series during the period of the Nationalization Campaign, between the late 1930s and early 1940s, when the steady growth in student enrollment halted and flattened. This disruption was highlighted by Kang (2017) in his analysis of educational outcomes from 1930 to 1964. However, the exact causes of this disruption were unclear. I argue that a key factor was the policies implemented during the Nationalization Campaign.

1.3.3 Diversity Among Immigrant Communities

A key immigrant institution affected by the Nationalization Campaign was the network of community schools, although not all immigrant groups established such institutions. Italians, Japanese, and Germans—who were not only among the largest immigrant groups in Brazil but also traditionally established community-based schools in their settlements—were specifically targeted by the Nationalization Campaign due to their associations with the Axis powers during World War II.

However, historical evidence suggests that they were not the only ones. Immigrant communities of Slavic origin, for instance, also faced significant consequences from the assimilation policies. Given the widespread enforcement of the Nationalization Campaign, I

Figure 1.1: Number of students in primary education - Brazil



Source: Data from the very first annual reports on the educational system published by the Brazilian Ministry of Education (INEP/MEC) and compiled by the Brazilian Institute of Geography and Statistics (IBGE).

categorize immigrants by their origin to assess the potential impact of the policy on education and religious practices. Immigrants from Southern European countries — namely Italy, Portugal, and Spain — were less likely to be affected by the assimilation policies, while those from non-Southern European countries, particularly Germany, Japan, and Poland, were more severely impacted.

Table 1.1 shows that only 16% of Italian and and 21% of Spanish immigrant households preferred to speak their mother tongues at home, compared to 58% of German and 85% of Japanese households. The enforcement and effects of assimilation policies were mediated by factors such as cultural proximity. Communities that were able to more quickly adapt to "Brazilianness" - for instance, by speaking Portuguese, practicing Catholicism, and adopting other cultural norms - experienced less disruption than those from less culturally similar backgrounds.

Table 1.1: Immigrant households use of mother tongue at home - 1940 Brazilian Census

Country of Origin	Preferably spoke mother tongue
Japanese	**85%**
German	**58%**
Russian	53%
Polish	48%
Austrian	42%
Spanish	21%
Italian	**16%**

Source: Author with data from the Brazilian 1940 Census.

1.4 Data

This research uses historical administrative data for individual-, municipality-, and state-level analyses. I begin by combining data from multiple sources across the twentieth century to create a panel data set for Brazilian states and municipalities. Demographic and socioeconomic information for the early twentieth century comes from the 1940 and 1950 Brazilian Censuses, which provide data on age, sex, citizenship status, place of origin, and education at the state and municipal levels. Additionally, I incorporate educational data from the first half of the twentieth century, drawn from the earliest publications of the Brazilian Ministry of Education and Health, as well as the Brazilian National Institute of Statistics (IBGE). Some of these documents were personally scanned and organized from historical archives. This dataset includes information on the number of schools, students, school staff (disaggregated by origin), and student outcomes at the state level, covering the period from 1932 to 1955.[8]

Although specific data on community-based immigrant schools is not available, I leverage the fact that these schools were predominantly private institutions (Kreutz, 2000) to examine variations in private school outcomes in areas with high concentrations of immigrants. This serves as a proxy for changes in immigrant community schools. Additionally,

[8]The data from the Brazilian Ministry of Education and Health, "Sinopse Regional do Ensino Primário Fundamental Comum - Dados Retrospectivos 1940-1957", provides information through 1957. However, due to missing or preliminary data for 1956 and 1957, these years are excluded from the analysis.

these schools were largely located in rural areas, which is an important contextual factor. Given the focus of the Nationalization Campaign on immigrant schools, we would expect the most significant effects to be observable in the data on private schools in rural regions of Southern Brazil. For example, between 1940 and 1947, a period associated with the Nationalization Campaign, there was a net decrease of 2,416 private school units. This figure closely aligns with the estimated 2,500 immigrant community schools identified by Kreutz (2010) in the 1930s. We infer that the schools that closed during this period were, in fact, the immigrant community schools that were shut down as part of the Nationalization Campaign.

Another source of data comes from the municipality-level information in the 1940 and 1950 Brazilian Censuses. Since these censuses are only available as scanned pages, I first applied Optical Character Recognition (OCR) algorithms to extract the relevant data. I then compiled a municipality-level dataset for both years. Given that the Nationalization Campaign primarily targeted immigrant communities, I exploit the differences in characteristics between the 1940 and 1950 censuses to estimate the local effects of nationalization.

Finally, I use three individual-level data sources. The first consists of scanned passenger lists for ships arriving at the Port of Santos[9] between 1930 and 1963. I randomly selected approximately 100 lists, balanced across years, and extracted information on immigrants at the time of arrival, including age, literacy, and occupation. The second source is the work card order registration sheets for the state of Rio Grande do Sul from 1930 to 1944, which include immigrant requests for accreditation as workers, detailing age, origin, and occupation.[10] Lastly, I use individual-level data from the 1991, 2000, and 2010 Brazilian Censuses to examine the long-term characteristics of immigrants who arrived between 1930 and 1963. Specifically, I utilized the 10% representative sample of individuals and

[9]The main port of São Paulo, where most immigrants arrived in Brazil. See Figure A.2 in Appendix A for an example.

[10]See Figure A.3 in Appendix A for an example.

households from the Census, provided by the *Centro de Estudos da Metrópole* (CEM) at the University of São Paulo (USP).

1.5 Short-term effects: assimilation and education policies

The Nationalization Campaign encompassed structural changes to the Brazilian educational system as part of a broader set of assimilation policies targeting immigrant communities. The closure of hundreds of immigrant community schools not only disrupted individual educational processes but also affected ties to the cultural heritage of immigrants' home countries. I begin by comparing trends in educational outcomes across Brazilian states with historical immigrant settlements or not, focusing on the specific effect of the Nationalization Campaign on targeted immigrant communities. Next, I examine changes in educational outcomes at the municipal level using data from the 1940 and 1950 Censuses to assess local effects of the policy. Finally, I analyze individual participation in the formal labor market in the state of Rio Grande do Sul, with particular attention to the involvement of teachers and unemployed workers.

1.5.1 Empirical strategy

I start by using a difference-in-differences strategy to examine the dynamic treatment effects of the Nationalization Campaign on educational outcomes at the state level. This initial analysis rests on the assumption that, prior to the campaign, Brazilian states exhibited similar trends in educational outcomes. However, states with a high concentration of non-Southern European immigrants were differentially impacted by the Nationalization Campaign, particularly through the closure of immigrant community schools.

Figure 1.2 presents pre- and post-treatment trend estimations for the number of private

schools, used here as a proxy for immigrant community schools.[11] The analysis compares two groups of states: those with a higher concentration of non-Southern European immigrants, who were targeted by the Nationalization Campaign, and others. The periods of dynamic treatment are linked to changes in the federal government, as outlined by Kang (2017). Although the trends are not perfectly parallel, Figure 1.2 shows that both groups exhibited similar upward trends prior to the Nationalization Campaign. Between 1938 and 1945, the trend sharply declined, but only in the states with a high presence of non-Southern European immigrants. Following the first democratic government after Vargas' dictatorship (Post-I), non-targeted states experienced a boom in the number of private schools. By the second post-period (Post-II), however, both groups of states returned to the upward trends seen before the Nationalization Campaign.

The short-term effects of the Nationalization Campaign on educational outcomes are estimated using a state-level panel structure, based on the following reduced-form equation:

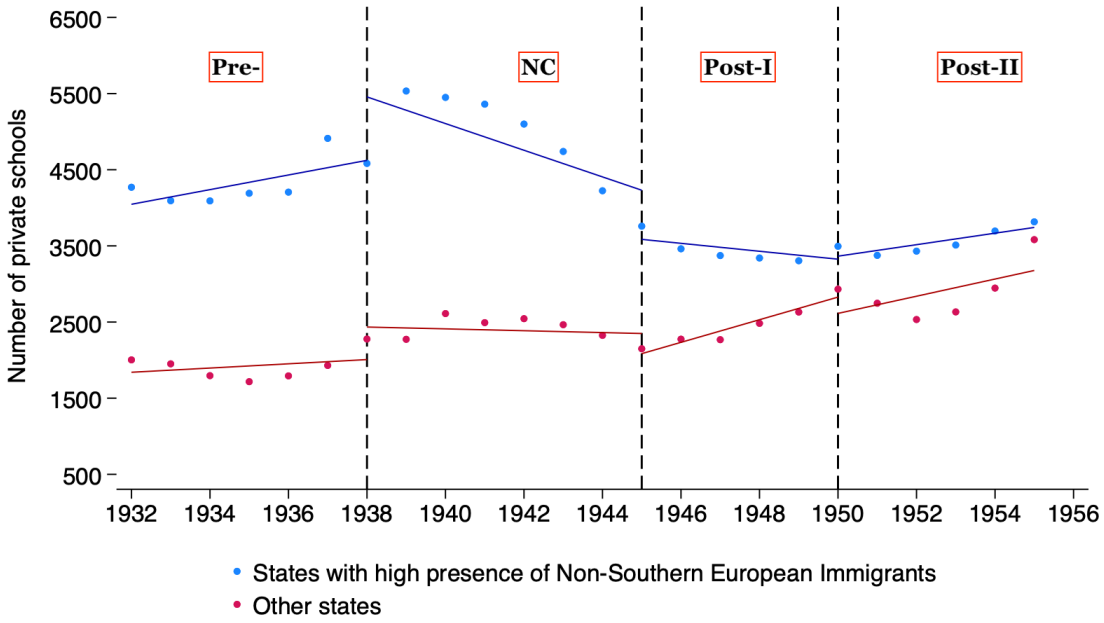
$$\begin{aligned}\text{Educ.}_{s,t} = \alpha &+ \omega_1 \left(\text{Non-Southern European Immigrants}_{s,1940} * \mathbb{1}_{1938-1945}\right) + \\ &+ \omega_2 \left(\text{Non-Southern European Immigrants}_{s,1940} * \mathbb{1}_{1946-1950}\right) + \\ &+ \omega_3 \left(\text{Non-Southern European Immigrants}_{s,1940} * \mathbb{1}_{1951-1955}\right) + \\ &+ \rho_s + \lambda_t + \epsilon_{s,t}\end{aligned}$$

where, *Educ.* is the educational outcome variables observed in state s and year t. The term *Non-Southern European Immigrants* can be both the log [12] number of non-Southern European immigrants population in state s or a dummy for states that historically received

[11] I use data on private schools as a proxy for immigrant community schools, since the latter were a specific type of private school. They were governed by similar legislation and had strong ties to religious and heritage institutions (Kreutz, 2000).

[12] In this setting, logs are preferred given both the skewed distribution of immigrant populations and the historical policy that was triggered more by large absolute clusters of foreigners.

Figure 1.2: Trends pre- and post-treatment: number of private schools in Brazilian states 1932-1955



Source: Data from the very first annual reports on the educational system published by the Brazilian Ministry of Education (INEP/MEC) and compiled by the Brazilian Institute of Geography and Statistics (IBGE). Immigrants from non-Southern European origins are Asians and Europeans not from Italy, Spain, and Portugal; mainly Japan, Germany, and Poland.

immigrants from those origins[13], in the 1940 Census.[14] The terms $\mathbb{1}_{1938-45}$, $\mathbb{1}_{1946-50}$, and $\mathbb{1}_{1951-55}$ are indicator variables for the dynamic effects[15] of the assimilation policy during and after the Nationalization Campaign. Thus, ω_1, ω_2, and ω_3 are estimates of the parameters of interest, relating the post-treatment period with being an affected unit. ρ_s are state fixed-effect dummies, λ_t are year-fixed effect dummies, and $\epsilon_{s,t}$ the idiosyncratic error clustered at the state level.

In the municipal-level analysis, I compare differences in educational outcomes between the 1940 and 1950 Brazilian Censuses for municipalities in the State of Rio Grande do Sul. The reduced-form estimations capture the relationship between changes in the local educational system and the presence of immigrant communities targeted by the Nationalization Campaign. Since immigrant communities were predominantly located in rural, isolated areas of the territory (Kreutz, 2000), I use the number of schools in rural areas, only available in the 1940 Census, as follows:

$$\begin{aligned}\Delta\, y_{m,1950-1940} = \alpha + \beta\ (\text{Non-Southern European Immigrants}_{m,1940} * \text{Rural Sch.}_{m,1940}) + \\ +\ \delta\ (\text{Non-Southern European Immigrants})_{m,1940} + \\ +\ \rho\ (\text{Rural Schools})_{m,1940}\ + X'_{m,1940}\,\Lambda + \epsilon_{m,t}\end{aligned}$$

where, Δy represents the first difference in educational outcomes observed in municipality m between the 1950 and 1940 Censuses. The term *Non-Southern European Immigrants* refers to the log number of non-Southern European immigrants in municipality m in the 1940 Census. *Rural Schools*, the number of schools in rural areas as the 1940 Census. The parameter of interest β captures levels of the treatment effect, associating the high

[13]States with a significant population of non-Southern European immigrants include Rio Grande do Sul, Paraná, Santa Catarina, São Paulo, Mato Grosso, Distrito Federal (Capital), Rio de Janeiro, Minas Gerais, and Espírito Santo.

[14]The 1940 Census provides immigrant information the closest in time to the NC, and data collection was primarily conducted in the pre-treatment period.

[15]The effect of the Nationalization Campaign is considered a dynamic treatment, as the policy implementation evolved over time. See Wolfers (2006) for a similar setting.

presence of non-Southern European immigrants and rural schools with changes in local educational outcomes. X' is a vector of municipal characteristics in the 1940 Census, and $\epsilon_{m,t}$ the robust, idiosyncratic error term.

The dependent variable is specified in first differences to capture the change in educational outcomes over time, specifically between the 1940 and 1950 Censuses. Taking the first difference allows for the estimation of the effect of the Nationalization Campaign on educational outcomes by focusing on within-municipality changes, thereby controlling for any time-invariant unobserved heterogeneity at the municipality level. This approach emphasizes how changes in the educational system, such as school closures or changes in teacher numbers, correlate with the presence of immigrant communities targeted by the Nationalization Campaign, while accounting for baseline differences in educational conditions.

1.5.2 Short-term results

The short-term results are presented from macro- to micro-level analyses. They provide robust estimates, or at least correlations, of the relationship between exposure to the Nationalization Campaign (i.e., being an immigrant targeted by the policy) and educational outcomes at the state, municipal, and individual levels.

Table 1.2 presents the results of the difference-in-differences estimations at the state level. The coefficient on the interaction term between the indicator for the Nationalization Campaign period (1938–1945) and the group of states with a high prevalence of non-Southern European immigrants is shown in four columns for each educational outcome. The odd-numbered columns (first, third, and fifth) use a dummy variable for the treated states - those with a high presence of non-Southern European immigrants - while the even-numbered columns use the log of the number of targeted immigrants as a continuous variable in the state population.

The interaction between targeted states and the post-treatment period indicators

shows a significant negative association with the number of students, private schools, and teachers.[16] As the treatment accumulated, with more schools being closed over time, the magnitude of the effect increased. Consequently, the greatest differential effects are observed in the period immediately following the Nationalization Campaign (1946-1950), compared to states in the control group; see Figure 1.2. In the final period, Post-2, it appears that the treatment reached its peak and began to fade, with trends indicating a return to pre-treatment levels. These results are consistent with historical evidence suggesting that the Nationalization Campaign had a negative impact on educational outcomes in states with a high presence of non-Southern European immigrants.

Table 1.2: Effects of the Nationalization Campaign on educational outcomes given the prevalence of non-Southern European immigrants in Brazilian States

Variables in log number of	Students		Private Schools		Teachers	
Type of treatment	Binary	Continuous	Binary	Continuous	Binary	Continuous
Interaction of Treated States *						
* $\mathbb{1}_{1938-1945}$ (NC)	-0.090**	**-0.021***	-0.617**	**-0.124***	-0.112*	**-0.034****
* $\mathbb{1}_{1946-1950}$ (Post-I)	-0.156*	**-0.045*****	-0.716**	**-0.169****	-0.118	**-0.047****
* $\mathbb{1}_{1951-1955}$ (Post-2)	-0.130	**-0.034***	-0.678**	**-0.159****	-0.144	**-0.046***
N of States	528	528	528	528	528	528
N of unique states in the panel	22	22	22	22	22	22
State and Year Fixed Effects	X	X	X	X	X	X

Source: Author. Results of difference-in-differences estimates with dynamic treatment. The treated states are those with high prevalence of non-Southern European immigrants, given by the log number of immigrants minus the number of Portuguese, Spanish, and Italian immigrants in the population of a state in the 1940 Brazilian Census. Treatment periods of time are historically defined as federal government changes. The pre-period represents the first republican rule of Getúlio Vargas; the Nationalization Campaign period, his rule as a dictator; Between 1946 and 1950, the rule of elected president Gaspar Dutra; then, Vargas again as elected president between 1951 and 1955 (although he died in 1954 and his vice took office for 1955). Educational outcome dependent variables in log number of the outcomes: private schools are used as proxies for immigrant community schools. *** p<0.01, ** p<0.05, * p<0.1

Next, I examine the short-term evidence at the municipal level using data from the 1940 and 1950 Censuses to assess how changes in educational outcomes are associated with

[16]The pre-treatment period (1932-1937) corresponds to the first republican term of Getúlio Vargas; the Nationalization Campaign period (1938-1945) corresponds to his dictatorship; the period between 1946 and 1950 marks the presidency of elected president Gaspar Dutra; and between 1951 and 1955, Vargas was re-elected president, though he passed away in 1954, and his vice president assumed office for the remainder of the term.

the presence of immigrant communities within each municipality. I exploit the variation in the origins of immigrant communities across municipalities in the State of Rio Grande do Sul. Additionally, since most immigrant community schools were located in rural areas, exposure to the Nationalization Campaign is defined by the interaction between the presence of non-Southern European immigrants and the number of rural schools.

Table 1.3 presents the results of OLS estimations with differences in local characteristics between the 1950 and 1940 Censuses as the dependent variables. The coefficient on the interaction term between the number of rural schools and the log of non-Southern European immigrants shows a negative and significant association with educational outcomes. Consistent with the decrease in the number of students, teachers, and schools observed in Table 1.2, we find a significant decline in the proportion of individuals who were literate, completed primary education, and attained high school education in municipalities more exposed to the Nationalization Campaign's treatment effect between the 1950 and 1940 Censuses.

Table 1.3: Changes in characteristics of municipalities between the 1950 and 1940 Census - State of Rio Grande do Sul

Δ between 1950 and 1940 Census (N of)	Literate	Primary School	High School
Inter. Rural Schools. * Non-Sou. Eur. imm.	**-0.314*** **	**-0.438*** **	**-0.119*** **
Non-Southern European immigrants	7.086***	7.678***	1.807***
Schools in rural areas	379.189***	518.163***	136.898***
N of observations	86	86	86
Controls at the municipal level	X	X	X
Mean Dependent Variable	4,837	5,066	547

Source: Author with data from the Brazilian 1940 and 1950 Census. Ordinary Least Square results at the municipal level. Controls at the municipal level include share of economic activity by sector and share of black and brown population. There were 88 municipalities in the state of Rio Grande do Sul at the time of the 1940 Census. However, two had missing information on rural schools. *** p<0.01, ** p<0.05, * p<0.1.

Finally, I exploit another source of information at the individual level, the work card registration sheets for the state of Rio Grande do Sul between 1930 and 1944. Any worker who was ever registered by an employer would have to request an accreditation. The

registration sheets contained information such as age, nationality, and occupation. There were 1,207 records of workers from German (857) and Italian (350) origins between 1930 and 1944. Approximately 75% of those sheets were positions held at the state capital, Porto Alegre.

Table 1.4 presents the characteristics of work card requests by the origin of immigrant workers before and after the Nationalization Campaign period. Before 1938, only 3% of immigrants were registered as unemployed. However, during the Nationalization Campaign, the unemployment rate among immigrant workers in the State of Rio Grande do Sul increased to 18%. The increase was especially pronounced among Italian workers, with 26% of the entries indicating an unemployment status. Similarly, there was a rise in the participation of foreign teachers, with an average increase of 6 percentage points. The closure of immigrant community schools likely contributed to this higher participation of immigrant workers in the local labor market. Finally, there was an overall decline in the number of work card requests by foreign nationals after 1938.

Table 1.4: Requests for work card registration by immigrants in the State of Rio Grande do Sul between 1930 and 1944

Characteristics	Unemployed		Teachers		Total requests (N)	
Time	Pre-1938	Post-1938	Pre-1938	Post-1938	Pre-1938	Post-1938
Germans	3%	15%	0%	7%	467	390
Italians	3%	26%	1%	3%	209	141
Total	3%	18%	0%	6%	676	531

Source: Author with data from the DRT/RS (*Acervo da Delegacia Regional do Trabalho do Rio Grande do Sul*) made available by the *Núcleo de Documentação Histórica – Professora Beatriz Loner, Universidade Federal de Pelotas*.

1.6 Long-term effects and intergenerational consequences

Similar to assimilation policy interventions within the educational system of other contexts (Carvalho and Koyama, 2016; Fouka, 2020; Lleras-Muney and Shertzer, 2015), the Brazilian Nationalization Campaign had a significant negative effect on a generation of school-age immigrant children and their families. Since inequality over generations and inequality between families are closely related (Becker and Tomes, 1986), we can expect long-term effects of the assimilation policy. The Nationalization Campaign not only disrupted the education of school-age immigrants at the time, but also had lasting impacts on their life trajectories. As a result, we can observe long-term differences in educational outcomes between immigrant children affected by the Nationalization Campaign (1938–1945) and similar immigrant groups who were not subjected to the assimilation policy during their school-age years.

To analyze long-term effects, I use individual-level data from the 1991, 2000, and 2010 Brazilian Censuses. Beginning in 1991, the Census collected information on both the origin of immigrants and the exact year of their arrival in Brazil, which is a crucial variable for the empirical strategy. The household datasets allow us to identify the second generation - children of the immigrants - who reside in the same household as the immigrants themselves at the time of the Census survey for intergenerational analysis.

1.6.1 Empirical strategy

At the time of the Nationalization Campaign, most immigrant community schools were primary education institutions. More frequently, students who attended those had age ranging between 7 and 12. I observe school-age immigrant children at the time of the Nationalization Campaign decades later, in the 1991, 2000, and 2010 Brazilian Census by

age-range groups. I take as a lower bound children age 7 in 1945 and as upper bound those with age 12 in 1938. For instance, the group of children subject to the Nationalization Campaign can be observed in the 1991 Census by the immigrant individuals with age ranging from 53 (5 years old in 1945) to 65 (12 years old in 1938).[17]

This empirical strategy relies on the hypothesis that groups of immigrants who arrived before 1945, then possibly subject to the policy treatment, constitutes a similar group that of those who arrived after 1945, not subjected to the Nationalization Campaign. The logic is that groups of individuals with same ages and country of origin are comparable units, given no previous differences. They attended similar schools, as the immigrant community schools in Brazil offered the same kind of secular education found in their countries of origin. They also came from families who migrated at some point, and immigration laws at the time permitted entry primarily to groups with similar backgrounds between 1930 and 1960. Therefore, we can take those who arrived after 1945 as a control group of those who arrived earlier. They should represent a potential outcome for the immigrants, had they not been subject to the Nationalization Campaign. Again, I use the historical evidence and cultural proximity to analyze differential effects by country of origin.

First, I use changes in Brazilian immigration legislation to define the group of immigrants subject to the Nationalization Campaign as those who arrived between 1930 and 1945.[18] The second group consists of immigrants who arrived between 1946 and 1963. Thus, the sample includes immigrants of school age (7 to 12 years) and their household relatives in the 1991, 2000, and 2010 Brazilian Censuses. The reduced-form effect of exposure to the Nationalization Campaign on immigrants and their descendants is estimated as follows:

$$y_{i,t} = \alpha + \beta \; \mathbb{1}_{1930-1945} + X'_{i,t} \, \Gamma + \delta_m + \epsilon_{i,t}$$

where y represents educational outcomes for the immigrant or their descendants i in the

[17] See Table A.1 in Appendix A for all the age brackets.
[18] See Section 1.3 for detailed information.

1991, 2000, or 2010 Census year t. The indicator $\mathbb{1}1930 - 1945$ is a dummy variable for immigrants who arrived in Brazil before 1945, thus subject to the Nationalization Campaign, or for being a relative of such immigrants. X' is a matrix of controls at the individual and household (i) levels at the time of the Census, δm, the municipality fixed effects, and $\epsilon_{i,t}$ is the robust, idiosyncratic error term.

We would expect that the younger the immigrant was at the time of the Nationalization Campaign, the greater the impact on their skill formation process. Moreover, the strongest effects should be observed among school-age immigrants who attended community schools, particularly those between the ages of 7 and 12. One limitation of this analysis is that it only includes immigrants who survived until the time of the Censuses, decades later. Additionally, I am unable to observe the children of immigrants who were born in Brazil but also attended immigrant-community schools. Finally, similar limitations apply to the intergenerational analysis. I can only observe the sons and daughters of immigrants who still reside in the same household at the time of the Census.

1.6.2 Immigrant characteristics

Before presenting the reduced-form effects of the Nationalization Campaign on long-term, intergenerational outcomes of immigrants and their descendants, I first provide evidence that families with school-age children did not differ in characteristics before and after 1945. To do this, I randomly selected approximately 100 passenger lists of ships arriving at the Brazilian port of Santos between 1930 and 1963, ensuring a balance across years. From these lists, I extracted information on each individual permanent immigrant arriving in Brazil, organized by family units.

Table 1.5 presents the characteristics of fathers and mothers of school-age children (7–12 years old) from non-Southern European countries. There were no significant differences in literacy rates between fathers or mothers who arrived before and after 1945. Although barely significant, fewer fathers were employed as farmers after 1945, which may

reflect the industrial development in Brazil during this period. However, historical sources suggest that many of these farmers relocated to Brazilian towns for work after 1945 as well. Parents' literacy and occupation, particularly that of fathers, are important predictors of children's educational outcomes, as shown in the literature (Abramitzky et al., 2021). Finally, more fathers and mothers who arrived after 1945 identified as Catholic, though this difference was only barely significant for mothers.

Table 1.5: Comparison of characteristics of immigrants from non-Southern European countries in families with children at school age (7-12 years old) at arrival in the Port of Santos

Average Characteristic	Before 1945	After 1945	Diff.
Father was literate	1.00	0.99	0.01
Father was a farmer	0.91	0.83	0.08*
Father was catholic	0.06	0.10	-0.04
Mother was literate	1.00	0.98	0.02
Mother was catholic	0.04	0.11	-0.07*
N of fathers	107	117	-
N of mothers	104	112	-

Source: Author with data from the passengers lists of immigrants arriving at the port of Santos between 1930 and 1963. *** p<0.01, ** p<0.05, * p<0.1.

Another important consideration is the distribution of immigrants by origin within the non-Southern European group targeted by the Nationalization Campaign, as reflected across different data sources. Table 1.6 presents the top four origins of non-Southern European immigrants of school age during the Nationalization Campaign, based on the Brazilian Census. The distribution is fairly consistent, with nearly half of the immigrants being of Japanese origin. Similarly, the distribution of origins among passengers arriving at the Port of Santos shows a similar pattern, despite being limited to this port. Although there is some variation in the share of each origin group in the sample before and after the Nationalization Campaign, I demonstrate that the results are robust when considering each origin separately, even though some estimates may suffer from reduced statistical power due to sample size limitations.

Table 1.6: Top four origins of non-Southern European immigrants in school-age at the time of the Nationalization Campaign

Country of Origin	Germany		Japan		Lebanon		Poland	
Arrival	before 1945	after 1945	b. 1945	a. 1945	b. 1945	a. 1945	b. 1945	a. 1945
1991 Census	7%	9%	64%	34%	4%	13%	8%	4%
2000 Census	6%	9%	71%	37%	2%	12%	8%	4%
2010 Census	5%	9%	73%	41%	2%	13%	8%	2%
Passengers lists	10%	10%	76%	71%	1%	4%	1%	1%

Source: Author with data from the Brazilian 1991, 2000, and 2010 Censuses; and passengers lists of immigrants arriving at the port of Santos between 1930 and 1963. The group of non-Southern European immigrants are those from Asian and European countries, except Italy, Spain, or Portugal.

1.6.3 Long-term, intergenerational results

I begin by presenting results for individual immigrants in the Brazilian Censuses who arrived before and after 1945. Table 1.7 shows a negative association between immigrants of non-Southern European origin who were of school age during the Nationalization Campaign compared to those who arrived after 1945. Although we cannot determine if the individuals observed in the 1991 Census are the same as those in the 2000 and 2010 Censuses, it is likely that many are, given the sample selection. The decrease in the number of observations is largely due to aging, with the oldest individuals reaching 84 years in the 2010 Census, and many having passed away over time.

The significance of these results lies in the fact that, decades after the Nationalization Campaign, immigrants who were likely subjected to assimilation policies during their primary school years were 12% less likely to complete high school, 6% less likely to attain a college education, and 4% less likely to complete primary education as the 1991 Census. On average, they had 1.7 fewer years of education. Surprisingly, these immigrants were more likely to be literate, 3% and to identify as Catholic, 4%. These effects are especially pronounced among Japanese immigrants, as shown in Table A.2 of Appendix A.

These findings suggest long-lasting negative effects of the forced assimilation policy on school-age children, which resulted in poorer human capital formation, as evidenced by lower educational attainment across their lifetime. While the mechanisms remain unclear,

we observe that those who were exposed to Brazilian culture earlier in life, particularly through the Nationalization Campaign, were more likely to convert to Catholicism. The mandatory integration into the Brazilian public education system may have played a key role in this outcome.

Table 1.7: Long-term results - Individual migrants from non-Southern European origins who arrived before and after 1945 in school age during the Nationalization Campaign

Individual charact.	Primary Education	High School	College Education	Years of Education	Literate	Catholic
	Immigrants from non-Southern European origins in the 1991 Census					
Arrival $\mathbb{1}_{1930-1945}$	**-0.038*** **	**-0.116*** **	**-0.059*** **	**-1.715*** **	**0.033*** **	**0.042** **
N of observations	4,665	4,665	4,665	4,665	4,665	4,665
	Immigrants from non-Southern European origins in the 2000 Census					
Arrival $\mathbb{1}_{1930-1945}$	**-0.037** **	**-0.147*** **	**-0.048*** **	**-1.691*** **	**0.040*** **	**0.108*** **
N of observations	4,289	4,289	4,289	4,289	4,289	4,289
	Immigrants from non-Southern European origins in the 2010 Census					
Arrival $\mathbb{1}_{1930-1945}$	-0.025	**-0.092*** **	**-0.073** **	-	**0.062*** **	**0.083** **
N of observations	2,010	2,010	2,010	-	2,010	2,010
Controls	X	X	X	X	X	X
Municipality FEs	X	X	X	X	X	X

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants from non-Southern European origins who arrived before and after 1945 in school age (7-12 years old) during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. *** p<0.01, ** p<0.05, * p<0.1.

Now, I turn my attention to the intergenerational process of human capital formation. Table 1.8 presents results for the second generation - sons and daughters of immigrants from non-Southern European origins who arrived before or after 1945 - focusing on the same age groups as in the previous analysis. Once again, the lower educational attainment of the first-generation immigrants is reflected in the educational outcomes of their children. Given that the Brazilian educational system experienced significant development over these two generations, it is reasonable to observe that children of parents affected by the Nationalization Campaign had lower college completion rates (approximately 6%) and fewer years of education (0.6 years less) by the 1991 Census. It is important to note that this analysis is limited to children who lived in the same household as their immigrant parent at the time of the Census.

Another notable finding is that children of immigrants who arrived earlier were also more likely to convert to Catholicism (6%). While the underlying mechanisms are not entirely clear, it is plausible that exposure to the Nationalization Campaign played a key role in this outcome. These effects are particularly pronounced among Japanese immigrants, as shown in Table A.4 of Appendix A.

These results highlight the even more pernicious consequences of the assimilation policies. The fact that these policies also impacted the educational outcomes of the next generation suggests an intergenerational channel linking the policy's implementation to long-term consequences for human capital formation. The broader takeaway is that decisions made today can have lasting effects on individuals for generations to come.

Table 1.8: Long-term results - Sons and daughters of migrants from non-Southern European origins who arrived before and after 1945 in school age during the Nationalization Campaign

Individual charact.	Primary Education	High School	College Education	Years of Education	Literate	Catholic
	Sons and daughters of immigrants from non-Southern European origins in the 1991 Census					
Arrival $\mathbb{1}_{1930-1945}$	0.001	0.016	**-0.033***	**-0.567*****	**-0.009**	0.058***
N of observations	4,869	4,869	4,869	4,869	4,869	4,869
	Sons and daughters of immigrants from non-Southern European origins in the 2000 Census					
Arrival $\mathbb{1}_{1930-1945}$	-0.012	0.020	**-0.070*****	**-1.238*****	**-0.040*****	0.133***
N of observations	2,799	2,799	2,799	2,799	2,799	2,799
	Sons and daughters of immigrants from non-Southern European origins in the 2010 Census					
Arrival $\mathbb{1}_{1930-1945}$	0.073*	0.002	**-0.081**	-	**0.002**	0.184***
N of observations	828	828	828	-	828	828
Controls	X	X	X	X	X	X
Municipality FEs	X	X	X	X	X	X

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants' daughters and sons from non-Southern European origins who arrived before and after 1945 in school age (7-12 years old) during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. *** p<0.01, ** p<0.05, * p<0.1.

1.6.4 Long-term results for different educational levels

Although the primary focus has been on the closure of immigrant-community schools, the literature on skill formation suggests that the effects of such educational disruptions can vary across different stages of childhood (Cunha and Heckman, 2007). We would therefore expect heterogeneous effects of the Nationalization Campaign, depending on the age and educational stage of the immigrant children enrolled in school at the time. More precisely, Heckman (2006) summarizes recent evidence on the asymmetric effects of educational policy interventions across different stages of the life cycle, particularly in relation to skill formation.

Furthermore, it is important to note that I cannot guarantee that the immigrants observed in the 1991, 2000, and 2010 Censuses actually attended the immigrant-community schools. To address this limitation, I exploit the fact that these schools were predominantly primary education institutions, with immigrant children attending them between the ages of 7 and 12 during the Nationalization Campaign. To assess the differential effects of exposure to the Nationalization Campaign by educational level, I conduct a robustness check by dividing children into age groups based on the level of education they would have been eligible for at the time. The lower bound for secondary education is set at children aged 12 in 1945, and the upper bound is those aged 15 in 1938. For tertiary education, the lower bound is children aged 15 in 1945, and the upper bound is those aged 18 in 1938. For detailed age brackets, see Table A.1 in Appendix A. [19]

Table 1.9 presents the results for children at different school levels, based on their ages during the Nationalization Campaign, compared to those who arrived after 1945. The strongest effects on primary and high school completion are observed for children who were in primary school at the time, followed by those in secondary school, and then tertiary education. These findings are consistent with the human capital formation literature,

[19]The age brackets overlap due to age-grade distortion issues and slight differences in local education legislation.

which links lifelong educational attainment to earlier educational opportunities.

Table 1.9: Long-term results - Individual migrants from non-Southern European origins who arrived before and after 1945 by school levels during the Nationalization Campaign

Individual charac.	Primary Education	High School	College Education	Years of Education	Literate	Catholic	N
Arrival $\mathbb{1}_{1930-1945}$	*Immigrants from non-Southern European origins in the 1991 Census*						
Primary Education (7-12 yo)	**-0.038*** **	**-0.116*** **	-0.059***	-1.715***	0.033***	0.042**	4,665
Secondary Education (12-15 yo)	**-0.027** **	**-0.095*** **	-0.061***	-1.542***	0.039***	0.005	4,590
Tertiary Education (15-18 yo)	**-0.017**	**-0.083*** **	-0.059***	-1.478***	0.013	-0.006	4,559
Arrival $\mathbb{1}_{1930-1945}$	*Immigrants from non-Southern European origins in the 2000 Census*						
Primary Education (7-12 yo)	**-0.037** **	**-0.147*** **	-0.048***	-1.691***	0.040***	0.108***	4,289
Secondary Education (12-15 yo)	**-0.038** **	**-0.116*** **	-0.083***	-1.976***	0.042***	0.056***	3,999
Tertiary Education (15-18 yo)	**-0.031***	**-0.101*** **	-0.088***	-1.951***	0.033**	0.010	3,726
Arrival $\mathbb{1}_{1930-1945}$	*Immigrants from non-Southern European origins in the 2010 Census*						
Primary Education (7-12 yo)	**-0.025**	**-0.092*** **	-0.073**	-	0.062***	0.083**	2,010
Secondary Education (12-15 yo)	**-0.017**	**-0.059***	-0.092***	-	0.058***	0.070*	1,658
Tertiary Education (15-18 yo)	**-0.006**	**-0.040**	-0.096***	-	0.048*	-0.011	1,375
Controls	X	X	X	X	X	X	-
Municipality FEs	X	X	X	X	X	X	-

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants from non-Southern European origins who arrived before and after 1945 by school levels and ages during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. Schools levels overlap individuals' ages because of age-grade distortions, characteristic of the time. *** p<0.01, ** p<0.05, * p<0.1.

1.6.5 Robustness: results for Italians

If the previous results were solely driven by the poor quality of the Brazilian educational system, we would expect to see similar effects for immigrants from other countries with comparable educational systems. Take Italian immigrants, for example. Italy's educational system was similarly developed to Brazil's, especially compared to that of other Axis nations. If the observed effects for children who arrived earlier were solely due to the poor quality of the Brazilian educational system, we would expect to see similar differences in educational outcomes between Italian immigrants who arrived before and after 1945. Additionally, Italians were also targeted by other aspects of the Nationalization Campaign, such as labor market policies, as discussed in Subsection 1.5.2. However, due to the cultural proximity between Brazil and Southern European countries, we would not expect significant effects on educational outcomes for Italian immigrants.

Table 1.10 presents the results for individual Italian immigrants. Overall, there are few significant differences between those who arrived before or after the Nationalization Campaign in terms of educational and religious outcomes. When differences are significant, the results suggest that immigrants who arrived before 1945 were more likely to enter the educational system, complete college, and ultimately achieve more years of education.

Table 1.10: Long-term results - Individual migrants from Italy who arrived before and after 1945 in school age during the Nationalization Campaign

Individual charac.	Primary Education	High School	College Education	Years of Education	Literate	Catholic
			Immigrants from Italy in the 1991 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.003	-0.011	0.068***	0.754***	0.006	-0.008
N of observations	1,862	1,862	1,862	1,862	1,862	1,862
			Immigrants from Italy in the 2000 Census			
Arrival $\mathbb{1}_{1930-1945}$	0.002	0.013	0.051	0.848**	0.010	-0.023
N of observations	1,733	1,733	1,733	1,733	1,733	1,733
			Immigrants from Italy in the 2010 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.035	0.099	0.106	-	0.076**	-0.045
N of observations	692	692	692	-	692	692
Controls	X	X	X	X	X	X
Municipality FEs	X	X	X	X	X	X

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants from Italy who arrived before and after 1945 in school age (7-12 years old) during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.11 presents the results for the second generation, the sons and daughters of Italian immigrants. While other dimensions of the Nationalization Campaign that affected targeted immigrants - such as labor market policies and cultural institutions - could have contributed to worse college completion rates for Italian descendants, the results are predominantly not significant.

In Appendix A, Tables A.2 and A.3 present the results for Japanese and German immigrants, respectively. Additionally, Tables A.4 and A.5 display the results for the second generations of Japanese and German immigrants, respectively, for comparison.

Table 1.11: Long-term results - Sons and daughters of migrants from Italy who arrived before and after 1945 in school age during the Nationalization Campaign

Individual charac.	Primary Education	High School	College Education	Years of Education	Literate	Catholic
			Sons and daughters of immigrants from Italy in the 1991 Census			
Arrival $\mathbb{1}_{1930-1945}$	0.033*	0.001	-0.069***	-0.721***	-0.009	0.034*
N of observations	1,939	1,939	1,939	1,939	1,939	1,939
			Sons and daughters of immigrants from Italy in the 2000 Census			
Arrival $\mathbb{1}_{1930-1945}$	0.025	0.025	-0.046	-0.691	-0.013	0.033
N of observations	1,123	1,123	1,123	1,123	1,123	1,123
			Sons and daughters of immigrants from Italy in the 2010 Census			
Arrival $\mathbb{1}_{1930-1945}$	0.029	-0.055	-0.032	-	0.034	0.141
N of observations	255	255	255	-	255	255
Controls	X	X	X	X	X	X
Municipality FEs	X	X	X	X	X	X

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants' daughters and sons from Italy who arrived before and after 1945 in school age (7-12 years old) during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. *** p<0.01, ** p<0.05, * p<0.1.

1.7 Discussion and Conclusion

This paper analyzes the short- and long-term effects of Brazil's Nationalization Campaign (1938–1945), focusing on the educational and intergenerational consequences for immigrants and their descendants. While the short-term analyses provide evidence of a negative effect of the assimilation policies on local educational outcomes, the long-term suggests that immigrants from targeted origins who arrived before 1945, those from non-Southern European countries such as Japan and Germany, had lower educational attainment, including completion of primary education, high school and college education, as compared to those who arrived after 1945.

By analyzing data from multiple sources with different empirical strategies, I provide robust estimates for the consequences of this historical event. They reveal that younger immigrants, particularly those who were in primary school during the campaign, suffered the greatest consequences, as expected by the literature (Cunha and Heckman,

2007; Heckman, 2006). These effects persisted into the second generation, with children of these immigrants exhibiting similar disadvantages in educational outcomes, the intergenerational link in human capital formation. This suggests that the forced assimilation policies disrupted the educational trajectories of entire families, leading to long-lasting consequences for human capital development.

The findings align with existing literature on the long-term effects of forced assimilation policies, such as those documented in other historical contexts (Carvalho and Koyama, 2016; Fouka, 2020; Lleras-Muney and Shertzer, 2015). The results underscore the importance of considering the cumulative and intergenerational effects of policy interventions, as early disruptions to education can have cascading effects on individuals' life outcomes and on the educational opportunities available to future generations.

The analysis also suggests that the Nationalization Campaign disproportionately impacted immigrants from certain regions, particularly those of less cultural proximity, as noted by (Fouka et al., 2021; Tabellini, 2019). While immigrants from Southern European countries, such as Italians, faced some challenges, their educational outcomes were not as severely affected, likely due to their cultural and linguistic proximity to the dominant Brazilian population. On the other hand, immigrants from Japan and Germany - who were subjected to more disruptive pressures - experienced more significant setbacks in terms of educational attainment, both for themselves and for their children.

The findings have important implications for understanding the long-term impacts of assimilation and educational policies, not only in Brazil but in other contexts as well. The closure of immigrant-community schools disrupted educational opportunities for many immigrant children and led to a decline in their educational attainment over time. These effects were compounded by the fact that many of these immigrants were subjected to discrimination and exclusion from broader social and economic opportunities, further hindering their human capital development.

Finally, while this study provides valuable insights into the educational outcomes

of immigrants affected by the Nationalization Campaign, it also suggests avenues for future research. Further studies could explore how the Nationalization Campaign affected other aspects of immigrant life, such as employment, political participation, and social mobility. Additionally, future work could investigate the impact of similar assimilation policies in other countries and historical contexts, helping to build a more comprehensive understanding of the long-term effects of such policies on immigrant communities.

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Appendix A

Tables and Figures

Table A.1: Age brackets for school-age individuals between 1938-1945 observed in the 1991, 2000, and 2010 Censuses

School level attended	Age in 1938	Age in 1945	Age in 1991	Age in 2000	Age in 2010
Immigrant community schools	7-12	7-12	53-65	62-74	72-84
Primary Education	7-12	7-12	53-65	62-74	72-84
Secondary Education	12-15	12-15	58-68	67-77	77-87
Tertiary Education	15-18	15-18	61-71	70-80	80-90

Source: Author.

Table A.2: Long-term results - Individual migrants from Japan who arrived before and after 1945 in school age during the Nationalization Campaign

Individual charac.	Primary Education	High School	College Education	Years of Education	Literate	Catholic
			Immigrants from Japan in the 1991 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.058***	-0.161***	-0.084***	-2.594***	0.039**	0.111***
N of observations	2,293	2,293	2,293	2,293	2,293	2,293
			Immigrants from Japan in the 2000 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.051**	-0.175***	-0.076***	-2.378***	0.068***	0.172***
N of observations	2,258	2,258	2,258	2,258	2,258	2,258
			Immigrants from Japan in the 2010 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.026	-0.164***	-0.080**	-	0.104***	0.175***
N of observations	1,172	1,172	1,172	-	1,172	1,172
Controls	X	X	X	X	X	X
Municipality FEs	X	X	X	X	X	X

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants from Japan who arrived before and after 1945 in school age (7-12 years old) during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. *** p<0.01, ** p<0.05, * p<0.1.

Table A.3: Long-term results - Individual migrants from Germany who arrived before and after 1945 in school age during the Nationalization Campaign

Individual charac.	Primary Education	High School	College Education	Years of Education	Literate	Catholic
			Immigrants from Germany in the 1991 Census			
Arrival $\mathbb{1}_{1930-1945}$	0.064	-0.056	-0.118	-1.431**	0.000	-0.093
N of observations	372	372	372	372	372	372
			Immigrants from Germany in the 2000 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.017	-0.182**	0.061	-0.470	0.009	-0.065
N of observations	329	329	329	329	329	329
			Immigrants from Germany in the 2010 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.111	0.088	-0.068	-	0.000*	-0.458***
N of observations	154	154	154	-	154	154
Controls	X	X	X	X	X	X
Municipality FEs	X	X	X	X	X	X

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants from Germany who arrived before and after 1945 in school age (7-12 years old) during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. *** p<0.01, ** p<0.05, * p<0.1.

Table A.4: Long-term results - Sons and daughters of migrants from Japan who arrived before and after 1945 in school age during the Nationalization Campaign

Individual charac.	Primary Education	High School	College Education	Years of Education	Literate	Catholic
			Sons and daughters of immigrants from Japan in the 1991 Census			
Arrival $\mathbb{1}_{1930-1945}$	0.009	-0.008	0.014	-0.467**	-0.013	0.103***
N of observations	2,609	2,609	2,609	2,609	2,609	2,609
			Sons and daughters of immigrants from Japan in the 2000 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.051**	-0.175***	-0.076***	-2.378***	0.068***	0.172***
N of observations	2,258	2,258	2,258	2,258	2,258	2,258
			Sons and daughters of immigrants from Japan in the 2010 Census			
Arrival $\mathbb{1}_{1930-1945}$	0.080	-0.067	0.018	-	0.011	0.139
N of observations	553	553	553	-	553	553
Controls	X	X	X	X	X	X
Municipality FEs	X	X	X	X	X	X

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants' daughters and sons from Japan who arrived before and after 1945 in school age (7-12 years old) during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. *** p<0.01, ** p<0.05, * p<0.1.

Table A.5: Long-term results - Sons and daughters of migrants from Germany who arrived before and after 1945 in school age during the Nationalization Campaign

Individual charac.	Primary Education	High School	College Education	Years of Education	Literate	Catholic
			Sons and daughters of immigrants from Germany in the 1991 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.071	-0.085	0.054	0.587	0.029	-0.102
N of observations	267	267	267	267	267	267
			Sons and daughters of immigrants from Germany in the 2000 Census			
Arrival $\mathbb{1}_{1930-1945}$	-0.002	-0.004	0.082	-0.616	-0.010	-0.162
N of observations	148	148	148	148	148	148
			Sons and daughters of immigrants from Germany in the 2010 Census			
Arrival $\mathbb{1}_{1930-1945}$	1.000***	0.146	-1.000***	-	-0.000	-1.000***
N of observations	32	32	32	-	32	32
Controls	X	X	X	X	X	X
Municipality FEs	X	X	X	X	X	X

Source: Author with data from individuals and households micro-level sample data from the Brazilian 1991, 2000, and 2010 Censuses. Census data from the Datacem project. OLS results with sample weights of the Census for individual migrants' daughters and sons from Germany who arrived before and after 1945 in school age (7-12 years old) during the Nationalization Campaign, municipality fixed effects and time-varying controls at the individual and household levels. *** p<0.01, ** p<0.05, * p<0.1.

Figure A.1: The newspaper *A Nação* (The Nation) reported the prohibition of German, Italian, and Japanese languages use in public spaces - City of Caxias do Sul, State of Rio Grande do Sul, February 1, 1942.

Proibido Falar em Italiano, Alemão e Japonês Em Qualquer Lugar Público

Disposições Gerais Baixadas Pela Chefia de Polícia

Edital

Delegacia de Polícia

ATENDENDO á situação internacional e em virtude de ordem superior, tórno público que:

1 — Os estrangeiros nacionais da Alemanha, Itália e Japão, devem comunicar a sua residência desta delegacia, dentro do prazo de 50 dias;

2 — Não lhes é permitido:

a) — Viajar de uma localidade a outra, sem licença da Delegacia;

b) — Reunirem-se, ainda que em casas particulares e á titulo de carater, particular (aniversários, bailes, banquetes, etc.);

c) — Discutir ou trocar idéias sôbre a situação internacional;

d) — Mudar de residência, sem prévia autorisação;

3 — Todos os estrangeiros das referidas nacionalidades devem entregar suas armas na Delegacia, acompanhadas do registro e porte, quando detentores dos mesmos;

4 — Aos mesmos estrangeiros ficam cassadas as licenças para negociar com armas, munições e materiais explosivos;

5 — E' proibido:

a) — Distribuição de escritos em idioma das potências, com as quais o Brasil rompeu relações;

b) — Cantar ou tocar hinos das referidas potências;

c) — Fazer saudações peculiares a essas potências;

d) — Usar o idioma das mesmas potências em qualquer lu-

Delegacia de Polícia

Sociedades Culturais, Recreativas e Beneficentes

De ordem superior, tórno público que as Sociedades Recreativas, Culturais e Beneficentes deverão apresentar nésta Delegacia, dentro do praso de 15 dias, a relação nominal da Diretoria, constando da mesma a nacionalidade e residência.

Comunico, ainda, que nenhuma sociedade poderá realizar reuniões, mesmo da Diretoria, sem prévia licença desta Repartição.

Delegacia de Polícia de Caxias, 29/1/1942.

Adão Masseua Vieira
Delegado de Polícia

Delegacia de Polícia

CARNAVAL

De ordem superior, tórno público que, durante o carnaval, observar-se-á o seguinte:

I)—Nenhum baile poderá realizar-se sem prévia licença;

II) — Nenhum agrupamento carnavalesco que transitar pelos passeios públicos poderá penetrar em bares e casas comerciais;

III) — Não é permitido o uso de fantasias atentatórias á moral;

IV) — Não é permitido o uso de fantasias, distintivos, emblemas, bonés, fitas, golas, botões ou outras quaisquer insignas adotadas pelas classes armadas;

V) — Não é permitido o uso de unifórme de qualquer outra classe, como fantasias;

VI) Durante os dias de carnaval fica proibida a venda de bebidas alcoólicas em bares, cafés, botequins, restaurantes, hotéis e mercadinhos, exceptuando-se o vinho, chope, cerveja, champanha e uisqui;

VII) — O uso de máscaras, na via pública, será permitida sómente nos dias próprios do carnaval, ficando, entretanto, os portadores sugeitos, a qualquer momento, á fiscalização da policia;

VIII) — E' proibido o uso de lança-perfume como entorpecente, aspirando-o ou bebendo-o.

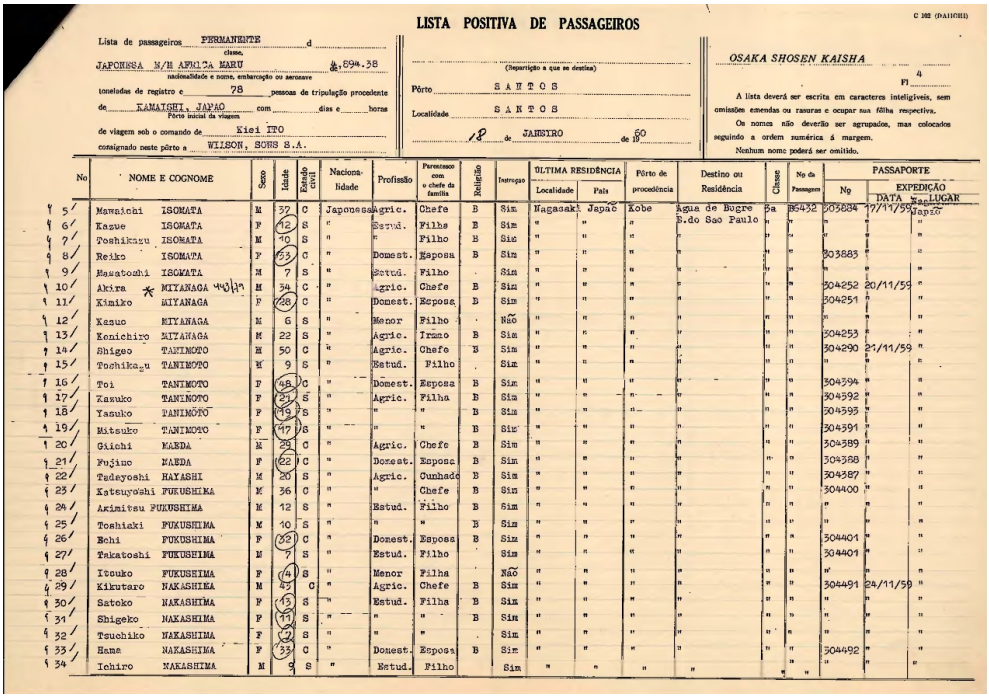
Adão Masseua Vieira
Delegado de Polícia

Caxias, 29 de Janeiro de 1942.

Edição de 1º/02/1942 do jornal A Nação, de Caxias do Sul (Imagem: Arquivo/Câmara Municipal de Caxias do Sul).

Source: City of Caxias do Sul, Legislative archival.

Figure A.2: Example of a passengers list's page



LISTA POSITIVA DE PASSAGEIROS

C 102 (DAHOH)

Lista de passageiros PERMANENTE d
classe.
JAPONESA M/M AFRICA MARU de 8.894.38
nacionalidade e nome, embarcação ou aeronave
toneladas de registro e 28 pessoas de tripulação procedente
de KAMAIGHI, JAPAO com dias e horas
Pôrto inicial da viagem
de viagem sob o comando de Kiei ITO
consignado neste pôrto a WILSON, SONS S.A.

(Separação a que se destina)
Pôrto SANTOS
Localidade SANTOS
18 de JANEIRO de 1960

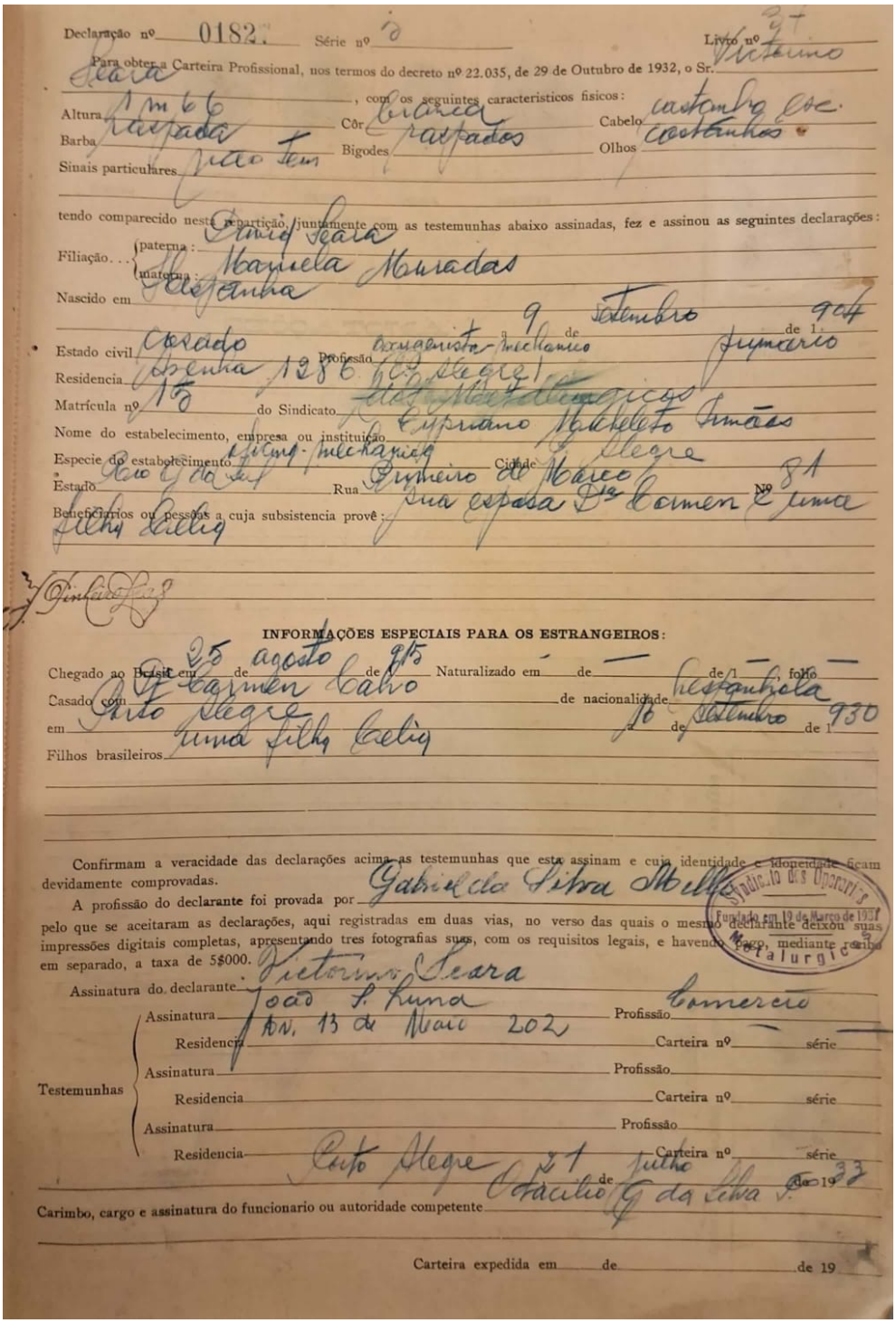
OSAKA SHOSEN KAISHA
Fl 4

A lista deverá ser escrita em caracteres inteligíveis, sem omissões emendas ou rasuras e ocupar sua fôlha respectiva.
Os nomes não deverão ser agrupados, mas colocados seguindo a ordem numérica á margem.
Nenhum nome poderá ser omitido.

No	NOME E COGNOME	Sexo	Idade	Estado civil	Nacionalidade	Profissão	Parentesco com o chefe da família	Relação	Instrução	ÚLTIMA RESIDÊNCIA Localidade	ÚLTIMA RESIDÊNCIA País	Pôrto de procedência	Destino ou Residência	Classe	Nº da Passagem	PASSAPORTE Nº	PASSAPORTE EXPEDIÇÃO DATA	PASSAPORTE EXPEDIÇÃO LUGAR
5	Mawaichi ISOMATA	M	37	C	Japonesa	Agric.	Chefe	B	Sim	Nagasaki	Japão	Kobe	Agua de Bugre	5a	86432	303684	17/11/59	Japão
6	Kazue ISOMATA	F	12	S	"	Estud.	Filha	B	Sim	"	"	"	S.do Sao Paulo	"	"	"	"	"
7	Toshikazu ISOMATA	M	10	S	"	"	Filho	B	Sim	"	"	"	"	"	"	"	"	"
8	Reiko ISOMATA	F	33	C	"	Domest.	Esposa	B	Sim	"	"	"	"	"	"	303883	"	"
9	Masatoshi ISOMATA	M	7	S	"	Estud.	Filho	.	Sim	"	"	"	"	"	"	"	"	"
10	Akira MIYANAGA 40/39	M	34	C	"	Agric.	Chefe	B	Sim	"	"	"	"	"	"	304252	20/11/59	"
11	Kimiko MIYANAGA	F	28	C	"	Domest.	Esposa	B	Sim	"	"	"	"	"	"	304251	"	"
12	Kazuo MIYANAGA	M	6	S	"	Menor	Filho	.	Não	"	"	"	"	"	"	"	"	"
13	Konichiro MIYANAGA	M	22	S	"	Agric.	Irmão	B	Sim	"	"	"	"	"	"	304253	"	"
14	Shigeo TANIMOTO	M	50	C	"	Agric.	Chefe	B	Sim	"	"	"	"	"	"	304290	21/11/59	"
15	Toshikazu TANIMOTO	M	9	S	"	Estud.	Filho	.	Sim	"	"	"	"	"	"	"	"	"
16	Toi TANIMOTO	F	48	C	"	Domest.	Esposa	B	Sim	"	"	"	"	"	"	304594	"	"
17	Kazuko TANIMOTO	F	21	S	"	Agric.	Filha	B	Sim	"	"	"	"	"	"	304592	"	"
18	Yasuko TANIMOTO	F	19	S	"	"	"	B	Sim	"	"	"	"	"	"	304593	"	"
19	Mitsuko TANIMOTO	F	17	S	"	"	"	B	Sim	"	"	"	"	"	"	304591	"	"
20	Giichi MAEDA	M	28	C	"	Agric.	Chefe	B	Sim	"	"	"	"	"	"	304589	"	"
21	Fujino MAEDA	F	22	C	"	Domest.	Esposa	B	Sim	"	"	"	"	"	"	304588	"	"
22	Tadeyoshi HAYASHI	M	20	S	"	Agric.	Cunhado	B	Sim	"	"	"	"	"	"	304587	"	"
23	Kateuyoshi FUKUSHIMA	M	36	C	"	"	Chefe	B	Sim	"	"	"	"	"	"	304400	"	"
24	Akimitsu FUKUSHIMA	M	12	S	"	Estud.	Filho	B	Sim	"	"	"	"	"	"	"	"	"
25	Toshiaki FUKUSHIMA	M	10	S	"	"	"	B	Sim	"	"	"	"	"	"	"	"	"
26	Echi FUKUSHIMA	F	32	C	"	Domest.	Esposa	B	Sim	"	"	"	"	"	"	304401	"	"
27	Takatoshi FUKUSHIMA	M	7	S	"	Estud.	Filho	.	Sim	"	"	"	"	"	"	304401	"	"
28	Itsuko FUKUSHIMA	F	14	S	"	Menor	Filha	.	Não	"	"	"	"	"	"	"	"	"
29	Kikutaro NAKASHIMA	M	45	C	"	Agric.	Chefe	B	Sim	"	"	"	"	"	"	304491	24/11/59	"
30	Sateko NAKASHIMA	F	13	S	"	Estud.	Filha	B	Sim	"	"	"	"	"	"	"	"	"
31	Shigeko NAKASHIMA	F	11	S	"	"	"	B	Sim	"	"	"	"	"	"	"	"	"
32	Tsuchiko NAKASHIMA	F	9	S	"	"	"	.	Sim	"	"	"	"	"	"	"	"	"
33	Hama NAKASHIMA	F	33	C	"	Domest.	Esposa	B	Sim	"	"	"	"	"	"	304492	"	"
34	Ichiro NAKASHIMA	M	9	S	"	Estud.	Filho		Sim	"	"	"	"	"	"	"	"	"

Source: Passengers list of ships arriving in the Port of Santos, São Paulo, Brazil.

Figure A.3: Example of a worker card registration sheet for the State of Rio Grande do Sul



Source: DRT/RS (*Acervo da Delegacia Regional do Trabalho do Rio Grande do Sul*) made available by the *Núcleo de Documentação Histórica – Professora Beatriz Loner, Universidade Federal de Pelotas.*

Chapter 2

Social Mobility and CCT Programs: the Bolsa Família Program in Brazil

[1]

[1]This chapter is the result of a collaboration with the Institute for Mobility and Social Development - IMDS, Rio de Janeiro. A similar version (Fassarella et al., 2024) was published in the journal *World Development Perspectives*, Volume 35, September 2024, 100624, https://doi.org/10.1016/j.wdp.2024.100624

2.1 Introduction

In 2019, approximately 13 million Brazilian households were beneficiaries of the Bolsa Família Program (BFP). One of the largest and most successful income transfer programs in the world, the BFP stands out for its ability to target the most vulnerable, helping to lift millions of people out of poverty at a relatively low cost. Even more important and similar to other Conditional Cash Transfer (CCT) programs (Fietz et al., 2021; Bastagli et al., 2019), the BFP conditionalities have also led to improved human capital formation of vulnerable children (de Brauw et al., 2015; Souza et al., 2019; Campello and Neri, 2013).

More recently, almost two decades after the implementation of the BFP, we are finally able to observe longer term outcomes associated with the program (Millán et al., 2019). We are specifically concerned with the ability of former BFP beneficiaries to rise socially by overcoming the vicious cycle of poverty (Nurkse, 1953); emancipating from social programs and finding better positions in the formal labor market (Dahl et al., 2014; Chay et al., 1999; Card and Hyslop, 2005).

To this end, we tracked a cohort of BFP beneficiaries aged between 7 and 16 years old in December 2005[2] over more than a decade, until 2019. We analyze two indicators of social mobility: a future emancipation from federal government social programs and their access to formal labor market positions in their adulthood.[3] We use a combination of individual-level administrative data for so: mainly the *Cadastro Único para Programas Sociais* (CadÚnico), the Bolsa Família Program Payrolls, and the *Relação Anual de Informações Sociais* (RAIS), as well as socioeconomic and demographic data at the municipality level.

[2]In 2005, the highest age to register a children living in a household for the BFP was 15 years. However, the benefit was very often only suspended when children completed 16 years, at the end of the school year. Thus, we decided to include children aged 16 to include this transition period.

[3]Positions in the Brazilian formal labor market are found to be of better quality in terms of social protections, tenure, and wages (Meghir et al., 2015).

We observe that 64% of the former BFP beneficiaries during childhood did not rely on federal government social programs in 2019, then aged between 21 and 30 years, while 45% of them accessed the formal labor market, at least once, between 2015 and 2019. The results represent improvements in their social status. In addition, we assess how improvements in formal employment compares with that of non-BFP beneficiaries over the same period. Although the former beneficiaries face comparatively worse employment conditions, they are in better socioeconomic situation than in their childhood.

Then, we focus on potential mechanisms related to the characteristics of Brazilian municipalities. We estimate how the local characteristics correlates with the individual social mobility indicators within a municipality, evaluated as a probability. Results suggest that better health and education structures, and higher economic activity are significantly correlated with greater social mobility of individuals, which are highlighted by significant territorial heterogeneity. As the literature suggests, territorial heterogeneity is also observed in the United States (Chetty et al., 2014), as in Brazil (Bedran-Martins and Lemos, 2017).

Our findings contribute to a growing literature concerned with the determinants of social mobility in developing countries (Britto et al., 2022; Sandberg, 2012). More specifically, we are able to show how individual characteristics, such as race, gender, and place of living, are highly associated with social mobility. We do also find similar results that of Bastagli et al. (2019), which observe in their systematic literature review that CCTs have significant effects in reducing monetary poverty and income inequality, while promoting improvements in education, health, savings, employment, and empowerment indicators of the target population, due to their conditionalities (Andrews et al., 2021; Fiszbein et al., 2009; Gertler et al., 2012). It is also noteworthy that possibly undesired side effects, such as work disincentives and increased fertility, are not observed (Banerjee et al., 2017).

In the long term, Araujo and Macours (2021) and Oliveira and Chagas (2020) find positive effects on schooling and formal labor market participation, with mixed results

for income, and significant heterogeneity according to individual characteristics. Our study focus on highlighting heterogeneities in social mobility, across the territory and individual characteristics, made possible by connecting many institutional datasets; while presenting a connection between the emancipation from social programs and access to formal employment for low-income Brazilian households, beneficiaries of the Bolsa Família program. This is one of the first studies to link those.

This paper is structured as follows: Section 2.2 starts by introducing the Bolsa Família Program; Section 2.3 presents the two ways in which we measure social mobility; Section 2.4 presents the background and a characterization of our sample; Section 2.5 introduces the many datasets we used for the analysis; Section 2.6 discusses the selection and representativeness of our sample; Section 2.7, the results of the social mobility analysis with our two main indicators between 2005 and 2019; Section 2.8 characterizes and compares the labor market outcomes; Section 2.9 presents the main determinants of social mobility in Brazilian municipalities; and finally, Section 2.10 presents the conclusions and final considerations.

2.2 The Bolsa Família Program

A comprehensive understanding of the Bolsa Família Program (BFP) is essential for the measurements and analyses presented in this paper. This section, therefore, provides an overview of the program's key features and developments over the years.

The Bolsa Família Program is a Conditional Cash Transfer (CCT) for poor and extremely poor Brazilian households. It was established in October 2003, by the Provisional Measure No. 132 (Brasil, 2003). Its main goal was to tackle poverty by administratively unifying and expanding four existing social programs within the federal administration[4].

[4]Namely, the programs created between 2001 and 2003: Bolsa Escola Nacional, Bolsa Alimentação, Auxílio Gás, and Cartão Alimentação; linked to four different ministries: Education; Health; Mines and Energy; and Food Security and Fight against Hunger, respectively.

It was also meant to consolidate the Cadastro Único for Social Programs, created in 2001 (Brasil, 2001) with the main goal of identifying and keeping record of all low-income households in Brazil.

The program is managed by a decentralized and shared system between the Federal administration, the Federative Units, and the local municipalities, as established by Law No. 10,836/2004 (Brasil, 2004b) and regulated by Decree No. 5,209/2004 (Brasil, 2004a). Households are registered in the Cadastro Único by the local municipalities, under the supervision of the local states. The federal government manages the system and provides eligible households with the benefits based on that information.

Financial benefits are monthly credited to payment cards in the name of the responsible beneficiary, which are preferably the mothers by design. Dependent beneficiaries are the other members of the household registered in the CadÚnico. The benefits can be basic (fixed) or variable, considering the households' monthly *per capita* income, the number of children and adolescents up to 17 years old (15 years old in 2005), and the presence of pregnant women and nursing mothers in the households. The BFP established two eligibility thresholds for poverty and extreme poverty lines based on the average household's income *per capita*, which granted different amounts of benefits.

In 2005, the guidelines defined by Law No. 10,836/2004 were still in effect. Households in poverty were those with a monthly *per capita* income equal to or less than 100 BRL, while those in extreme poverty had a monthly *per capita* income equal to or less than 50 BRL. Basic (or fixed) benefits, worth 50 BRL, were granted only to extremely poor households; while the variable benefits, worth 15 BRL, were granted based on the presence of children from zero to fifteen years old, pregnant women, and/or nursing mothers in the household - with a maximum of three benefits (45 BRL) per household. Over the years, BFP has undergone several adjustments and updates, such as the addition of variable benefits paid to sixteen- and seventeen-year-old adolescents, and the benefit for Overcoming Extreme Poverty (BSP, in Portuguese).

In 2019, the rules applied to the program were those of the Decree No. 9,396/2018 (Brasil, 2018). Households in poverty were, then, those with a monthly *per capita* income equal to or less than 178 BRL, while extremely poor households were those with a monthly *per capita* income equal to or less than 89 BRL. The basic (or fixed) benefits, worth 89 BRL, were granted only to extremely poor households. The variable benefits, worth 41 BRL, were granted based on the presence of children aged zero to fifteen years, pregnant women, and/or nurturing women - with a maximum of five benefits per household. Additionally, there was a variable benefit linked to adolescents aged sixteen and seventeen years, worth 48 BRL - with a maximum of two benefits per household. Finally, there was also the BSP variable benefit for households which, despite receiving any other type of benefits, still had a monthly *per capita* income below 89 BRL. Thus, there was no pre-established value for the BSP. It was calculated on a case-by-case basis, so that each household could overcome extreme poverty, as defined by the program, by exceeding the monthly income of 89 BRL per person/month.

Although the BFP was significantly expanded - new benefits within it, its eligibility criteria remained the same. Values were only deflated over the years. Therefore, we should not expect that any policy changes significantly affected the number and pool of families registered as beneficiaries.[5]

2.3 Measuring Social Mobility

We now turn to understanding how social benefits relate to different measures of social mobility. Social mobility can be defined as "the movement in time of individuals, families, or other social units between positions of varying advantage in the system of social stratification of a society." (Müller, 2001). Measuring social mobility, thus, entails observing and comparing social units over time and space across many dimensions.

[5]For a comprehensive history of the laws and legislative acts that regulates the Bolsa Família Program since its implementation, see Table 1 of Souza et al. (2018).

A large branch of literature focuses on a key dimension: mobility in income (Becker and Tomes, 1986; Chetty et al., 2014; Corak, 2013). In association, the extent to which policy can affect social mobility in income (Heckman and Landersø, 2022; Beller and Hout, 2006). The fact is that, while equal opportunity has been a central issue in social policy, there is no consensus on how policy is capable of promoting it.

We are mainly interested in analyzing whether CCT programs have significant effects on the life trajectory of social policy beneficiaries. Similar to Araujo and Macours (2021); Heckman (2006); Oliveira and Chagas (2020), our indicators of social mobility tracks a group of individuals over their life cycle.

To this end, we exploit the intertwined relationship between individual eligibility to government social benefits and their participation in the formal labor market. Our two indicators of social mobility are: (i) an individual emancipation from federal government social programs and (ii) their access to better quality positions in the formal labor market in adulthood. More precisely, we observe whether children, BFP beneficiaries aged between 7 to 16 years in 2005, still received social benefits (registered in the CadÚnico) in 2019; or if they were employed in the formal sector of the economy (registered in RAIS) between 2015 and 2019, then aged 17 to 30 years.

2.3.1 Emancipation from Social Programs as Social Mobility

This indicator stems from the hypothesis that individuals who have ceased to depend on government social programs have improved their financial status over time. We observe if individuals received social benefits as a child versus as an adult, suggesting that vulnerable children have grown into higher-earning adults.

Indeed, children beneficiaries of the BFP belonged to poor and extremely poor households, by eligibility. We assume that if they are no longer beneficiaries of social programs in adulthood is due to an upward social mobility in income.[6]. There certainly are other

[6]The main criteria was and still is to have a household income *per capita* not exceeding half of the

reasons why we would not be able to observe individuals registered in federal government social programs in their adulthood: i) those who, even within the income criteria, did not update their profile information with the government agency in time, a requirement; and ii) those who died during that period.

As for those who are not found in the administrative record neither because they died, nor because they failed to update their profiles, there are two distinct subgroups: i) those who have structurally managed to escape poverty and have a low probability of returning to it; ii) those who are temporarily above the "poverty line"; any change in their current situation could lead them back within the eligibility criteria.[7] The first subgroup represents the individuals we classify as emancipated from social programs. Those who experienced upward social mobility. However, with the available data, we cannot observe that precisely, beyond the fact that they are no longer registered in the federal government record of social programs (CadÚnico).

2.3.2 Access to Formal Labor Market as Social Mobility

Similarly, we observe social mobility in income by analyzing improvements in financial conditions due to employment characteristics. We exploit the fact that most BFP beneficiaries do not have stable employment contracts in the formal sector of the economy.[8] Thus, we assume that individuals who were beneficiaries of social programs in their childhood, but are employed in the formal sector in adulthood, ascended socially.

This indicator is more susceptible to business cycle factors. We, thus, use information over a period of five years, from 2015 to 2019, and for how long individuals were employed in the formal sector, which helps to develop a better understanding of structural changes.[9]

minimum wage

[7] Although starting in 2010, the federal government decided to grant benefits to any individual in the following two years in which they were first eligible, to smooth out economic cycles (Fietz et al., 2021).

[8] This is due to the income eligibility criteria. Approximately only 3% of households in CadÚnico present at least one person with tenured job in the formal economy.

[9] It is important to note that Brazil underwent one of its most severe economic crises between 2015 and 2017.

We focus on four situations: (i) individuals who were never employed; (ii) those who were employed at least once over the years; (iii) those who were employed for up to two years, (iv) and those who were employed for three or more years. The groups are expected to approximate the intensity of the employment relationship, more or less strong, given the number of years employed. We expect that workers employed in formal positions for more years have structurally improved their employment conditions. Therefore, they have socially ascended in income.

2.4 The target population

Social mobility is a long-term process that generally requires detailed and longitudinal information from individuals. This paper provides such an assessment by comparing the individual's socioeconomic conditions during childhood and adulthood. We focus on the very first cohorts of children, beneficiaries of the Bolsa Família Program, since its first years of implementation; more precisely, in 2005.[10] Thus, we study the life trajectories of BFP beneficiary children, aged between 7 and 16 years old in December 2005. They add up to more than eleven million individuals, who are tracked more than a decade later, between 2015 and 2019.

2.4.1 A characterization of the target population

The target group consists of young dependent beneficiaries of the BFP, aged between 7 and 16, observed on the December 2005 BFP payroll. The 11,628,308 individuals were tracked for over a decade, until 2019. This group represents 73% of the approximately 16 million BFP dependent beneficiaries in 2005.[11]

[10] We chose the year 2005, as that was when the program was well established and achieved significant coverage of the target population.

[11] Notice that due to legal issues related to the creation and extinction of a specific municipality, the municipality of Pinto Bandeira in Rio Grande do Sul, eight of these dependent beneficiaries were disregarded in the statistics related to an emancipation from social programs - found in the CadÚnico.

Table 2.1 presents summary statistics of the BFP beneficiaries by group of characteristics and a group of the Brazilian population matching age between 2015-2019 in the PNADc household survey. The predominant profile of BFP dependent beneficiaries in 2005 was: 70% aged between 10 and 16; 46% resided in the Northeast region; 50% were black [12]; and 42% were male[13]. Furthermore, Table 2.1 does also present information on the educational level of the BFP responsible beneficiary, by design mostly mothers, of the target population[14]. It is interesting to notice, however, that only 6% of those had completed high school, while the vast majority, 55%, had completed only the first years of elementary school or less.

The comparison group of Brazilians with matching age in the PNADc household survey presents similar gender and age distribution characteristics of those of our target population in CadÚnico. There are, however, two main differences related to the characteristics of vulnerable households in Brazil: the higher proportion of Black people and those from the Northeast region in CadÚnico when compared to the average Brazilian population. While almost 70% of those in CadÚnico with available data are Black, the comparison group in the Brazilian population total approximately 60%. Similarly, Northeasters comprises almost double the number of Southeasters in CadÚnico. Indeed, structural and historical reasons help explain the territorial and racial differences in Brazil.

However, we managed to overcome this issue for the analysis of accesses to the formal labor market - RAIS data. Hence, there is a small difference of eight beneficiaries between the analyses with CadÚnico data (11,628,300 individuals) and those with RAIS data (11,628,308 individuals).

[12]Color or race information was only available from 2012 on. We tracked this information by individual, but 27% of the population could not be found in the 2012 data onwards.

[13]Gender information was only available from 2006. We tracked this information by individual, but 17% of the population could not be found in the 2006 data onwards.

[14]Educational level of the household head was only available from 2012. We tracked this information by individual, but 33% of the population could not be found in the 2012 data onwards. This information may be overestimated, if the heads have acquired more years of education between 2005 and 2012.

Table 2.1: Summary Statistics - Target population and Brazilian population in the same age group (PNADc)

Characteristic	N in CadÚnico	%	% Brazilian pop. (PNADc)
by age in 2005			
10-16 years-old	8,093,604	70%	70%
7-9 years-old	3,534,696	30%	30%
by gender			
Men	4,894,101	42%	50%
Women	4,741,472	41%	50%
Not available	1,992,727	17%	-
by color, race, or ethnic group			
Black	5,842,234	50%	59%
White	2,570,140	22%	40%
Yellow	29,093	0%	0.5%
Indigenous	36,006	0%	0.3%
Not informed	71,940	0%	0.2%
Not available	3,078,887	27%	-
by residence - Brazilian regions			
Northeast	5,291,361	46%	-
Southeast	3,291,855	28%	-
South	1,368,319	12%	-
North	1,087,158	9%	-
Midwest	589,607	5%	-
by head of household's educational level			
Incomplete Elementary Education or less	3,688,172	32%	-
Completed Elementary Education	2,688,825	23%	-
Completed Middle Education	710,413	6%	-
Completed High School	636,510	6%	-
Completed Higher Education or more	25,927	0%	-
Not informed	23,057	0%	-
Not available	3,855,396	33%	-

Source: Own elaboration with data from the *Cadastro Único* for Social Programs of the Federal Government and the Bolsa Família Program Payrolls from the Brazilian Ministry of Citizenship/Ministry of Social Development, and PNADc (Continuous National Household Sample Survey) from IBGE. The target population consists of young BFP beneficiaries, aged between seven and sixteen in 2005. Color or race; gender; and household head's educational information was only available from 2012, 2006, and 2012 onwards, respectively. We tracked this information by individual, but could not find information of 27% of the population for color or race, 17% for gender, and 33% for educational level. The last information may be overestimated, if the household heads have acquired more years of education between 2005 and 2012. The PNADc comparison group is given by the average share of characteristics of individuals with matched age between 2015 and 2019. For each year we take as comparison group the characteristics of those with similar age. For instance people aged 17 to 26 in 2015; 18 to 27 in 2018; and so forth, until 2019. We are not able to compare their region of residence, because it might have changed over time.

2.5 Data

We combined administrative restricted data with publicly available data from multiple government sources to track individual socioeconomic information over the years.[15] We did also aggregate data at the municipality level to estimate the local determinants of the two indicators of individual social mobility.

The six main data sources were: the *Cadastro Único para Programas Sociais*(CadÚnico);[16] the Bolsa Família Program Payrolls;[17] the *Relação Anual de Informações Sociais* (RAIS);[18] the Atlas of Human Development in Brazil;[19] the *Sistema de Informação sobre Mortalidade* (SIM);[20] and the *Pesquisa Nacional por Amostra de Domicílios Contínua* (PNADc)[21]

2.6 Sample and Representativeness

Several steps were taken in this research to ensure that the set of individuals analyzed over the years was most representative of the population at the base of the Brazilian social pyramid. This section details the treatment given to the CadÚnico and Bolsa Família Program payroll datasets, as well as their representativeness of the Brazilian population.

[15] Mainly baseline information in 2005; when not available, inputted information from the following years, and data from 2015 to 2019 for the main indicators.

[16] Unified Registry for Social Programs, in free translation; which is a database that identifies and characterizes the universe of poor and extremely-poor households in Brazil.

[17] Administrative record with socioeconomic information of every beneficiary of the BFP.

[18] Annual Social Information Report, in free translation; which is an administrative record with detailed information on the universe of formal sector employer-employees.

[19] A platform organized by the United Nations Development Program (UNDP) and local institutes that releases more than 200 human development indicators of Brazilian municipalities and states. Table B.8 in B presents the full list of variables.

[20] Mortality Information System, in free translation; which is the main longitudinal administrative record on mortality in the Brazilian territory. It is maintained by the Ministry of Health by using primary information directly from the death certificates of individuals.

[21] Continuous National Household Sample Survey, in free translation; which is one of the most important household sample surveys managed by the Brazilian Institute of Geography and Statistics (IBGE, in Portuguese). Its main goal is to collect quarterly data on the labor force from a sample of Brazilian households.

2.6.1 The *Bolsa Família* Sample

Initially, we restricted observations in CadÚnico to cases with "registered", active, status.[22] In this sense, Table 2.2 shows the total number of households and individuals with "registered" status in CadÚnico.[23] In particular, we can observe an increase in the number of registered households, from approximately 25 millions in 2012 to 29 millions in 2019. On the contrary, the total number of individuals in the "registered" category decreased for the same period, from approximately 81 million in 2012 to 76 million in 2019. While approximately 55% of households with an active and up-to-date registration in CadÚnico were also beneficiaries of the Bolsa Família Program in 2012, it is estimated that this value dropped to approximately 46% for the same group in 2019.

Table 2.2: Number of households and individuals with active and updated records in CadÚnico and number of the Bolsa Familia Program beneficiaries

Number of (in millions)	2012	2013	2014	2015	2016	2017	2018	2019
Households in CadÚnico	25.1	27.2	29.2	27.3	26.5	26.9	26.9	28.9
Bolsa Família Beneficiaries	13.7	13.9	14.0	14.0	13.6	14.0	13.8	13.2
Individuals in CadÚnico	81.3	84.3	88.2	80.8	77.8	76.5	73.6	76.4

Source: Own elaboration with data from the Cadastro Único for Social Programs of the Federal Government and the Bolsa Família Program Payrolls, Ministry of Citizenship/ Social Development.

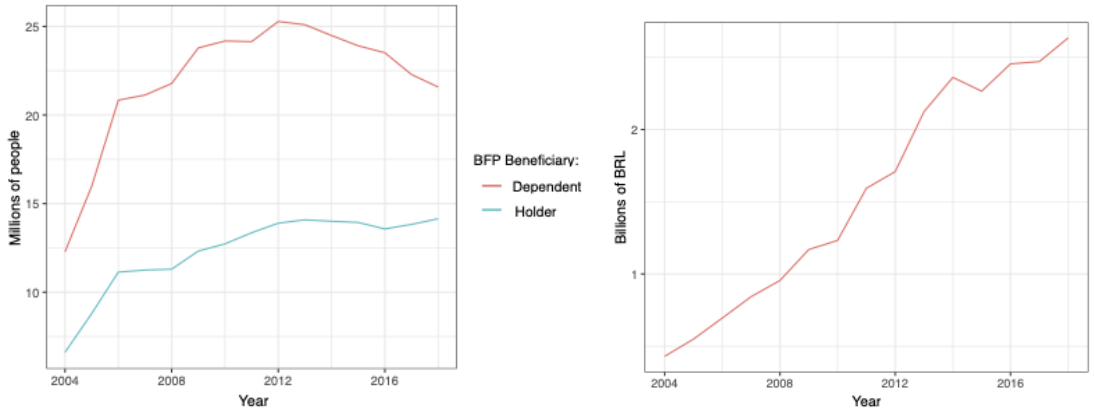
Another relevant characterization is the evolution of the BFP over the years. Figure 2.1 presents the number of individuals registered as benefit holders or dependents and the total amount disbursed by the federal government through the BFP from 2004 to 2019. Notice that the BFP has expanded over the years both in number of beneficiaries and in terms of the total amount spent by the federal budget in constant currency. The higher growth rate of dependent beneficiaries, when compared to beneficiaries, until 2012,

[22]This restriction is fundamental to ensure the quality of information, as the "excluded" records refer to information stocks that have not been completely discarded from the database, but are not updated either. Similarly, "other" categories of records are extremely rare, less than 0.1%, indicative of only a procedural flow of information.

[23]The distribution of people and beneficiary households of the Bolsa Família Program according to their registration status can be observed in B, in Tables B.1 and B.2.

is related to changes in PBF rules over the years, which allowed more categories to receive the benefit.[24]

Figure 2.1: Number of Beneficiaries and Total Value of BFP Benefits over the years



(a) **Number of dependents and holders** (b) **Total value spent with benefits**

Source: Authors, with data from the *Cadastro Único* for Federal Social Programs and the Bolsa Família Program Payrolls, Ministry of Citizenship/Social Development.

2.6.2 Sample Representativeness

Although CadÚnico and BFP Payrolls encompass a great share of low-income Brazilian households, it is relevant to understand how representative our analysis is of the Brazilian population at the base of the social pyramid. We proceed as follows by estimating the coverage rate of the BFP for the eligible Brazilian population over the years, which represents the portion of the population that the sample of beneficiaries comprises[25], a common approach in the literature.

The first challenge is to observe the total number of low-income Brazilian households and which are beneficiaries of social programs. We used as reference the article by Souza et al. (2019), which addresses this issue by using data from a Continuous National House-

[24]Children aged 7 to 16 in 2005 could only be observed as dependent beneficiaries in that year, but could have turned into benefit holders in 2019. In fact, they could be the specific benefit holder, or just another member in a beneficiary household in 2019.

[25]The eligibility criteria can be found in section **??**.

hold Sample Survey (PNADc) to estimate the distribution of Brazilian households by income groups and identify those who are beneficiaries of social programs. The authors estimate a BFP coverage rate[26] of 46% in 2005, which reaches about 60% between the years 2012 and 2017.[27]. However, these results should be analyzed with caution. The authors highlight that there is a significant under-reporting of the number of BFP beneficiaries in self-reported household surveys, with estimates between 30% and 35% lower than the administrative data.[28] In other words, the program's coverage rate is significantly higher than the one estimated by them when comparing the number of beneficiaries from administrative records of the Cadastro Único and the BFP payroll with data from the PNADc.

In any case, household surveys can provide a perspective of the Brazilian population, specially labor market information with the PNADc. Thus, we used as comparison groups to the children aged 7 to 16 beneficiaries of the BFP in 2005, the group of individuals with matched age between 2015 and 2019. For instance, we compare them to people aged 17 to 26 in 2015; 18 to 27 in 2016; and so forth, until 2019. The conclusion is that the majority of the Brazilian population at the base of the social pyramid is indeed covered by the BFP over the years, even more registered in the CadÚnico. Therefore, our estimates of social mobility indicators are highly representative of the low-income Brazilian population.

2.7 Social Mobility indicators between 2005 and 2019

This section characterizes the social mobility experienced by BFP dependent beneficiaries more than a decade after they started receiving the benefit. The two social mobility indicators are evaluated between 2015 and 2019, when BFP dependent beneficiaries then

[26]The BFP coverage rate is calculated by the authors as the percentage of beneficiaries among the poorest 20% of the population, defined by the household *per capita* income net of BFP transfers in the PNADs.

[27]Detailed information can be found in Figure B.1 of B

[28]This fact can be observed in Figure B.2 of B.

were between 21 and 30 years old. We can observe that 64% of them were no longer in the CadÚnico in 2019, meaning they were emancipated from federal government social programs. Similarly, we observe that 45% of them accessed the formal labor market at least once between the years 2015 and 2019. These results are suggestive of social mobility at the base of the Brazilian income distribution for BFP beneficiaries during the analyzed period. They do also contribute to the literature on long-term effects of CCTs by linking future employment status to an emancipation of social programs (Millán et al., 2019).

2.7.1 Emancipation from Social Programs

There are some reasons why an individual might not be found in the *CadÚnico* records over the years, as explained in Section 2.3. Our hypothesis is that the individuals who were BFP beneficiaries in childhood and are not observed as such in adulthood have emancipated from social programs. Table 2.3 presents the *CadÚnico* registration status in 2019 of the BFP dependent beneficiaries aged between 7 and 16 in 2005. In 2019, about 7.45 million individuals, 64% of them, were not found in the CadÚnico; meaning they were no longer beneficiaries of federal government social programs for low-income households. Among the approximately 4 million people who remained in the registry, 2.4 million, 20%, continued to receive the BFP; while 1.6 million, 14%, remained in the registry but were not on the BFP payroll. The latter most probably did not meet the requirements to receive the BFP but were still eligible for other federal government social programs.

Table 2.3: *CadÚnico* registration status in 2019 of the BFP dependent beneficiaries aged between 7 and 16 in 2005

Registration Status	N	Distribution (%)
Total	11,628,300	100%
Still beneficiaries of the BFP	2,372,528	20%
Registered but not BFP beneficiaries	1,628,291	14%
Not found in *CadÚnico*:	7,627,481	66%
Deceased (estimate)	176,376	2%
Not registered in *CadÚnico* (Exit Rate)	7,451,105	64%

Source: Own elaboration with data from the *Cadastro Único* for Federal Social Programs and the Bolsa Família Program Payrolls, Ministry of Citizenship/Social Development.

Note: The "Not found in *CadÚnico*" group is subdivided between deceased individuals and those who left the registry for other reasons, such as lack of updating or failure to meet program requirements. Mortality estimates based on data from the Mortality Information System and PNADc/IBGE population.

We start by analyzing how individual characteristics of the beneficiaries are associated to differences in the observed exit rates from *CadÚnico* and the BFP payroll. Table 2.4 shows greater mobility, i.e. higher exit rates, for male, White, and older individuals within the analyzed cohort; those whose household heads had higher educational levels; and those residing in the central-southern regions of Brazil.

While 69% of males left the registry, only 55% of females did so. Similarly, 67% of dependent beneficiaries aged between 10 and 16 in 2005 were no longer in the registry in 2019, 11 percentage points higher than dependents aged between 7 and 9 in 2005. For White individuals, the exit rate from the registry was 65%, while for Black ones it was 54%; 51% for Yellow; and 46% for Indigenous people. Furthermore, about 62% of dependent beneficiaries whose household heads had completed elementary school or higher level of education were not found in the registry in 2019. This proportion dropped to 56% for those whose household heads had not completed elementary school.

Regional differences are also observed. The exit rate was over 70% in the central-southern regions of the country; 9 and 12 percentage points higher than those of North

and Northeast regions, respectively. The latter presented a proportion of individuals still beneficiaries of the BFP in 2019 that was more than double the retention rate in the central-southern regions.[29]

Table 2.4: *CadÚnico* registration status in 2019 of dependent beneficiaries aged 7 to 16 in 2005, by characteristics

Characteristic	BFP (N)	% of 2005	CadÚnico but non-BFP (N)	% of 2005	Out of CadÚnico (N)	% of 2005
			by age in 2005			
07 to 09 years	845,850	24%	579,848	16%	2,067,246	59%
10 to 16 years	1,526,678	19%	1,048,443	13%	5,383,860	67%
Total	2,372,528	20%	1,628,291	14%	7,451,105	64%
			by gender			
Male	742,198	15%	661,897	14%	3,376,119	69%
Female	1,342,923	28%	753,562	16%	2,616,416	55%
Total	2,085,121	22%	1,415,459	15%	5,992,535	62%
			by race/ethnicity			
Yellow	8,274	28%	4,795	17%	14,872	51%
Indigenous	13,892	39%	4,521	13%	16,461	46%
White	427,221	17%	424,492	17%	1,669,931	65%
Black	1,609,327	28%	969,756	17%	3,183,893	55%
Total	2,058,714	24%	1,403,564	17%	4,885,156	58%
			by region in Brazil			
Midwest	64,980	11%	87,083	15%	425,630	72%
South	138,089	10%	193,618	14%	1,009,766	74%
North	273,165	25%	138,836	13%	660,532	61%
Southeast	445,533	14%	484,971	15%	2,308,451	70%
Northeast	1,450,761	27%	723,783	14%	3,046,727	58%
Total	2,372,528	20%	1,628,291	14%	7,451,105	64%

Source: Own elaboration with data from the *Cadastro Único* for Federal Social Programs and the Bolsa Família Program Payrolls, Ministry of Citizenship/Social Development.

Note: The total number of individuals by characteristics does not add up to the total number of dependent beneficiaries aged between 7 and 16 in 2005 for all characteristics, given the limitations and availability of information presented in section 2.6.

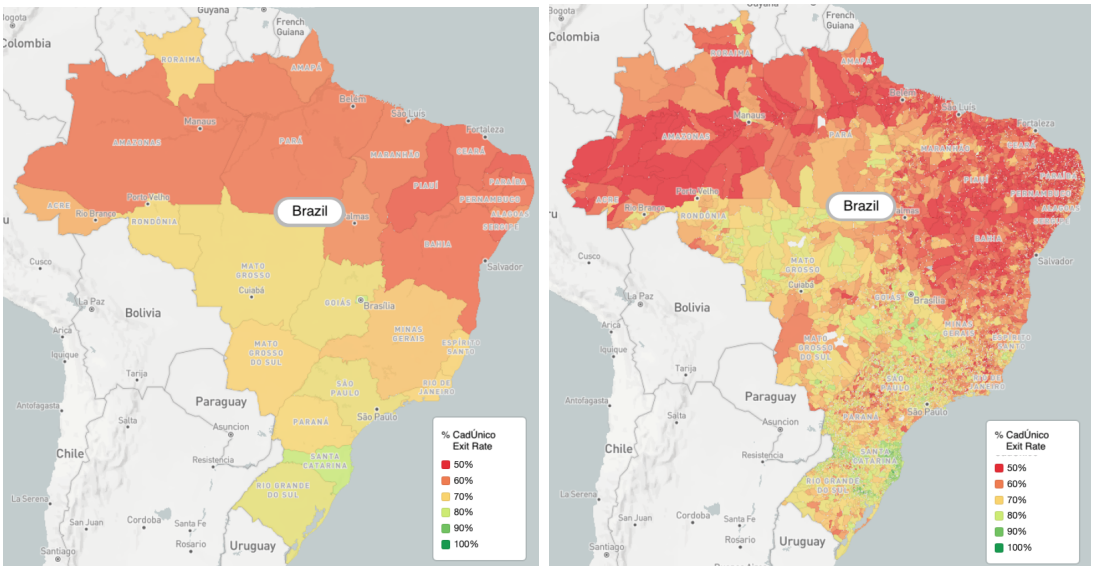
2.7.2 Emancipation from Social Programs in the territory

Similar to other countries (Chetty et al., 2014), Table 2.4 suggests great heterogeneity in the *CadÚnico* exits indicator across the Brazilian territory. Thus, we present in Figure 2.2 two maps with the CadÚnico exit rates, i.e. emancipation from social programs,

[29]It is worth noting that we do not present the exit rates from *CadÚnico* for individuals with unknown characteristics due to non-declaration or lack of information in the registry, as reported in Section 2.6.

by Federative Units and municipalities of Brazil. In addition to regional differences, there is considerable heterogeneity among municipalities within a same Federative Unit. Furthermore, even greater differences are observed between municipalities from different states and regions.[30]

Figure 2.2: *CadÚnico* exit rate in 2019 by place of residence - BFP dependent beneficiaries aged 7 to 16 in 2005



(a) **by Federative Unit of residence** (b) **by municipality of residence**

Source: Own elaboration with data from the *Cadastro Único* for Federal Social Programs and the Bolsa Família Program Payrolls, Ministry of Citizenship/Social Development.
Note: The legend presents value intervals. For example, areas filled with red indicate percentages between 0% and 50%, orange between 50.1% and 60%, and so on.

2.7.3 Access to the formal labor market

In addition to an emancipation from federal government's social programs, we evaluate a labor market indicator related to social mobility. We analyze the access of former BFP beneficiaries to the formal labor market in working age, as explained in section 2.3. Table 2.5 presents the status of access to the formal labor market (RAIS) between 2015 and

[30]Figure B.3 of B presents the cumulative distribution of the average individual emancipation from social programs at Brazilian municipalities by regions. Table B.3 of B presents the municipalities with the five highest and the five lowest *CadÚnico* exit rates by region of Brazil and by population size.

2019 of those BFP dependent beneficiaries aged 7 to 16 years in 2005. It does also present similar outcomes for Brazilians in the same age groups in PNADc household survey.[31]

Approximately 5.2 million of former BFP beneficiaries, 45%, were found in RAIS at least once during these years. A very similar share that Oliveira and Chagas (2020) observe for previous cohorts. Another 2.6 million, 23%, were in the formal labor market for three years or more. Similarly, we can observe that, on average, 31% of the Brazilian population in the same age group was employed in the formal labor market, which means they should be registered in RAIS, between 2015 and 2019. On the contrary, around 6.4 million former beneficiaries, 55%, were not found in the RAIS in the period. It is worth noting that with this data we are not able to observe whether these individuals were not working, but rather that they were not in formal job positions only.[32] Similarly, on average, 69% of the Brazilian population in the same age group was unemployed, employed in informal activities, or out of the job market between 2015 and 2019.

The comparison between administrative and household survey data is relevant to put our results into context. The fact that 45% of them accessed the labor market at least once is a big policy result, given that, on average, only 31% of the Brazilian population in the same age group were employed in formal occupations during the same period.[33] There are, however, two other relevant factors while analyzing these results: the Brazilian economic activity in the period and structural changes in life opportunities for young adults in Brazil. During this period of time, Brazil experienced an economic recession, followed by low economic growth, which affected the job opportunities in the labor market. Meanwhile, there was a huge expansion of educational opportunities due to programs launched by the federal governments since the late 2000's. Therefore, we should expect that young adults did also delay entering the job market.

[31]Note that people aged 7 in 2005 would be only 17 in 2015. Thus, they could only be observed as employed in "young apprentices" programs in the 2015 RAIS.

[32]In fact, they were most possibly engaged in informal economic activities.

[33]Notice that the two outcomes do not measure the exact same thing. While we look for individuals in a panel of RAIS datasets between 2015-2019, the PNADc outcome is given by the average of people with the same age profile working in the formal job market.

Table 2.5: Access to the formal labor market (RAIS) between 2015 and 2019 of dependent beneficiaries of the BFP aged 7 to 16 years in 2005 and PNADc Household Survey comparison group

Status	BFP Sample		PNADc	
	(N)	(%)	(N)	(%)
Total	11,628,308	100%	34,159,717	100%
Not found in RAIS (unemployed or out of formal labor market)	6,433,105	55%	23,479,659	69%
Found in RAIS (formally employed) at least once between 2015-2019:	5,195,203	45%	10,680,058	31%
in 1 year	1,670,871	14%	-	-
in 2 years	905,573	8%	-	-
in 3 years	892,818	8%	-	-
in 4 years	875,040	8%	-	-
in 5 years	850,901	7%	-	-

Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Also, the PNADc (Continuous National Household Sample Survey) from IBGE. The PNADc comparison group is given by the average share of characteristics of individuals with matched age between 2015 and 2019. For each year we take as comparison group the characteristics of those with similar age. For instance, people aged 17 to 26 in 2015; 18 to 27 in 2018; and so forth, until 2019. Formally employed individuals identified by variable V4029="Yes" in PNADc, i.e. answering "Yes" for having an active formal employment contract.

As for the first indicator, Table 2.6 present differences in the access rates to the formal labor market by characteristics of the BFP dependent beneficiaries with age 7 to 16 in 2005 and the Brazilian population in the same age group from PNADc. We observe, once again, greater mobility for individuals with the same characteristics. There is higher and more continuous access rates to the formal labor market over the years for men, White, and older individuals within the analyzed cohort, whose heads of household had higher levels of education and individuals from the central-southern regions of the country.

Notice the similar distribution by characteristics between those who accessed the formal labor market for three years or more in our sample and the Brazilian population in the same age group from the PNADc household survey who were formally employed at

the time of the survey. Although the latter is given by the average of the population in same age profile between 2015 and 2019, not a panel of individuals, we can put into context by how much the specific individual characteristics are correlated with greater access to formal, tenured occupations.

Our results are, also, similar to what is found in the literature. Similar to Arora et al. (2023), while 34% of men were in the RAIS for three or more years between 2015 and 2019, only 24% of women did the same. Similarly, 52% of dependent beneficiaries aged 10 to 16 years in 2005 were not found in the RAIS during the period, while those aged 7 to 9 years in 2005 were 62%. As for race or ethnicity, access to the formal labor market for three years or more occurred for 38% of White individuals, 28% of Black and Asian individuals, and only 18% of Indigenous people. Also, observe that there are greater differences while combining gender and race or ethnicity information. While 42% of White men entered the formal labor market for three years or more, only 23% of Black women did the same; Black men and White women had the same rate, 33%.

Likewise, we observed differences across the Brazilian territory. The highest proportion of beneficiaries in the South region, 43%, were found in the RAIS for three or more years; while 70% of those from the North and 63% from the Northeast regions were not found in the RAIS at all for the whole period.[34]

[34]Notice that there is a certain limitation in the analysis by individual characteristics due to the lack of information in the registration process or non-declaration, as mentioned in section 2.6.

Table 2.6: Access to the formal labor market (RAIS) between 2015 and 2019 for dependent beneficiaries aged 7 to 16 years in 2005 and the Brazilian population with matching ages in household surveys, by characteristics

Characteristic	Not in RAIS	In RAIS for 2 years	In RAIS for 3 + years	Formal workers - PNADc
		by age group in 2005		
07 to 09 years	62%	17%	21%	23%
10 to 16 years	52%	15%	33%	35%
		by gender		
Male	49%	17%	34%	35%
Female	61%	15%	24%	27%
		by color, race, or ethnicity		
White	45%	17%	38%	37%
Black	55%	17%	28%	28%
Indigenous	69%	13%	18%	21%
Yellow	56%	16%	28%	32%
		by race or ethnicity, and gender		
White Male	40%	18%	42%	40%
Black Male	49%	18%	33%	33%
White Female	50%	17%	33%	33%
Black Female	62%	15%	23%	22%
		by region of Brazil		
North	70%	13%	17%	17%
Northeast	63%	14%	23%	18%
Midwest	47%	17%	36%	35%
Southeast	45%	17%	38%	38%
South	40%	17%	43%	44%

Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Also, the PNADc (Continuous National Household Sample Survey) from IBGE. The PNADc comparison group is given by the average share of characteristics of individuals with matched age between 2015 and 2019. For each year we take as comparison group the characteristics of those with similar age. For instance people aged 17 to 26 in 2015; 18 to 27 in 2018; and so forth, until 2019. Formally employed individuals identified by variable V4029 in PNADc.

Note: The total number of individuals by characteristics does not add up to the total number of dependent beneficiaries aged between 7 and 16 in 2005 for all characteristics, given the limitations and availability of information presented in section 2.6.

2.7.4 Access to the formal labor market in the territory

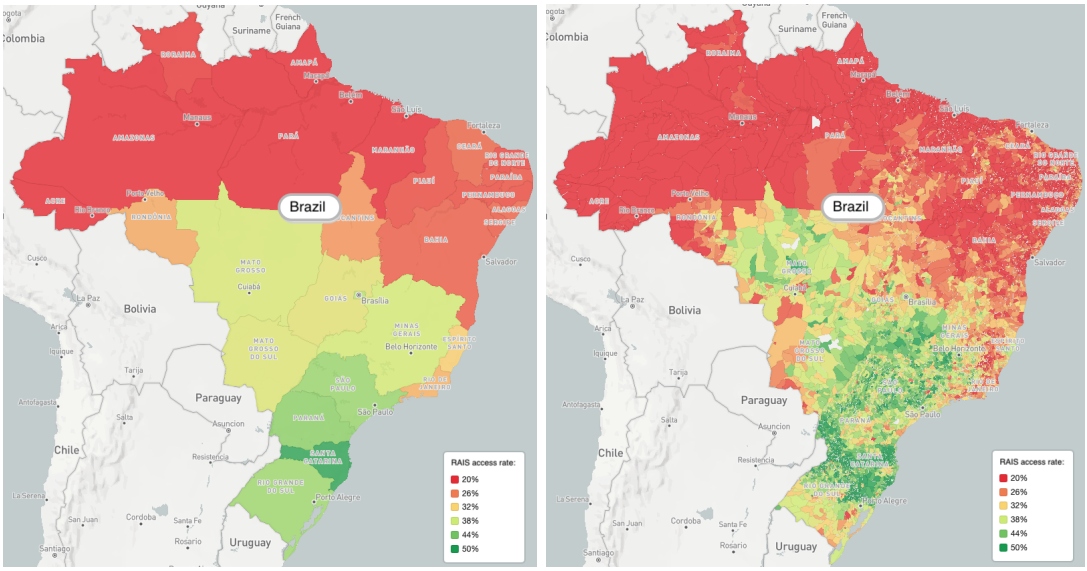
We focus, once again, on magnified differences across the territory. Table 2.6 highlights heterogeneities in the access to the formal labor market between Brazilian regions. Additionally, Figure 2.3 presents two maps with the access rates to the formal labor market (RAIS) by Federative Units and municipalities of Brazil. We observe differences in access to the formal labor market between and within the Federative Units again. In general, there is a high concentration of municipalities with higher rates of social mobility in the central-southern regions of Brazil, with mobility rates more than the double of the northern areas. Indeed, the maps highlight that the social mobility of former beneficiaries varies greatly depending on their municipalities of residence.[35]

2.7.5 Correlation between the two indicators of social mobility

At this point, the evidence suggest that there might be a strong link between the two indicators of social mobility. Figure 2.4 presents the relationship between the emancipation from federal government social programs and access to formal employment at the municipality level. More precisely, it shows the correlation between the average rates of individuals who were listed in RAIS in any year between 2015 and 2019 and were not listed in the *CadÚnico* in 2019. There is a positive correlation between the two indicators, which supports the idea that individuals emancipated from federal social programs, indeed have a high probability of having also accessed a formal job position. It supports the idea that the latter justifies and sustains the first.

[35]Figures B.5 and B.6 of B present the average rate of access to the formal labor market (RAIS) according to the Federative Unit of residence and the distribution of municipalities by region, respectively. Table B.4 and Figure B.7 of B, the municipalities with the five highest and five lowest rates of access to formal employment, and the highest and lowest rates by region and Federative Unit, respectively.

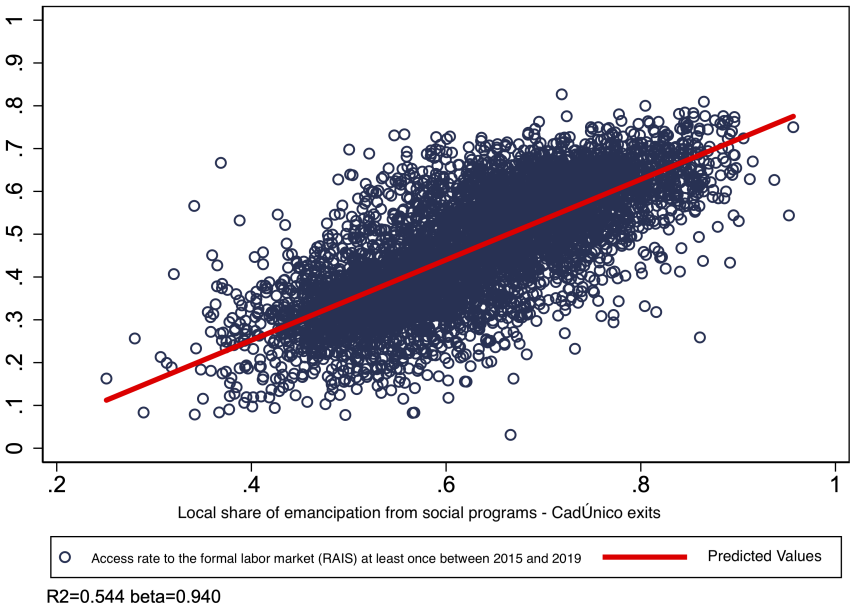
Figure 2.3: Access to the formal labor market (RAIS) for three or more years between 2015 and 2019 according to the place of residence in 2019



(a) **by Federative Unit of residence** (b) **by municipality of residence**

Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Note: The legend presents value intervals. For example, areas filled with darker red represent percentages between 0% and 20%, orange between 20.1% and 26%, and so on.

Figure 2.4: Relationship between the average rates of individuals "being outside the Cadastro Único" in 2019 and "being found in the RAIS at some point" between 2015 and 2019 at the municipal level



Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Note: The rate of individuals found in the RAIS (exits from the Cadastro Único) at the municipal level is given by the proportion of BFP dependent beneficiaries aged between 7 and 16 in 2005 who were observed for three or more years in the RAIS between 2015 and 2019 (not listed in the Cadastro Único in 2019). Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 in 2005 were disregarded to avoid extreme values and to ensure greater robustness in the data analysis. Predicted values show the linear relationship between the variables of interest. They are the result of the mathematical optimization (OLS) process that aims to find the best fit for the dataset by minimizing the sum of the squared differences between the estimated value and the observed data.

2.8 Formal employment characteristics

The previous analysis suggests that less beneficiaries of the BFP relied on social benefits more than a decade after its implementation. We expect that a generation of young BFP beneficiaries entered adulthood in better socioeconomic conditions than during childhood and adolescence. However, we can still investigate the characteristics of their social ascension. More precisely, by analyzing differences in characteristics of the occupations they accessed when compared to the rest of the Brazilian population, i.e. the non-beneficiaries.

2.8.1 Characterizing the analysis

The group of analysis is still the first generation of BFP dependent beneficiaries, aged 7 to 16 in 2005, but now restricted to those who accessed the formal labor market, i.e. found in RAIS, at least once between 2015 and 2019.[36] We compare their working conditions with individuals in the same age group between 2015 and 2019 (17 to 30 years old)[37] found in RAIS at least once, who were not beneficiary of federal government social programs in 2005 (not found in *CadÚnico*), and has never been a beneficiary of the BFP until 2019.

The two comparison groups are heterogeneous by definition. Therefore, it is necessary to take into account pre-existing characteristics that may be related to their labor market outcomes. Table 2.7 presents the average characteristics of the BFP dependent beneficiaries in our group of interest and the comparison group of non-beneficiaries. We can observe that a higher proportion of beneficiaries who accessed the formal labor market were males, around 16 percentage points higher, when compared to non-beneficiaries. Additionally, they were predominantly Black, while the non-beneficiaries were predominantly White, approximately 13 percentage points more Black individuals in the group

[36]This restriction is necessary because we do not have data to compare unemployed and those in informal positions with the rest of the population.

[37]Notice, again, that people aged 17 in RAIS can only be be employed in "young apprentices" programs, not exactly tenured job positions. Also, that only 38% of those with age 7 and 9 in 2005 were found in RAIS a decade later.

of beneficiaries. Lastly, we observe a big gap in educational attainment between the two groups; the proportion of beneficiaries with higher education was around 12 percentage points lower than that of non-beneficiaries, four times less.

Table 2.7: Characteristics of BFP dependent beneficiaries in 2005 and the group of non-beneficiaries in the same age group who accessed the formal labor market between 2015 and 2019

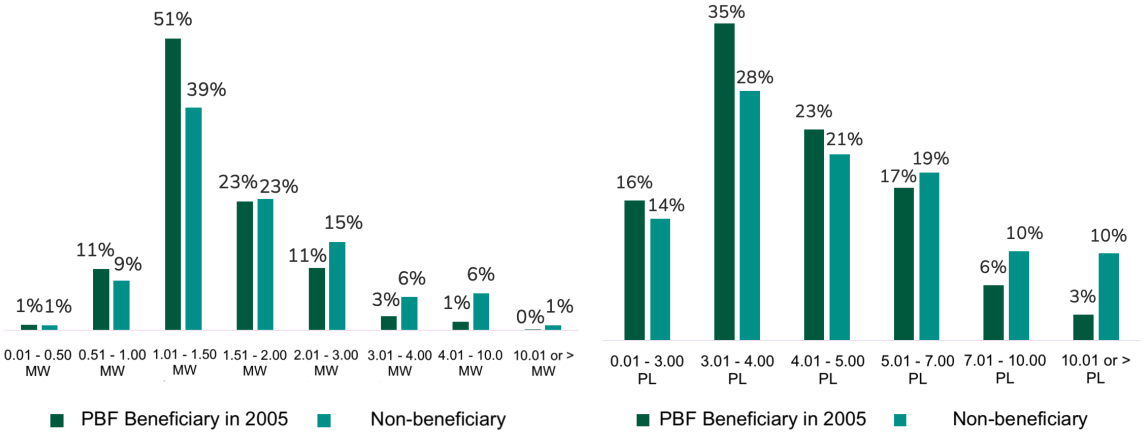
Characteristic	Beneficiaries (i)	Non-beneficiaries (j)	Difference (i-j)
Total individuals (N)	5,195,203	13,174,588	
by age group in 2005			
07 to 09 years	25.9%	24.5%	1.4%
10 to 16 years	74.1%	75.5%	-1.4%
by gender			
Male	58.6%	57.2%	1.4%
Female	41.4%	42.8%	-1.4%
by color, race, or ethnicity			
White	34.9%	44.1%	-9.2%
Black	46.8%	33.9%	12.9%
Yellow	0.5%	0.6%	-0.1%
Indigenous	0.2%	0.2%	0.0%
Not available	17.5%	21.3%	-3.8%
by educational attainment			
Incomplete or less than Elementary School	2.1%	0.9%	1.2%
Complete Elementary School	1.8%	0.8%	1.0%
Incomplete Lower Secondary School	5.7%	2.6%	3.1%
Complete Lower Secondary School	19.7%	13.8%	5.9%
Complete High School	66.1%	65.3%	0.8%
Complete Higher Education or more	4.6%	16.5%	-11.9%

Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Note: The group of beneficiaries is composed by the first generation of BFP dependent beneficiaries, aged 7 to 16 in 2005, found in RAIS at least once between 2015 and 2019. The group of non-beneficiaries are those in the same age group between 2015 and 2019 (17 to 30 years old) found in RAIS at least once, who were not beneficiary of federal government social programs in 2005 (not found in *CadÚnico*), and has never been a beneficiary of the BFP until 2019.

2.8.2 Labor income distributions

We start by analyzing their income distributions. Figure 2.5 presents the distribution of income levels in minimum wages and poverty line ranges.[38] Although the income distribution of PBF beneficiaries is left-skewed, with more than half of them receiving between 1.01 and 1.50 minimum wages, we can observe that some of them reached the highest brackets of the income distribution.[39]

Figure 2.5: Comparison of income distributions between BFP dependent beneficiaries in 2005 and those who were never PBF beneficiaries between 2005 and 2019



(a) **Income in minimum wages** (b) **Income in poverty line ranges**

Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Note: Monetary values in Brazilian *Reais* (BRL) of 2019. The poverty line ranges were regionalized for rural and urban areas of the Brazilian Federative Units and metropolitan regions, ranging between BRL 268.52 and BRL 434.09. The value of the national minimum wage in 2019 was BRL 998.00. The comparison groups are PBF dependent beneficiaries aged 7 to 16 in 2005 and those who were never PBF beneficiaries between 2005 and 2019 in the same age group.

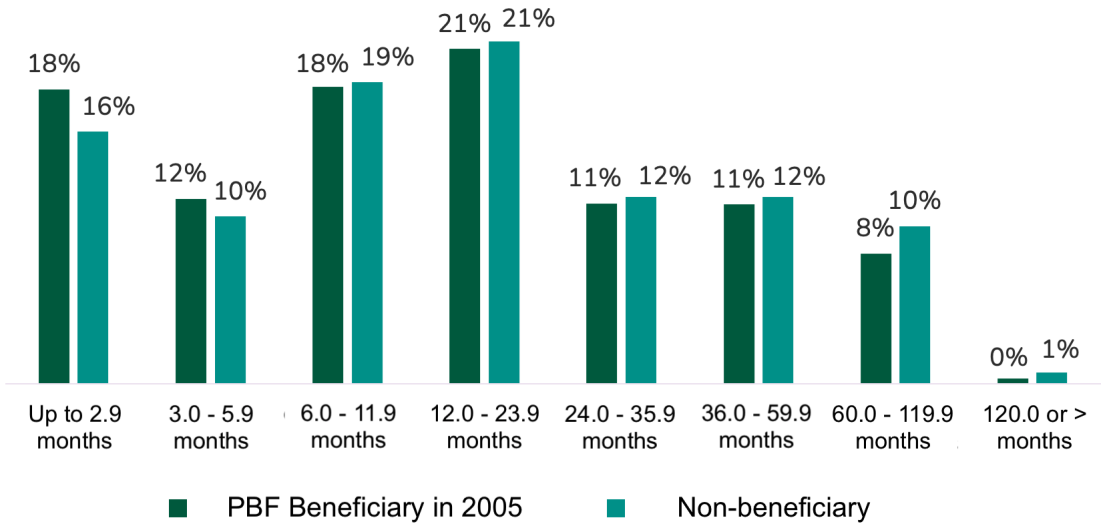
[38] Monetary values in Brazilian *Reais* (BRL) of 2019. The poverty line ranges were regionalized for rural and urban areas of the Brazilian Federative Units and metropolitan regions, ranging between BRL 268.52 and BRL 434.09. The value of the national minimum wage in 2019 was BRL 998.00.

[39] Notice that individual educational level may help explain this result. Figure B.8 of B shows that, conditioning for completed higher education, the average income is lower for previously PBF beneficiaries.

2.8.3 Occupation's characteristics

Not only is the income distribution important, but also the characteristics of employment contracts. The duration of contracts, for instance, can represent a consolidated emancipation of individuals from social programs, once they have achieved a sustained income above the poverty and extreme poverty lines. Figure 2.6 shows that there are smaller differences in the duration of employment between the two groups, despite a slightly higher concentration of non-beneficiaries at the top, i.e. longer job tenure.

Figure 2.6: Comparison of employment contracts' duration, last occupation, of BFP dependent beneficiaries in 2005 and those who were never beneficiaries between 2005 and 2019



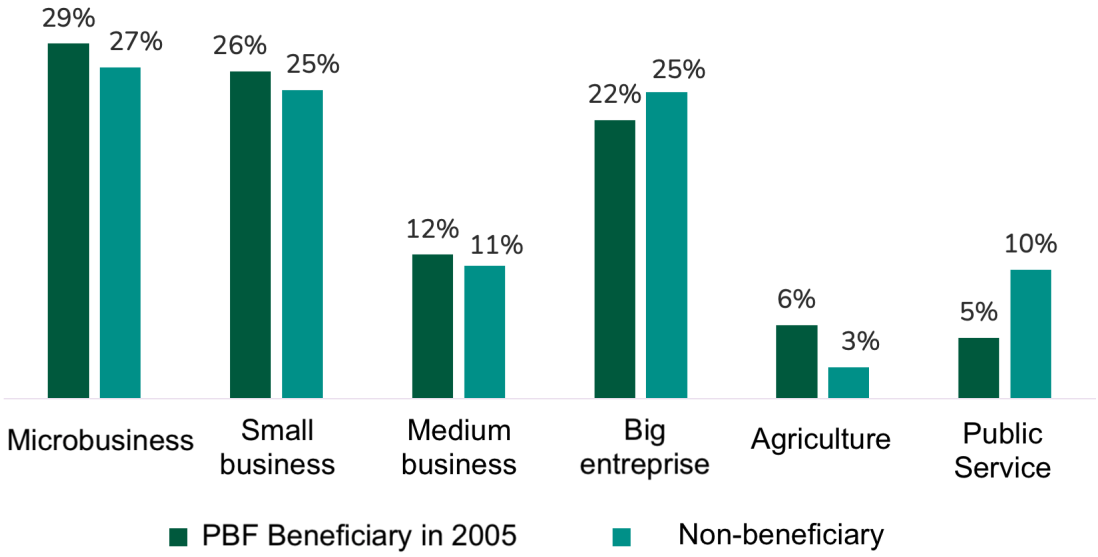
Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively.

Another aspect of it is the economic sector of activity and size of the companies in which individuals are employed. Figure 2.7 presents the size of the employing company in the industry, trade, and services sectors for the comparison groups, as well as the highlighted sectors of agriculture and public service.[40] Very similar distributions can be

[40]Table B.5 of B presents the methodology used to define the size of companies by economic sector of activity.

observed for both groups in the trade, industry, and services sectors. However, there are also differences in the other occupations. Previously BFP beneficiaries have a higher representation in the agriculture sector, while non-beneficiaries have a greater predominance in public service.[41]

Figure 2.7: Comparison of employing company's size by economic sector of activity between BFP dependent beneficiaries in 2005 and those who were never beneficiaries between 2005 and 2019



Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Note: The categories of companies' size in the trade, industry, and services sectors were based on the methodology presented in the "Anuário do trabalho na micro e pequena empresa" (Yearbook of Employment in Micro and Small Enterprises) by the 2013 "Serviço Brasileiro de Apoio às Micro e Pequenas Empresas" (SEBRAE).

[41] Figure B.9 of B suggests that differences in levels of education are correlated with employment in different sectors as well.

2.9 Determinants of social mobility in the municipalities

The previous analyses presented a high level of heterogeneity in social mobility across the Brazilian territory. This section deepens our understanding by estimating the association between local characteristics and the social mobility achieved by individuals.

2.9.1 Methodology

We are interested in analyzing the probability of individual social mobility over the same period, 2015 to 2019, by using the same indicators of the previous sections. Thus, our dependent variable is given by the fraction of the previously BFP dependent beneficiaries in a municipality who experienced social mobility according to our indicators. The explanatory variables consist of a set of demographic and socioeconomic municipal characteristics measured in 2005, or earlier, 2000 - data from the Census, aiming to mitigate issues of contemporaneous endogeneity to the implementation of the BFP. The matrix of explanatory variables includes groups of variables related to municipal management, demographics, economics, education, and health.

Since the dependent variable is a fraction of the population, aggregated in a municipality, we employ a fractional logistic model (fraclogit) as in Papke and Wooldridge (1996). The parameters of interest, i.e., how much the groups of municipal characteristics explain the observed social mobility, are estimated using a quasi-likelihood method following the reduced-form econometric model:

$$MOB_m = F(X'_m\beta) \tag{2.1}$$

where the dependent variable, MOB_m, is assessed in two ways: (i) share of BFP dependent beneficiaries in 2005 who are not found in the 2019 *CadÚnico*; (ii) share of

BFP dependent beneficiaries in 2005 who are found in the RAIS at least once between 2015 and 2019. The explanatory variables, X_m, are measured in 2005, the year of the cohort of interest, or earlier, 2000 - data from the Census. These variables are divided into the following categories[42]: Demography, Economy, Adult Education, Youth Education, and Health.[43] All explanatory variables are standardized[44] to enable a relative comparison of the relevance of each explanatory factor. In the model of Equation 2.1, the β's represent the relative importance of each explanatory factor, holding all others constant.

The reduced-form model is estimated in two complementary approaches. Firstly, we used all variables from the five groups of municipal characteristics simultaneously, as explanatory variables in a fractional logit model. We report the results of selected factors at margins in the next section. Then, we combine all variables within each group to compose an index, representative of the group, through a Principal Component Analysis (PCA). We use the "PCA Score" as explanatory variables and estimate their relative effect also on a fractional logit model. Additionally, we estimate the latter by quantiles of the distribution of the dependent variables. We report all the coefficients as the average marginal effects, analytical derivatives, of the response with respect to the explanatory variables through *margins*. The coefficients should be interpreted by how much one percentage point increase in X, the explanatory variable, is related to a β percentage point increase in Y, the dependent variable.

[42]The Table B.8 in the B contains the complete list of available variables.

[43]The explanatory variables at the municipality level by groups is the following: Demography - average population, average population growth, share of young population, dependency ratio; Economy - *per capita* GDP, average GDP growth, share of formal employment, sh. of agriculture, sh. of industry, sh. of services, sh. of population in poverty vulnerability, and Gini index; Adult Education - illiteracy, completed elementary education, and high school completion among the population over 25 years old, sh. of households where all have completed elementary education with and without children; Youth Education - share of children age 4-5 and 6-14 out of school, sh. of children attending elementary and high school, age-grade distortion for elementary and high school, average IDEB in 2005; Health - sh. of houses with access to treated water, basic sanitation system, inside restrooms, and waste collection system, infant mortality rate, and sh. of newborns with weight below average.

[44]Subtracting the mean and dividing the result by the standard deviation of each variable.

2.9.2 Results

We start by presenting the results for the full model, in which all municipal characteristics are used as explanatory variables for our social mobility indicators. Figure 2.8 presents the average marginal effect of selected factors from each group of characteristics on the share of former BFP beneficiaries among the local population who experienced social mobility, i.e. emancipated from social programs or accessed the formal labor market.[45]

The most interesting assessment is how the factors are consistently and significantly correlated with our two social mobility indicators in a similar magnitude and direction. Indeed, all coefficients are significant at a 99% level. It is also interesting to observe the correlation between adult illiteracy rates and the share of population in poverty vulnerability with social mobility. A one percentage point increase in those factors has an average marginal effect of approximately -0.05 percentage point decrease in the municipality's share of former BFP beneficiaries who emancipated from social programs.[46] That translates into a 8% decrease on the average number of beneficiaries who emancipated from social programs. Similarly, although of smaller magnitude, negative correlations are observed for the indicators youth dependency ratio, age-grade distortion in high school, and infant mortality rate. The three related to worse socioeconomic conditions for children in that municipalities, on average.

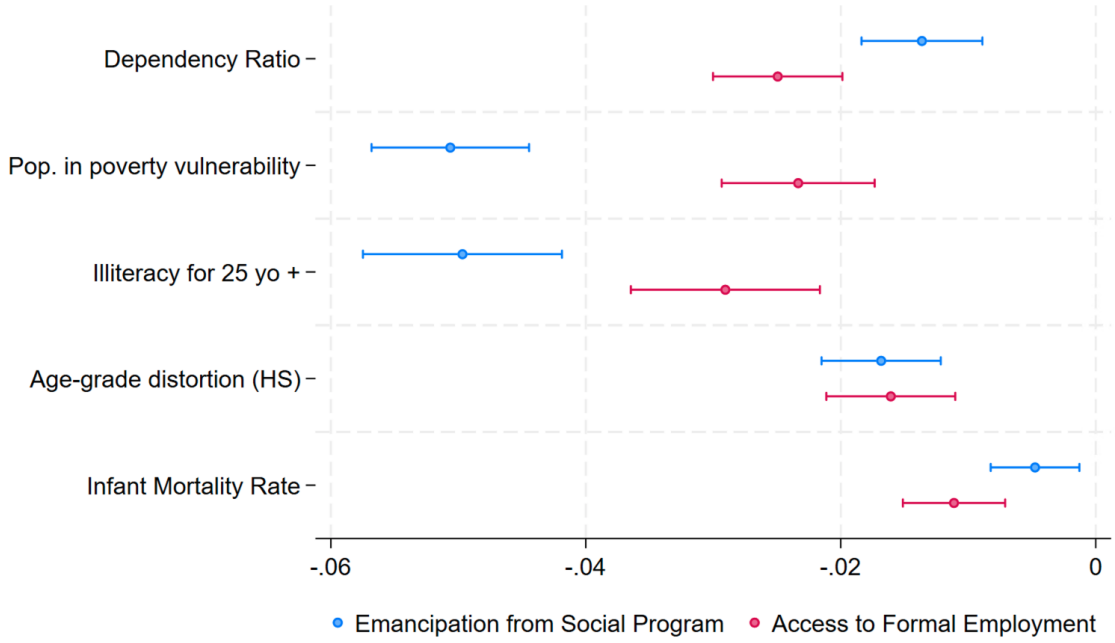
While individual factor analysis present a direct interpretation for the estimated coefficients, the estimates, more generally, are not able to convey the broader association between local characteristics and social mobility. Therefore, we construct the PCA groups of local characteristics, aggregating a vast range of local indicators.[47] Figure 2.9 presents the results for a similar model, by using the score of PCA groups as explanatory variables,

[45] We selected the variables based on statistical significance and direct relation to the structural factors we analyze.

[46] Notice the negative relationship between worse education and economic status with future social mobility, as expected.

[47] The list of variables within each group is presented in Section 2.9.1

Figure 2.8: Factor Analysis of local characteristics explaining the social mobility indicators



Source: Coefficients estimated by a fractional logit model and reported as the average marginal effects of selected municipal characteristics on the social mobility indicators, i.e. former BFP beneficiaries with age 7-16 in 2005 future emancipation of social programs in 2019 and access to formal employment in any year between 2015 and 2019. All coefficients significant at a 99% level. The matrix of explanatory variables comprises significant municipal characteristics for local demography, economy, education, and health. Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively.

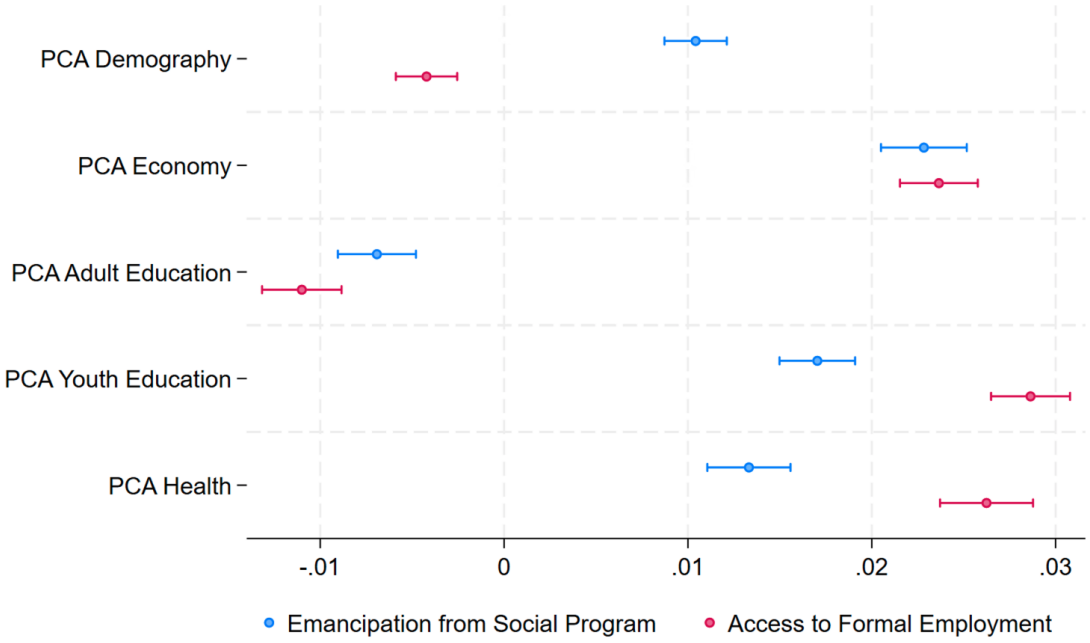
ordered as the factors in Figure 2.8. Notice that the estimated coefficients do not have a meaningful interpretation, however they are able to convey the relative importance of each group to local social mobility. For instance, a one percentage point improvement in local health structure would lead, on average, to a marginal increase between 0.01 and 0.03 percentage point on our social mobility indicators. Also, that for the PCA groups the logic is the opposite that of our individual socioeconomic indicators: the greater the PCA scores, the better socioeconomic environment at the municipality.

The first aspect we would like to highlight is how economic factors are consistently and positively correlated with social mobility. Indeed, Brazil experienced a period of economic growth with higher income distribution and reduction of social vulnerability in the period (Souza et al., 2019). Secondly, the positive correlation between Health and Youth Education indicators and social mobility, specially to the future access to formal employment, which is a well known result in the connection of the human capital formation and social mobility literature (Heckman, 2006). On top of that, the relationship between parental educational attainment and children social mobility can explain the negative relationship between Adult Education and our social mobility indicators, as observed in Section 2.7. Moreover, demographic trends presented divergent correlation with emancipation from social programs and access to formal labor market. On the one hand, it may have lead to more competition in the job market, on the other less young people relying on social programs.

Another interesting dimension is to understand how the local characteristics are correlated with social mobility over the distribution of our indicators. Figure 2.10 presents the results of similar estimations, associating local characteristics with social mobility indicators through the quantiles of their distributions. [48] The logic is to compare how much each factor marginally contributes to social mobility as measured by the distribution of our two indicators at the municipality level, i.e. if we observe constant or varying associations

[48] We present similar results for the average of each factor of analysis in Tables B.6 and B.7 of B

Figure 2.9: PCA groups of local characteristics explaining the social mobility indicators



Source: Coefficients estimated by a fractional logit model and reported as the average marginal effects of principal components on the social mobility indicators, i.e. former BFP beneficiaries with age 7-16 in 2005 future emancipation of social programs in 2019 and access to formal employment in any year between 2015 and 2019. All coefficients significant at a 99% level. The principal component analysis comprises municipal characteristics for local demography, economy, adult education, youth education, and health. Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively.

for each characteristic depending on higher or lower social mobility in a municipality.

We can observe that economic and demographic indicators have, on average, higher marginal effects on social mobility as we move towards higher social mobility rates in a municipality. While education and health indicators have constant association to social mobility. These results can be understood as how more structural factors, as education and health systems, have a significant and constant relative importance to social mobility, while economic and demographic fluctuations are associated with the variability of the indicators.

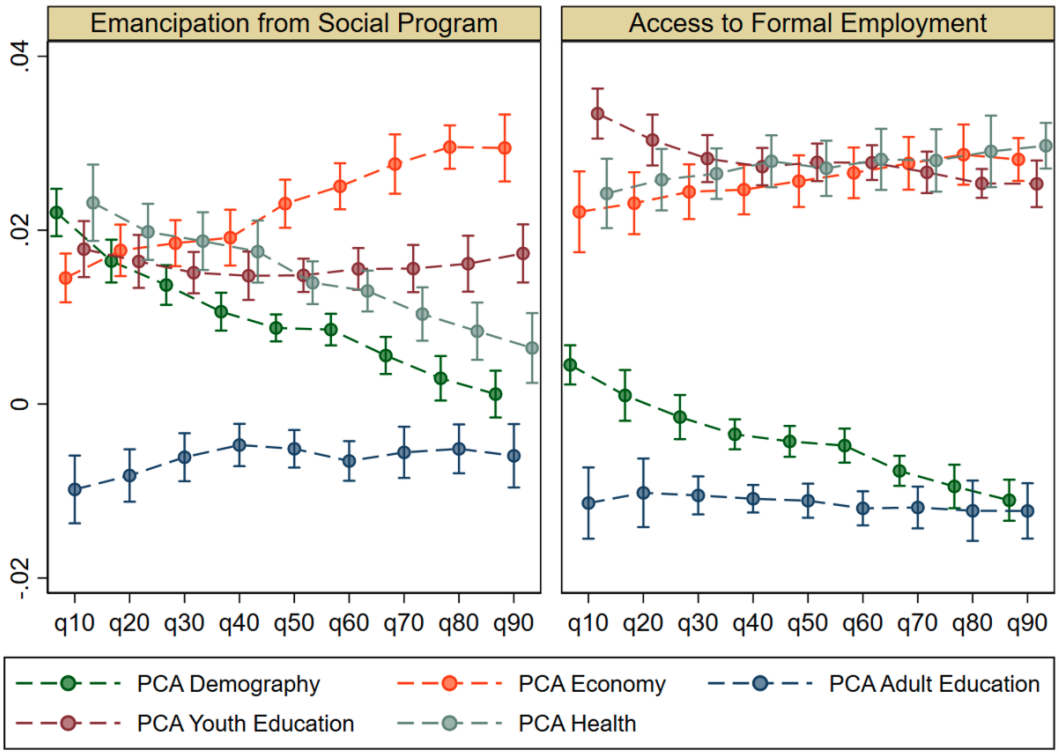
On top of that, we ran statistical tests for joint equality of the estimated coefficients across the quantiles. The F-test results present significant differences between the quantile coefficient estimators at 95% level for Demography, Economy, Adult Education, and Health PCA groups among the distribution of emancipation from social programs. While, the same is only observed for Demography and Youth Education PCA groups among the distribution of the indicator access to formal employment.

There are other dimensions that might intermediate the relationship between local characteristics and social mobility for BFP beneficiaries as we observed. For instance, spacial effects due to individual migration flows, as analyzed by Oliveira and Chagas (2018), and differences in local development over time, as determined by pitfall money from oil and gas royalties or intergovernmental transfers. We suggest those exercises for future research.

2.10 Conclusion

This research analyzes long-term outcomes associated with social mobility for beneficiaries of a Conditional Cash Transfer Program, the Brazilian Bolsa Família, from childhood to adulthood. We find that 64% of the BFP dependent beneficiaries aged 7 to 16 in 2005 were no longer beneficiaries of federal government social programs in 2019. Furthermore,

Figure 2.10: PCA groups of local characteristics by quantiles of social mobility indicators



Source: Coefficients estimated by simultaneous-quantile regression models and reported as the average marginal effects of principal components on the social mobility indicators, i.e. former BFP beneficiaries with age 7-16 in 2005 future emancipation of social programs in 2019 and access to formal employment in any year between 2015 and 2019. The principal component analysis comprises municipal characteristics for local demography, economy, adult education, youth education, and health. Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively.

45% of them accessed the formal labor market at least once between the years 2015 and 2019. These represent improvements in living conditions through their life cycles.

Additionally, we investigate the characteristics of the formal employment to which this group accessed compared to the average of non-beneficiaries during the same period. The former social program beneficiaries are employed in occupations of worse quality and pay. However, their higher participation in the formal labor market already indicates improved socioeconomic conditions than that of their childhood and youth.

The association between tenured employment and social program emancipation is a significant contribution to the literature. Not only it provides evidence that CCT beneficiaries, indeed, engage in the job market (Banerjee et al., 2017), but also that less people rely on cash transfers throughout generations. Increased participation in the formal labor market should lead to higher tax contributions, balancing the government budget.

Our results are highlighted by significant differences across individual characteristics and regions from Brazil as well. We observe that male, older and White individuals experience the highest levels of social mobility. Although a well-known result in the labor literature, we are able to contribute by showing how those characteristics do also apply for the social mobility analysis of CCTs during the individual's life trajectory, as Araujo and Macours (2021); Oliveira and Chagas (2020).

The regional differences highlight the need for further intersectional policy action to overcome poverty. We observe that the CCTs ability to promote social mobility is significantly associated with local characteristics. More specifically, education and health infrastructure, along with economic growth. Indeed, richer regions from Brazil, in the South, presented almost the double of mobility than Northern, least advantaged regions. Similar to what is observed in other parts of the world, even in developed countries (Chetty et al., 2014), and directly related to differences in opportunities due to human capital accumulation since childhood (Heckman, 2006).

Finally, our results should be put in the light of CCTs ability to improve the socioe-

conomic status of very vulnerable individuals. The BFP, for instance, was designed as a poverty alleviation program. A lot less is understood about its ability to tackle overall inequality, labor market segregation, regional disparities, and complement social protection systems. In fact, we observe that the latter mediates CCTs ability to promote social mobility. We encourage future research to exploit those characteristics in length, and over time and space. Furthermore, we show a high correlation between emancipation from social programs and labor market participation. We encourage further research to exploit this association, for instance on how CCTs can be integrated into active labor market policies, as by creating conditionalities for benefit holders too.

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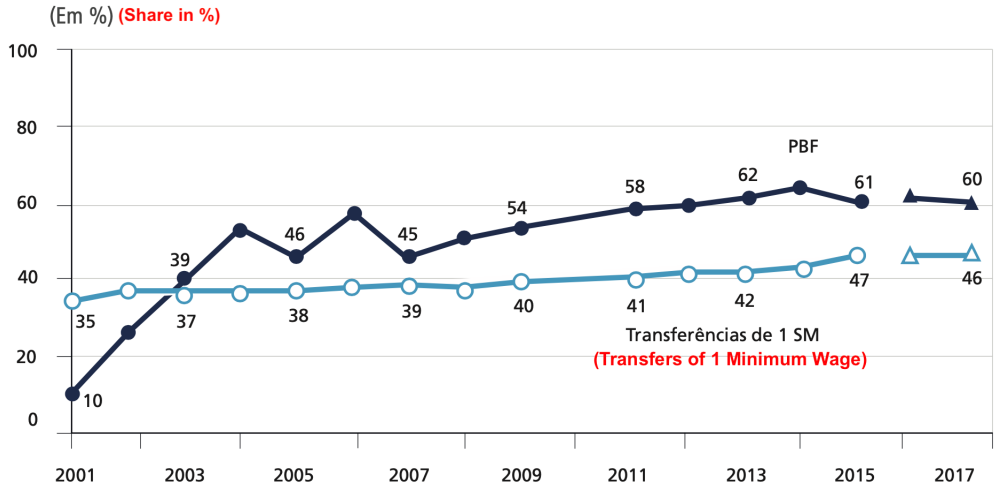
Appendix B

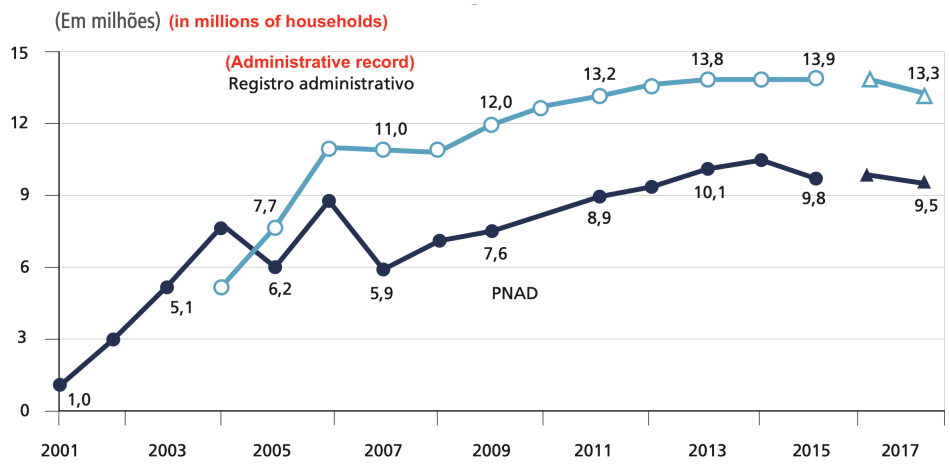
Additional Graphics and Tables

Figure B.1: Coverage of the Bolsa Família Program (BFP) and transfers equivalent to one minimum wage (Previdência and BPC) among the poorest 20% according to PNAD surveys (2001-2017)



Source: Adapted from (Souza et al., 2019), graph 3, page 15. Created using data from PNAD surveys (2001-2015), Continuous PNAD surveys (2016-2017).
Note: PNAD information includes the predecessor programs of the BFP and excludes rural areas of the Northern states (except Tocantins) until 2003. The population among the poorest 20% was defined based on the net per capita household income of each benefit.

Figure B.2: households benefiting from the BFP in administrative records and PNAD surveys (2001-2017)



Source: Adapted from (Souza et al., 2019), graph 1, page 11. Created using data from PNAD surveys (2001-2015), Continuous PNAD surveys (2016-2017), and data from the Social Information Matrix of the Secretariat for Evaluation and Information Management (SAGI/MCidadania).
Note: PNAD information includes the predecessor programs of the BFP and excludes rural areas of the Northern states (except Tocantins) until 2003. Information from administrative records includes only the BFP and refers to September (2001-2015) and June (2016-2017).

Table B.1: Distribution of households/households according to registration status

households	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2012**
Number of Obs.	53,187,644	48,770,064	44,112,029	40,015,875	37,612,900	35,439,014	32,897,119	30,243,128
	Number of observations per registration status code (cod_est_cadastral_fam)							
in registration	13,663	42,970	53,378	19,001	21,474	30,052	42,670	31,483
without civil registration	951	1,368	2,197	3,200	2,921	2,579	1,915	1,410
registered	28,884,068	26,913,965	26,950,657	26,457,577	27,326,122	29,172,487	27,200,920	25,069,565
excluded	24,288,962	21,811,761	17,105,797	13,536,097	10,262,383	6,233,896	5,651,614	5,140,670

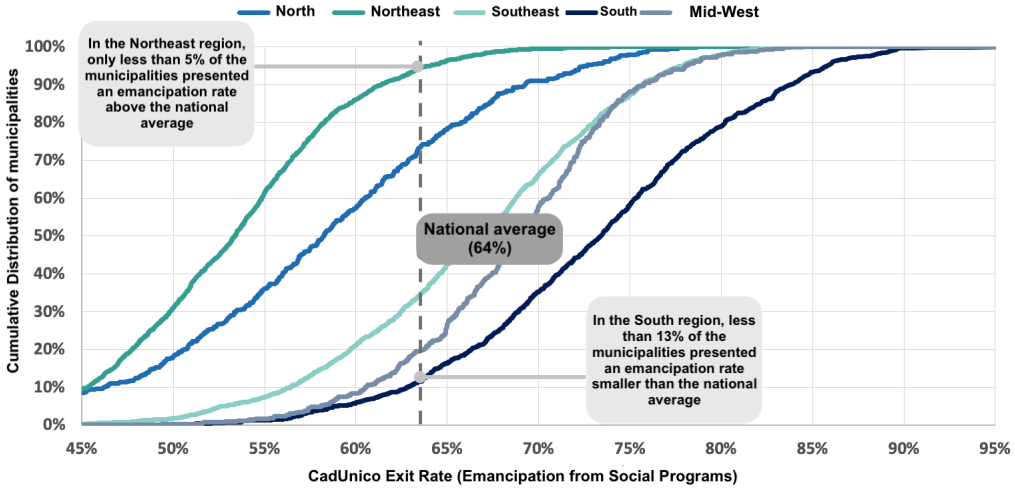
Source: Own elaboration with data from the Unified Registry for Social Programs of the Federal Government and the Payroll of the Bolsa Família Program, from the Ministry of Citizenship/Social Development.

Table B.2: Distribution of individuals according to registration status

Individuals	2019	2018	2017	2016	2015	2014	2013	2012
Number of Observations	175,995,622	165,016,862	153,645,158	143,935,709	136,994,748	130,429,631	123,179,294	115,543,894
	Number of observations per registration status code (cod_est_cadastral_memb)							
in registration	21,344	57,641	70,109	28,182	39,751	41,850	64,146	44,659
without civil registration	8,997	11,678	18,794	26,150	31,310	30,985	23,474	13,384
registered	76,415,223	73,570,482	76,464,300	77,829,966	80,793,612	88,181,943	84,291,806	81,296,980
excluded	99,118,459	90,957,954	76,731,894	66,002,780	55,969,699	41,979,054	37,949,178	34,083,210
awaiting NIS attribution	2,141	64,957	75,444	48,630	56,600	38,418	19,617	9,425
awaiting characterization change	0	0	0	0	103,775	157,376	768,224	66,185

Source: Own elaboration with data from the Unified Registry for Social Programs of the Federal Government and the Payroll of the Bolsa Família Program, from the Ministry of Citizenship/Social Development.

Figure B.3: Distribution of municipalities by region according to the exit rate from the Unique Registry in 2019



Source: Own elaboration with data from the Unique Registry for Social Programs of the Federal Government and the Payment List of the Bolsa Família Program, from the Ministry of Citizenship/Social Development.
Note: Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 in 2005 were excluded to avoid distorting the results with the statistics of these municipalities and to ensure greater robustness in data analysis.

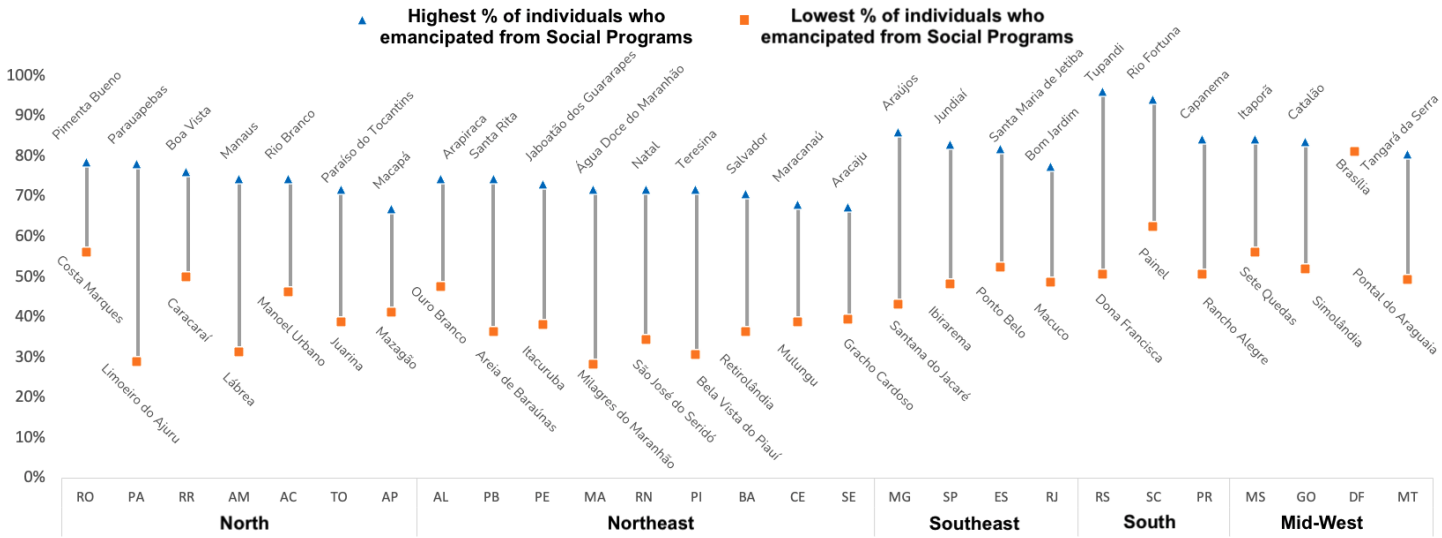
Table B.3: Highest and lowest exit rates from CadÚnico in 2019 for beneficiaries of BFP dependent in 2005 at the municipal level by characteristics

					By region in Brazil					
	North		Northeast		Southeast		South		Midwest	
Rank	Municipality	Rate	Municipality	Rate	Municipality	Rate	Municipality	Rate	Municipality	Rate
1st Highest	RO - Pimenta Bueno	78.7%	AL - Arapiraca	73.9%	MG - Araújos	86.0%	RS - Tupandi	95.7%	MS - Itaporã	83.8%
2nd Highest	PA - Parauapebas	77.6%	PB - Santa Rita	73.8%	MG - Divinópolis	84.4%	SC - Rio Fortuna	93.7%	GO - Catalão	83.4%
3rd Highest	RO - Cabixi	77.1%	PE - Jaboatão dos Guararapes	72.5%	MG - Ouro Fino	83.6%	RS - Nova Boa Vista	91.5%	GO - Davinópolis	82.9%
4th Highest	RR - Boa Vista	76.0%	PE - Recife	72.5%	MG - Carmo do Cajuru	83.5%	SC - Dona Emma	90.6%	GO - Goiânia	82.4%
5th Highest	RO - Chupinguaia	76.0%	MA - Água Doce do Maranhão	71.5%	SP - Jundiaí	82.9%	SC - Pouso Redondo	89.8%	MS - Ivinhema	82.1%
1st Lowest	PA - Limoeiro do Ajuru	28.9%	MA - Milagres do Maranhão	28.0%	MG - Santana do Jacaré	42.7%	PR - Rancho Alegre	50.1%	MT - Pontal do Araguaia	49.3%
2nd Lowest	AM - Lábrea	31.3%	PI - Bela Vista do Piauí	30.7%	MG - São João do Manhuaçu	44.1%	PR - Sertaneja	50.4%	GO - Simolândia	51.5%
3rd Lowest	PA - Faro	31.8%	PI - Cocal dos Alves	32.0%	MG - Pedra Dourada	44.6%	RS - Dona Francisca	50.6%	GO - Damolândia	51.6%
4th Lowest	PA - Muaná	34.2%	RN - São José do Seridó	34.1%	MG - Imbé de Minas	44.6%	RS - São João do Polêsine	51.2%	GO - Campinaçu	52.8%
5th Lowest	AM - Silves	34.3%	RN - Jundiá	35.1%	MG - Curral de Dentro	45.2%	PR - Novo Itacolomi	52.0%	GO - Jesúpolis	53.5%
					By municipality size in number of inhabitants					
	Up to 20,000		20,000 to 50,000		50,000 to 200,000		200,000 to 500,000		More than 500,000	
1st Highest	**RS - Tupandi**	**95.7%**	SC- Timbó	89.2%	SC - Brusque	88.8%	SC - Joinville	84.7%	**GO - Goiânia**	**82.4%**
2nd Highest	SC - Rio Fortuna	93.7%	SC - Pomerode	88.9%	SC - Içara	86.9%	MG - Divinópolis	84.4%	SP - Ribeirão Preto	81.3%
3rd Highest	RS - Nova Boa Vista	91.5%	SC - Braço do Norte	87.4%	SC - Concórdia	86.5%	SP - Jundiaí	82.9%	MG - Uberlândia	80.7%
4th Highest	SC - Dona Emma	90.6%	SC- Indaial	87.1%	SC - Tubarão	85.7%	SC - Blumenau	82.4%	DF - Brasília	80.6%
5th Highest	SC - Pouso Redondo	89.8%	SC - Laguna	86.0%	SC - Balneário Camboriú	85.1%	SP - Mauá	81.5%	SP - Guarulhos	77.9%
1st Lowest	**MA - Milagres do Maranhão**	**28.0%**	PA - Limoeiro do Ajuru	28.9%	PA - Cametá	41.0%	PA - Santarém	55.3%	**CE - Fortaleza**	**61.6%**
2nd Lowest	PI- Bela Vista do Piauí	30.7%	AM - Lábrea	31.3%	BA - Conceição do Coité	45.7%	CE - Juazeiro do Norte	57.6%	BA - Feira de Santana	64.1%
3rd Lowest	PA - Faro	31.8%	PA - Muaná	34.2%	PA - Abaetetuba	46.4%	BA - Juazeiro	60.4%	MA - São Luís	64.5%
4th Lowest	PI- Cocal dos Alves	32.0%	AM - Santo Antônio do Içá	35.0%	CE - Tianguá	49.3%	PE - Caruaru	62.1%	PA - Belém	66.0%
5th Lowest	RN - São José do Seridó	34.1%	PA - Oeiras do Pará	37.7%	RN - Açu	49.3%	RJ- Campos dos Goytacazes	63.7%	PB - João Pessoa	68.4%

Source: Own elaboration with data from the Unique Registry for Social Programs of the Federal Government and the Payment List of the Bolsa Família Program, from the Ministry of Citizenship/Social Development.

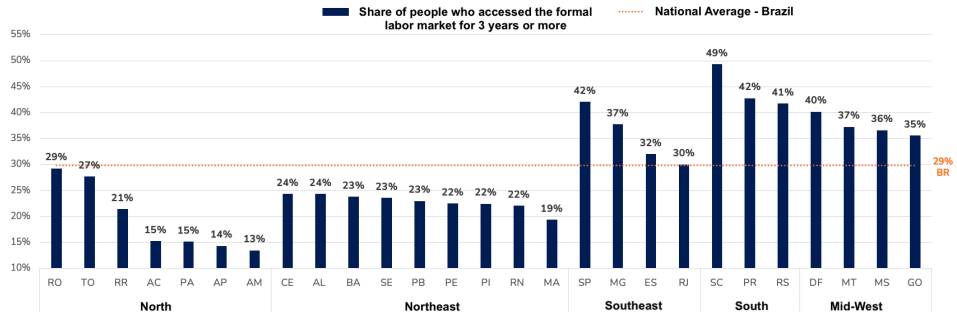
Note: The municipal exit rate of the CadÚnico is given as the proportion of dependent beneficiaries aged between 7 and 16 years in 2005 who are no longer observed in the Cadastro Único in 2019. Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 years in 2005 were disregarded to avoid distorting the results with the statistics of these municipalities and to ensure greater robustness in data analysis.

Figure B.4: Municipalities with the highest and lowest exit rates from CadÚnico by state



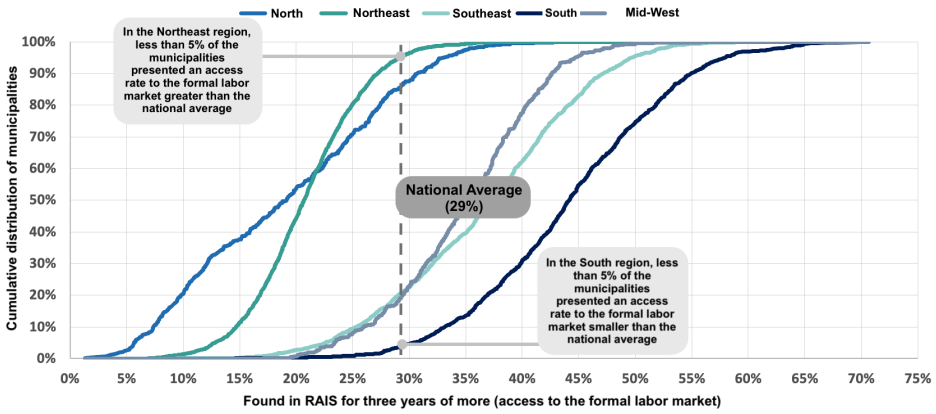
Source: Own elaboration with data from the Unique Registry for Social Programs of the Federal Government and the Payment List of the Bolsa Família Program, from the Ministry of Citizenship/Social Development. Note: The municipal exit rate of the CadÚnico is given as the proportion of dependent beneficiaries aged between 7 and 16 years in 2005 who are no longer observed in the Cadastro Único in 2019. Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 years in 2005 were disregarded to avoid distorting the results with the statistics of these municipalities and to ensure greater robustness in data analysis.

Figure B.5: Access rate to the formal labor market (RAIS) for three or more years between 2015 and 2019 according to the Federative Unit



Source: Own elaboration with data from the Annual Social Information Report (RAIS), the Single Register for Social Programs of the Federal Government, and the Payroll of the Bolsa Família Program, provided by the Ministry of Labor and Employment, and the Ministry of Citizenship/Social Development, respectively.

Figure B.6: Distribution of municipalities by region of origin according to access to the formal labor market for three or more years between 2015 and 2019



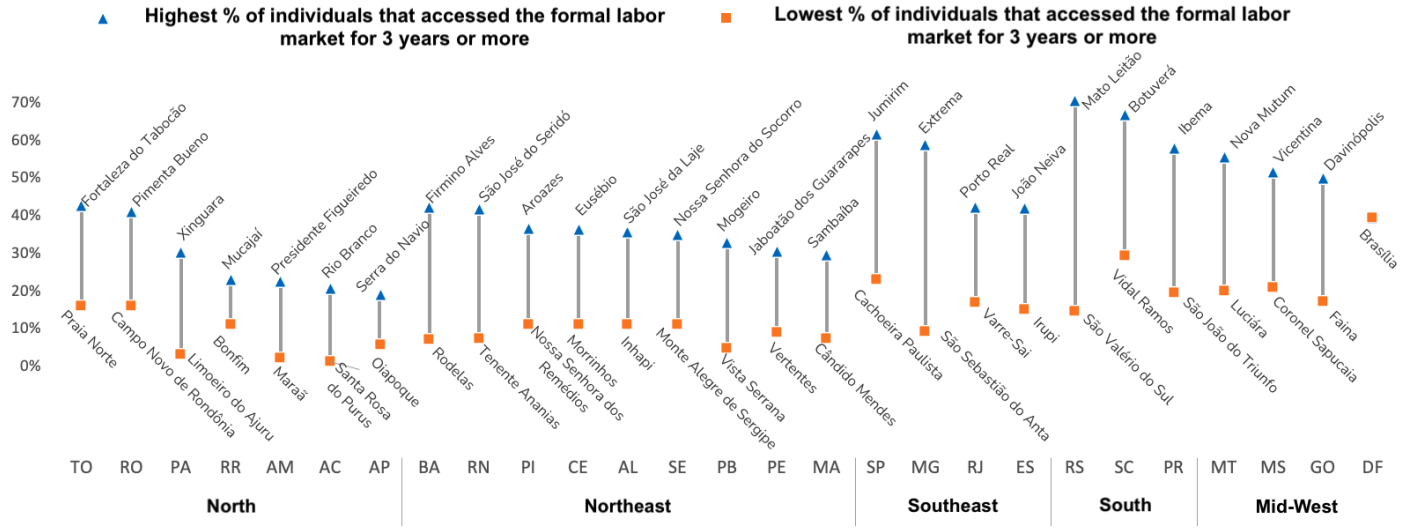
Source: Own elaboration with data from the Annual Social Information Report (RAIS), the Single Register for Social Programs of the Federal Government, and the Payroll of the Bolsa Família Program, provided by the Ministry of Labor and Employment, and the Ministry of Citizenship/Social Development, respectively.
Note: Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 in 2005 were excluded to avoid distorting the results with the statistics of these municipalities and to ensure greater robustness in data analysis.

Table B.4: Highest and Lowest rates of dependent beneficiaries in 2005 found in the RAIS for three or more years in municipalities between 2015 and 2019 by municipality characteristic

					By region of Brazil					
	North		Northeast		Southeast		South		Midwest	
Order	Municipality	Rate	Municipality	Rate	Municipality	Rate	Municipality	Rate	Municipality	Rate
1st Highest	TO - Fortaleza do Tabocão	42.8%	BA - Firmino Alves	42.4%	SP - Jumirim	61.8%	RS - Mato Leitão	70.7%	MT - Nova Mutum	55.7%
2nd Highest	RO - Pimenta Bueno	41.0%	RN - São José do Seridó	41.7%	SP - Taguaí	61.5%	RS - Serafina Corrêa	69.9%	MS - Vicentina	51.7%
3rd Highest	RO - Primavera de Rondônia	38.9%	BA - Guajeru	37.3%	MG - Extrema	58.8%	RS - Bom Retiro do Sul	67.9%	GO - Davinópolis	50.0%
4th Highest	TO - Lajeado	38.1%	PI - Aroazes	36.6%	MG - Varjão de Minas	58.4%	SC - Botuverá	66.9%	GO - Portelândia	49.0%
5th Highest	TO - Juarina	37.6%	CE- Eusébio	36.3%	SP - Araçariguama	58.3%	SC - Luzerna	66.1%	MS - Aparecida do Taboado	48.5%
1st Lowest	AC - Santa Rosa do Purus	1.3%	PB - Vista Serrana	4.7%	MG - São Sebastião do Anta	9.4%	RS - São Valério do Sul	14.6%	GO - Faina	17.1%
2nd Lowest	AM - Maraã	2.4%	BA - Rodelas	6.9%	MG - Pedra Bonita	11.7%	PR- São João do Triunfo	19.5%	GO - Simolândia	19.5%
3rd Lowest	PA - Limoeiro do Ajuru	3.1%	PB - Salgadinho	7.1%	MG - Alto Caparaó	13.0%	RS - Dom Feliciano	19.9%	GO - Hidrolina	19.8%
4th Lowest	PA - Muaná	3.3%	RN - Tenente Ananias	7.5%	MG - Chalé	15.0%	RS - São José do Inhacorá	20.5%	GO - Flores de Goiás	20.1%
5th Lowest	PA - Bagre	3.6%	MA - Cândido Mendes	7.6%	ES - Irupi	15.1%	RS - Arroio do Padre	21.1%	MT - Luciára	20.1%
					By municipality size in terms of population					
	Up to 20,000 inhabitants		>20,000 up to 50,000 inhabitants		>50,000 up to 200,000 inhabitants		>200,000 up to 500,000 inhabitants		>500,000 inhabitants	
1st Highest	**RS - Mato Leitão**	**70.7%**	SC - Pomerode	65.2%	SC - Rio do Sul	57.4%	SC - Blumenau	56.6%	**MG - Uberlândia**	**49.4%**
2nd Highest	RS - Serafina Corrêa	69.9%	SC - Timbó	64.0%	RS - Lajeado	57.3%	MG - Divinópolis	53.2%	SP - Campinas	44.8%
3rd Highest	RS - Bom Retiro do Sul	67.9%	RS - Carlos Barbosa	63.2%	SC - São Bento do Sul	56.6%	SP - Jundiaí	52.8%	MG - Belo Horizonte	43.9%
4th Highest	SC - Botuverá	66.9%	RS - Três Coroas	60.4%	SC - Jaguará do Sul	56.6%	SC - Joinville	51.7%	PR - Curitiba	43.8%
5th Highest	SC - Luzerna	66.1%	RS - Guaporé	59.5%	RS - Vacaria	55.8%	PR - Cascavel	50.8%	SP - São Bernardo do Campo	43.5%
1st Lowest	**AC - Santa Rosa do Purus**	**1.3%**	AM - Maraã	2.4%	PA - Igarapé-Miri	5.4%	AP - Macapá	16.8%	**PA - Belém**	**11.9%**
2nd Lowest	PA - Bagre	3.6%	PA - Limoeiro do Ajuru	3.1%	PA - Cametá	6.2%	PA - Santarém	17.6%	AM - Manaus	20.0%
3rd Lowest	PB - Vista Serrana	4.7%	PA - Muaná	3.3%	PA - Viseu	7.3%	AC - Rio Branco	20.7%	AL - Maceió	24.2%
4th Lowest	PA - Faro	4.9%	PA - Oeiras do Pará	3.9%	AM - Coari	7.3%	PA - Ananindeua	21.4%	BA - Feira de Santana	24.4%
5th Lowest	AM - Santa Isabel do Rio Negro	5.4%	PA - Porto de Moz	4.1%	PA - Breves	9.2%	BA - Juazeiro	22.2%	PE - Recife	25.2%

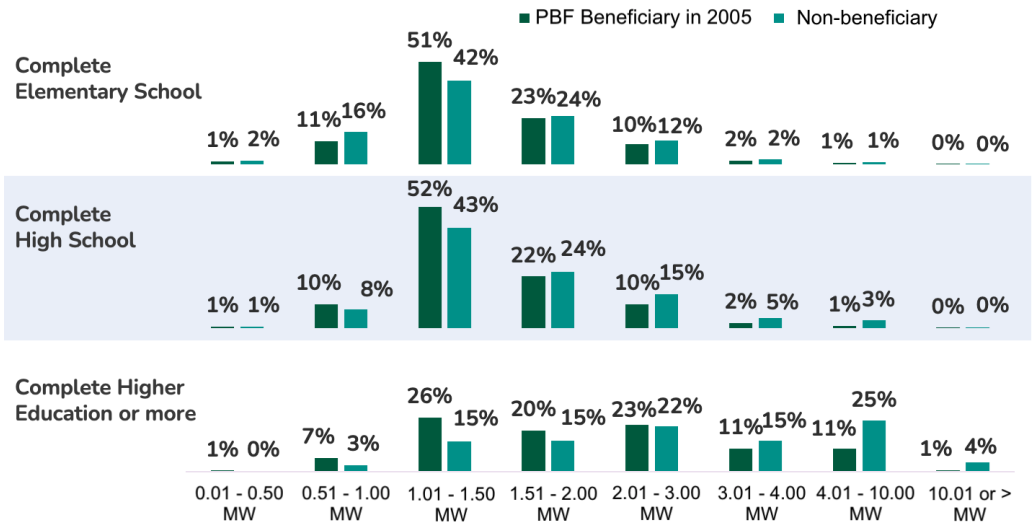
Source: Own elaboration with data from the Annual List of Social Information (RAIS), the Unified Registry for Social Programs of the Federal Government, and the Payroll of the Bolsa Família Program, made available by the Ministry of Labor and Employment, and the Ministry of Citizenship/Social Development, respectively. Note: The municipal-level enrollment rate in RAIS is given by the proportion of dependent beneficiaries aged 7 to 16 in 2005 who were observed for three or more years in RAIS between 2015 and 2019. Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 in 2005 were disregarded to avoid distorting the results with the statistics of these municipalities and to ensure greater robustness in the data analysis.

Figure B.7: Municipalities with the highest and lowest rates of access to formal labor market (RAIS) for three or more years between 2015 and 2019 by UF



Source: Own elaboration with data from the Annual List of Social Information (RAIS), the Unified Registry for Social Programs of the Federal Government, and the Payroll of the Bolsa Família Program, made available by the Ministry of Labor and Employment, and the Ministry of Citizenship/Social Development, respectively.
Note: The municipal-level enrollment rate in RAIS is given by the proportion of dependent beneficiaries aged 7 to 16 in 2005 who were observed for three or more years in RAIS between 2015 and 2019. Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 in 2005 were disregarded to avoid distorting the results with the statistics of these municipalities and to ensure greater robustness in the data analysis.

Figure B.8: Comparison of the income distributions in minimum wages between PBF dependent beneficiaries in 2005 and non-beneficiaries of BFP between 2005 and 2019 - by educational level



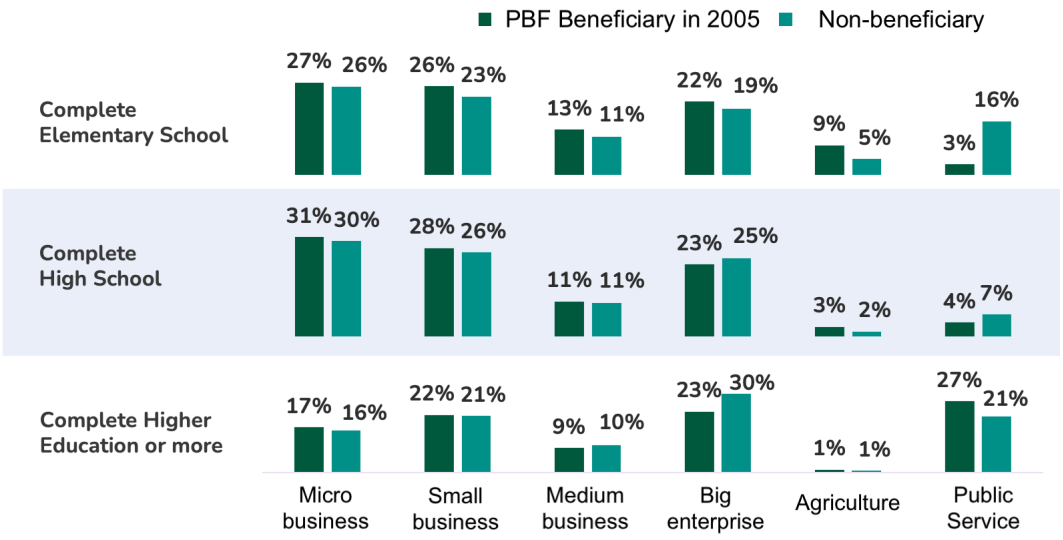
Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Note: Monetary values in Brazilian *Reais* (BRL) of 2019. The value of the national minimum wage in 2019 was BRL 998.00. The comparison groups are PBF dependent beneficiaries aged 7 to 16 in 2005 and those who were never PBF beneficiaries between 2005 and 2019 in the same age group.

Table B.5: Methodology for defining company size by economic sector

Size	Industrial Sector (i)	Trade and Services (ii)
Microenterprise	up to 19 employed persons	up to 9 employed persons
Small enterprise	20 to 99 employed persons	10 to 49 employed persons
Medium enterprise	100 to 499 employed persons	50 to 99 employed persons
Large enterprise	500 or more employed persons	100 or more employed persons

Source: Own elaboration with the methodology for defining company size by economic activity sector presented in the Yearbook of Labor in Micro and Small Enterprises of the Brazilian Support Service for Micro and Small Enterprises (SEBRAE) of the year 2013. Note: (i) The same size delimitations were used for the construction sector; (ii) The services sector does not include public administration and domestic service. Divisions related to agriculture were also excluded, as this sector is underrepresented in the Rais, as indicated by SEBRAE.

Figure B.9: Comparison of employer company size by economic activity sector between beneficiaries dependent on BFP in 2005 and non-beneficiaries of BFP between 2005 and 2019 - by educational level



Source: Own elaboration with data from the Annual Social Information Report (RAIS), the Unified Registry for Social Programs of the Federal Government, and the Payroll of the Bolsa Família Program, provided by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively. Note: The company size categories correspond to the commerce, industry, and services sectors of the economic activity. The methodology presented in the Yearbook of Labor in Micro and Small Enterprises of the Brazilian Support Service for Micro and Small Enterprises (SEBRAE) of the year 2013 was used as reference. The domestic services activity was not included in the visualization due to its small representation: 358 dependent beneficiaries and 548 non-beneficiaries in the same age group were engaged in this activity.

Table B.6: Estimating the correlation between municipal characteristics and emancipation of social programs by a fraclogit model - fraction of BFP dependent beneficiaries in 2005 not found in the 2019 CadÚnico

Variables	All Average	Q1 Average	Q2 Average	Q3 Average	Q4 Average	Q5 Average
— ***Dependent Variable***						
Adjusted exit rate from the 2019 CadÚnico (rate - deceased estimate)	0.63	0.48	0.56	0.63	0.70	0.78
— ***Management Variable***						
Census coverage for ages 7 to 16	1.05	0.83	0.88	1.02	1.17	1.36
— ***Demographic Variables***						
Population (log)	9.39	9.14	9.35	9.32	9.51	9.65
Child and youth population (0-17 years)	8.38	8.24	8.44	8.31	8.41	8.50
Dependency ratio	62.44	72.82	69.90	61.96	55.34	52.16
— ***Economic Variables***						
GDP *per capita* (log)	8.61	7.97	8.21	8.63	9.03	9.24
GDP *per capita* in 2005 relative to 2000	0.83	0.81	0.97	0.87	0.78	0.71
Degree of formalized employed individuals (18 years or older)	36.07	21.41	26.48	37.41	45.20	49.88
% of Agriculture GDP	0.23	0.21	0.23	0.26	0.24	0.21
% of Industry GDP	0.15	0.11	0.13	0.14	0.18	0.21
% of Services GDP	0.56	0.65	0.59	0.54	0.51	0.49
% extremely poor	20.73	37.58	31.86	18.51	9.65	6.03
% of poor	41.11	63.35	56.93	40.16	26.72	18.37
% of poverty vulnerability	63.94	83.15	78.02	65.04	52.43	41.03
% of children vulnerable to poverty	74.98	90.66	86.69	76.96	66.03	54.57
Gini Index	0.55	0.56	0.56	0.55	0.54	0.52
— ***Adult Education Variables***						
Illiteracy rate - 25 years or older	27.60	42.37	38.48	26.85	17.90	12.37
% of 25 years or older with elementary school completed	19.42	12.81	14.48	19.41	24.01	26.38
% of 25 years or older with high school completed	11.52	7.62	8.67	11.61	14.41	15.30
% of children in households where no one has completed elementary school	61.99	73.99	71.23	61.67	53.87	49.17
% of people in households where no one has completed elementary school	56.77	68.80	65.95	56.10	48.71	44.29
— ***Youth Education Variables***						
% of children aged 4 to 5 out of school	53.30	46.10	51.44	57.18	57.57	54.19
% of children aged 6 to 14 out of school	7.50	9.22	9.29	7.95	6.22	4.81
Net attendance rate for elementary school	89.79	88.35	88.33	89.24	90.84	92.21
Net attendance rate for high school	26.65	12.49	16.70	27.02	35.40	41.66
Age-grade distortion in 2006, elementary school	30.78	44.82	39.90	29.51	22.25	17.42
Age-grade distortion in 2006, high school	47.13	66.82	59.53	45.92	35.52	27.88
IDEB (Basic Education Development Index) for final years	3.31	2.77	2.96	3.31	3.63	3.88
IDEB for initial years	3.61	2.81	3.11	3.67	4.13	4.37
IDEB for elementary years	3.46	2.79	3.04	3.50	3.88	4.12
— ***Health Variables***						
% in households with bathroom and piped water	62.65	33.53	44.55	66.26	81.41	87.52
% of people in households with water and sewage system	13.45	22.73	19.44	12.80	7.66	4.63
% of population in households with public garbage collection	79.68	64.68	69.68	81.11	89.76	93.16
Infant mortality rate	32.77	46.98	41.91	31.22	23.50	20.25
% of infants with low weight at birth	7.22	6.47	6.88	7.35	7.77	7.62
— ***Other Variables***						
% of individuals aged 18 or older w/o education, working in informal employment	64.93	77.83	73.99	64.19	56.79	51.83
% in vulnerable households where no one has education	44.18	61.74	57.47	43.76	32.90	24.99
% of vulnerable persons with 15 to 24 years who neither study nor work	19.03	24.27	23.44	20.07	16.28	11.10
% of single mothers w/o education (children under 15)	13.60	16.07	16.51	14.30	11.63	9.49

Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively.

Note: The municipal-level exit rate from *CadÚnico* is given by the share of BFP dependent beneficiaries aged between 7 and 16 years in 2005 who are no longer observed in the 2019 *CadÚnico*. Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 in 2005 were disregarded to ensure that the results are not distorted by the statistics of these municipalities and to guarantee greater robustness in data analysis.

Table B.7: Estimating the correlation between municipal characteristics and access to the formal labor market by a fraclogit model - fraction of BFP dependent beneficiaries in 2005 found in RAIS at least once between 2015 and 2019

Variables	Overall Average	Q1 Average	Q2 Average	Q3 Average	Q4 Average	Q5 Average
— ***Dependent Variable***						
Found at least once in RAIS between 2015-2019	0.47	0.28	0.38	0.47	0.56	0.65
Found in 2015 RAIS	0.30	0.15	0.22	0.29	0.38	0.47
Found in 2019 RAIS	0.34	0.19	0.26	0.34	0.42	0.50
Found in RAIS for the whole period 2015-2019	0.17	0.07	0.11	0.16	0.22	0.29
— ***Management Variable***						
Census coverage for ages 7 to 16 years	1.05	0.77	0.86	0.99	1.25	1.39
— ***Demographic Variables***						
Population (log)	9.39	9.48	9.40	9.35	9.37	9.37
Child and youth population (0-17 years)	8.38	8.60	8.48	8.34	8.26	8.22
Dependency ratio	62.44	75.70	69.06	60.76	54.37	52.29
— ***Economic Variables***						
GDP *per capita* (log)	8.61	7.94	8.15	8.68	9.06	9.24
GDP *per capita* in 2005 relative to 2000	0.83	0.86	0.93	0.92	0.77	0.67
Degree of formalized employed individuals (18 years or older)	36.07	18.76	24.92	37.15	47.15	52.40
% Agriculture GDP	0.23	0.22	0.22	0.25	0.24	0.22
% Industry GDP	0.15	0.10	0.12	0.15	0.18	0.21
% Services GDP	0.56	0.64	0.61	0.54	0.51	0.49
% extremely poor	20.73	38.69	33.21	17.95	8.16	5.62
% poor	41.11	64.41	58.71	39.63	24.40	18.37
% poverty vulnerability	63.94	83.50	79.39	64.31	50.39	42.10
% children vulnerable to poverty	74.98	90.51	87.81	76.07	64.49	56.04
Gini Index	0.55	0.57	0.56	0.55	0.54	0.51
— ***Adult Education Variables***						
Illiteracy Rate - 25 years and older	27.60	43.01	39.48	25.44	16.83	13.22
% of 25 years or older with elementary school completed	19.42	12.63	14.22	19.77	24.53	25.94
% of 25 years or older with high school completed	11.52	7.36	8.57	11.78	14.73	15.18
% of Children in households where no one has completed elementary school	61.99	75.39	72.47	61.45	52.02	48.59
% of people in households where no one has completed elementary school	56.77	70.40	67.02	56.04	46.84	43.53
— ***Youth Education Variables***						
% of children aged 4 to 5 out of school	53.30	49.61	49.87	58.07	56.72	52.22
% of children aged 6 to 14 out of school	7.50	11.30	9.07	7.64	5.23	4.25
Net attendance rate for elementary school	89.79	86.42	88.53	89.46	91.69	92.87
Net attendance rate for high school	26.65	10.79	14.24	25.74	38.48	44.01
Age-grade distortion in 2006, elementary level	30.78	46.44	41.53	29.51	20.11	16.31
Age-grade distortion in 2006, high school	47.13	68.41	62.08	45.84	32.84	26.37
— ***Health Variables***						
% of households with bathroom and piped water	62.65	28.88	42.01	66.65	85.48	90.25
% of people in households with water and sanitation	13.45	27.15	18.77	12.51	5.67	3.15
% of population in households with public garbage collection	79.68	60.51	69.69	81.42	92.35	94.43
Infant mortality rate	32.77	47.34	43.62	30.54	22.39	19.97
% of infants with low weight at birth	7.22	6.40	6.60	7.42	7.76	7.91
— ***Other Variables***						
% of individuals aged 18 or older w/o education, working in informal employment	64.93	79.19	75.20	64.31	55.10	50.81
% of vulnerable households where no one has education	44.18	63.29	58.77	43.16	30.70	24.94
% of vulnerable persons with 15 to 24 years who neither study nor work	19.03	24.62	23.69	19.88	15.30	11.67
% of households with single mothers without education (children under 15)	13.60	16.74	16.27	14.48	11.09	9.40

Source: Own elaboration with data from the Annual List of Social Information (RAIS), the *CadÚnico* for Social Programs of the Federal Government, and the Bolsa Família Program Payrolls, made available by the Ministry of Labor and Employment and the Ministry of Citizenship/Social Development, respectively.

Note: The rate of individuals found in RAIS at the municipal level is given by the share of BFP dependent beneficiaries aged 7 to 16 in 2005 who were found in RAIS at least once between 2015 and 2019. Municipalities with fewer than 100 dependent beneficiaries aged 7 to 16 in 2005 were disregarded to ensure that the results are not distorted by the statistics of these municipalities and to guarantee greater robustness in data analysis.

Table B.8: Dictionary of variables - UNDP data

Variable	Long Name
codmun7	Municipality Code
espvida	Life expectancy at birth
fectot	Total fertility rate
mort1	**Mortality rate up to one year of age**
mort5	Mortality rate up to five years of age
razdep	Percentage of the population under 15 years old and the population 65 years and older in relation to the population aged 15 to 64
sobre40	Probability of survival up to 40 years
sobre60	Probability of survival up to 60 years
t_env	Aging rate
e_anosestudo	Expectation of years of study at 18 years of age
t_analf11a14	Illiteracy rate of the population aged 11 to 14 years
t_analf15a17	Illiteracy rate of the population aged 15 to 17 years
t_analf15m	Illiteracy rate of the population aged 15 years or older
t_analf18a24	Illiteracy rate of the population aged 18 to 24 years
t_analf18m	Illiteracy rate of the population aged 18 years or older
t_analf25a29	Illiteracy rate of the population aged 25 to 29 years
t_analf25m	**Illiteracy rate of the population aged 25 years or older**
t_atraso_0_basico	Percentage of the population aged 6 to 17 years attending basic education without grade delay
t_atraso_0_fund	Percentage of the population aged 6 to 14 years attending primary education without grade delay
t_atraso_0_med	Percentage of the population aged 15 to 17 years attending secondary education without grade delay
t_atraso_1_basico	Percentage of the population aged 6 to 17 years attending basic education with 1 year of grade delay
t_atraso_1_fund	Percentage of the population aged 6 to 14 years attending primary education with 1 year of grade delay
t_atraso_1_med	Percentage of the population aged 15 to 17 years attending secondary education with 1 year of grade delay
t_atraso_2_basico	**Percentage of the population aged 6 to 17 years attending basic education with 2 or more years of grade delay**
t_atraso_2_fund	Percentage of the population aged 6 to 14 years attending primary education with 2 or more years of grade delay
t_atraso_2_med	Percentage of the population aged 15 to 17 years attending secondary education with 2 years or more of grade delay
t_fbbas	Gross enrollment rate in basic education
t_fbfund	Gross enrollment rate in primary education
t_fbmed	Gross enrollment rate in secondary education
t_fbpre	Gross enrollment rate in preschool education
t_fbsuper	Gross enrollment rate in higher education
t_flbas	Net enrollment rate in basic education
t_flfund	Net enrollment rate in primary education
t_flmed	Net enrollment rate in secondary education
t_flpre	Net enrollment rate in preschool education
t_flsuper	Net enrollment rate in higher education
t_freq0a3	School attendance rate of the population aged 0 to 3 years
t_freq11a14	School attendance rate of the population aged 11 to 14 years
t_freq15a17	School attendance rate of the population aged 15 to 17 years
t_freq18a24	School attendance rate of the population aged 18 to 24 years
t_freq25a29	School attendance rate of the population aged 25 to 29 years
t_freq4a5	School attendance rate of the population aged 4 to 5 years
t_freq4a6	Percentage of the population aged 4 to 6 years attending school
t_freq5a6	Percentage of the population aged 5 to 6 years attending school
t_freq6	School attendance rate of the population aged 6 years
t_freq6a14	School attendance rate of the population aged 6 to 14 years
t_freq6a17	School attendance rate of the population aged 6 to 17 years
t_freqfund1517	Percentage of the population aged 15 to 17 years attending primary education
t_freqfund1824	Percentage of the population aged 18 to 24 years attending primary education
t_freqfund45	Percentage of the population aged 4 to 5 years attending primary education
t_freqmed1824	Percentage of the population aged 18 to 24 years attending secondary education
t_freqmed614	Percentage of the population aged 6 to 14 years attending secondary education
t_freqsuper1517	Percentage of the population aged 15 to 17 years attending higher education
t_fund11a13	Percentage of the population aged 11 to 13 years attending the final years of primary education or who have already completed primary education
t_fund12a14	Percentage of the population aged 12 to 14 years attending the final years of primary education or who have already completed primary education
t_fund15a17	Percentage of the population aged 15 to 17 years with completed primary education
t_fund16a18	Percentage of the population aged 16 to 18 years with completed primary education
t_fund18a24	Percentage of the population aged 18 to 24 years with completed primary education
t_fund18m	Percentage of the population aged 18 years or older with completed primary education
t_fund25m	Percentage of the population aged 25 years or older with completed primary education
t_med18a20	Percentage of the population aged 18 to 20 years with completed secondary education
t_med18a24	Percentage of the population aged 18 to 24 years with completed secondary education
t_med18m	Percentage of the population aged 18 years or older with completed secondary education
t_med19a21	Percentage of the population aged 19 to 21 years with completed secondary education
t_med25m	Percentage of the population aged 25 years or older with incomplete secondary education
t_super25m	Percentage of the population aged 25 years or older with completed higher education
gini	Gini index
pind	Proportion of extremely poor individuals
pindcri	Proportion of extremely poor children
pmpob	**Proportion of poor individuals**
pmpobcri	Proportion of poor children
ppob	Proportion of individuals vulnerable to poverty
ppobcri	Proportion of children vulnerable to poverty
prentrab	Percentage of income derived from labor earnings
rdpc	Average per capita income
rind	Average per capita household income of extremely poor individuals
rmpob	Average per capita household income of poor individuals
rpob	Average per capita household income of individuals vulnerable to poverty
theil	Theil index - L
cpr	Percentage of employed individuals aged 18 years and older who are self-employed
emp	Percentage of employed individuals aged 18 years and older who are employers
p_agro	Percentage of employed individuals in the agricultural sector
p_com	Percentage of employed individuals in the trade sector
p_constr	Percentage of employed individuals in the construction sector
p_extr	Percentage of employed individuals in the extractive mineral sector
p_formal	**Degree of formalization of employment for employed individuals**
p_fund	Percentage of employed individuals with completed primary education
p_med	Percentage of employed individuals with completed secondary education
p_serv	Percentage of employed individuals in the services sector
p_siup	Percentage of employed individuals in the industrial sectors of public utilities
p_super	Percentage of employed individuals with completed higher education
p_transf	Percentage of employed individuals in the manufacturing industry

t_ativ	Activity rate of individuals aged 10 years and older
t_ativ1014	Activity rate of individuals aged 10 to 14 years
t_ativ1517	Activity rate of individuals aged 15 to 17 years
t_ativ1824	Activity rate of individuals aged 18 to 24 years
t_ativ18m	Activity rate of individuals aged 18 years and older
t_ativ2529	Activity rate of individuals aged 25 to 29 years
t_des	Unemployment rate of the population aged 10 years and older
t_des1014	Unemployment rate of the population aged 10 to 14 years
t_des1517	Unemployment rate of the population aged 15 to 17 years
t_des1824	Unemployment rate of the population aged 18 to 24 years
t_des18m	Unemployment rate of the population aged 18 years and older
t_des2529	Unemployment rate of the population aged 25 to 29 years
theiltrab	Theil-L index of labor income
trabcc	Percentage of employed individuals aged 18 years and older with formal employment
trabpub	Percentage of employed individuals aged 18 years and older working in the public sector
trabsc	Percentage of employed individuals aged 18 years and older with informal employment
t_agua	Percentage of the population living in households with piped water
t_banagua	**Percentage of the population living in households with bathroom and piped water**
t_dens	Percentage of the population living in households with a density of more than 2 persons per bedroom
t_lixo	Percentage of the urban population living in households with garbage collection service
t_luz	Percentage of the population living in households with electricity
agua_esgoto	% of people in households with inadequate water supply and sanitation
parede	% of people in households with walls that are not made of masonry or finished wood
t_crifundin_todos	% of children living in households where none of the residents have completed elementary education
t_fora4a5	% of children aged 4 to 5 years who do not attend school
t_fora6a14	% of children aged 6 to 14 years who do not attend school
t_fundin_todos	% of people living in households where none of the residents have completed elementary education
t_fund_todos	% of people in poverty-vulnerable households where no one has completed elementary education
t_fundin18minf	% of people aged 18 years and older without completed elementary education and engaged in informal employment
t_m10a14cf	Percentage of women aged 10 to 14 years who have had children
t_m15a17cf	Percentage of women aged 15 to 17 years who have had children
t_mulchefefif014	Percentage of female heads of households without completed elementary education and with at least one child under 15 years old
nest_ntrab	% of people aged 15 to 24 years who neither study nor work and are vulnerable to poverty
t_ocupdesloc_1	% of people in poverty-vulnerable households who spend more than one hour commuting to work
t_rmaxidoso	% of people in poverty-vulnerable households who are dependent on the elderly
t_sluz	% of people in households without electricity
t_pea18m	Economically active population aged 18 years and older
t_urb	Urban population
pop	Total population residing in permanent private households
i_escolaridade	Fundamental education sub-index of the adult population - Education HDI
i_freq_prop	School attendance sub-index of the youth population - Education HDI
idhm	Municipal Human Development Index
idhm_e	Municipal Human Development Index - Education dimension
idhm_l	Municipal Human Development Index - Longevity dimension
idhm_r	Municipal Human Development Index - Income dimension

Own elaboration with the Dictionary of Variables provided by the United Nations Development Programme (UNDP).

Note: Available at: `https://www.dropbox.com/scl/fi/0po5ao0qvz004r0861363/dicionario_PNUD.xlsx?dl=0&rlkey=v1vs2129y4aq1a7js4kml24t9`.

Chapter 3

Social Policy and Resilience: A Geospatial Analysis of Climate Change's Impact on Migration Among Vulnerable Agricultural Producers

[1]

[1]This chapter is the result of a collaboration with the Institute for Mobility and Social Development - IMDS, Rio de Janeiro; and the United Nations University World Institute for Development Economics Research - UNU-WIDER, Helsinki.

3.1 Introduction

Climate change has been associated to a rise in the frequency and severity of extreme natural events, resulting in significant economic and human losses globally (Dilley et al., 2005; Pindyck and Wang, 2013; Acharya et al., 2023). This situation is particularly dire for socioeconomically disadvantaged households, as climate change is projected to exacerbate existing vulnerabilities and inequalities (Hallegatte et al., 2017; Otto et al., 2017). One of the critical consequences for individuals in social and climate vulnerability is a heightened risk of displacement due to extreme weather events (Morrow-Jones and Morrow-Jones, 1991; Hallegatte et al., 2016). In this context, social policies and safety net programs may help vulnerable populations navigate migration decisions.

This research examines how social policy affects individual mobility decisions among vulnerable agricultural households in Brazil. Specifically, we investigate how the Conditional Cash Transfer (CCT) *Bolsa Família* Program (BFP) influences household responses to income shocks from extreme and severe drought-induced crop losses. By focusing on the interplay between climate-related stressors and social protection, we aim to understand the extent to which social policy mitigates the need for migration as a coping strategy. To precisely identify individual mobility and exposure to extreme weather events, we developed a novel methodology that links relocation patterns, both within and between Brazilian municipalities, to the geographical coordinates of household addresses and high-resolution historical precipitation data at fine spatial grids.

Using panel data from 2015 to 2020, we find that 20% of individuals in vulnerable agricultural households migrated at least once over a three-year period. Short-distance relocations, those within the same municipality, were five times more common than moving to other municipalities. These findings contribute to our understanding of how citizens use cash transfers to enhance resilience in the face of extreme natural events, with outcomes varying by individual and contextual characteristics. We find that the interaction

between social benefits and exposure to the most severe 1% of drought events increases the probability of migration: by 7% in the first year, 4% over the following two years, and 2% over the subsequent three years, with relatively larger effects for migrations across municipalities. In contrast, for individuals exposed to moderately severe droughts, between the 10th and 1st percentiles of intensity, access to social benefits reduces migration likelihood: by 4% in the first year, 3% in the next two years, and 5% in the following three years, with stronger effects for moves within the same municipality. These effects remain consistent when restricting the analysis to benefit holders and are robust across different model specifications, including a Poisson panel model. However, recipients of social benefits are more likely to remain in areas with weaker socioeconomic infrastructure compared to those who migrate.

Migration is one of the most common response mechanisms used by vulnerable individuals to withstand the consequences of extreme weather events (Berlemann and Steinhardt, 2017; Hunter, 2005; Ober, 2019). While safety net and social policy have significant importance for vulnerable households that have reduced access to traditional financial and non-financial responses to income-shocks (Dercon, 2002). The economic implications of resilient social policies are profound. By investing in adaptive capacity, governments can reduce the long-term costs associated with climate impacts. Therefore, social policy plays a pivotal role in enhancing household resilience to the multifaceted challenges posed by climate change. Safety nets that incorporate climate risk considerations not only protect against immediate shocks but also promote long-term development goals.

Accordingly, the association between CCTs and migration decisions have been of great interest in the literature (Adhikari and Gentilini, 2018; Hagen-Zanker and Himmelstine, 2012; Stecklov et al., 2005; Cirillo, 2018). While programs that focus on local strategies of implementation tend to reduce migration, broader and universal programs may induce mobility. In Brazil, this association has been studied at the municipality level by Oliveira and Chagas (2018) and Silveira Neto (2008), with results suggesting that CCTs reduce

individual probability of migration. However, research in this area often overlooks individual migration patterns within administrative regions, which limits our understanding of this phenomenon. We not only develop a new methodology to address this gap, but we also connect our findings to the challenges posed by climate change.

3.2 Climate Change, Social Policy and Migration

In recent years, the interplay between social policy and household resilience has garnered increasing attention, particularly in the context of socioeconomic vulnerabilities exacerbated by climate change. Cash transfer programs have emerged as a component of social policy able to bolster resilience among low-income households in developing countries.

These programs provide direct financial assistance to households, enabling them to manage immediate economic pressures while investing in adaptive strategies, particularly in rural areas where access to formal financial services is limited. This diversification is particularly important in regions facing increased climate risk, as it enables producers to buffer against crop failures or market fluctuations.

3.2.1 The Brazilian scenario

The Brazilian scenario is highly representative of such (WB, 2021). Between 2015 and 2020, approximately 14 million individuals lived in vulnerable agricultural households, beneficiaries from both social and agricultural programs.[2] Given the current technological standards, climate change is projected to reduce agricultural output per hectare in Brazil by 18% (Assunção and Chein, 2016). This decline is likely to lead to increased displacement of vulnerable populations.

In fact, data from the Brazilian specialized authorities, from the S2iD system, shows that 90% of recognized natural disasters in the Brazilian territory were hydrological in-

[2]Members of families registered both on the CadÚnico and DAP/Pronaf programs.

stances, caused by either insufficient rainfall or excessive precipitation. Table 3.1 highlights the two primary natural disasters linked to rainfall scarcity: dry spells and droughts. Notice that drought instances, recognized by the Brazilian authority, affected up to 7% of municipalities in certain years.

Table 3.1: Drought and Dry Spell occurrences in Brazilian municipalities as acknowledge by the governmental authorities between 2015-2019

N of Municipalities	Dry Spell	Drought
2015	843 (15%)	394 (7%)
2016	802 (14%)	370 (7%)
2017	109 (2%)	44 (1%)
2018	100 (2%)	132 (2%)
2019	37 (1%)	43 (1%)

Source: Authors, with data from the Integrated System of Information on Disasters (S2iD) and historical data on Federal Recognition of Emergency Situations and Public Calamity provided by the Ministry of Regional Integration and SEDECs.

There are, indeed, specific climatic characteristics of the Brazilian regions that make them more susceptible to such events. For instance, the Northeastern region, of semi-arid and arid climate, accounts for almost 80% of the cases of drought and dry spell phenomenons. As a result, there are existing government programs designed to help communities in these areas cope with exposure to extreme natural events, such as the *Garantia Safra* and the First and Second Water Cisterns programs (CP1A and CP2A) (Bobonis et al., 2022; Da Mata et al., 2023). Additionally, special funds have been allocated to assist affected populations, covering approximately 20% of the cases between 2015 and 2020.

The following sections present how we developed our methodology for analyzing individual migration patterns across the Brazilian territory in association with high-resolution historical precipitation data. We will then present a basic model for individual migration along with our estimations. First, however, we will introduce the datasets utilized in these analyses.

3.3 Data

In this section, we present the data sources used to construct our methodology for observing individual migration in association with the historical precipitation index. We combined administratively restricted data with publicly available information from multiple sources concerning low-income individuals and households in Brazil.

3.3.1 *Cadastro Único* (CadÚnico)

The *Cadastro Único para Programas Sociais*(CadÚnico)[3] of the Federal Government is a database that identifies and characterizes the universe of low-income households in Brazil.[4] It was created by the Decree No. 3,877/2001 (Brasil, 2001), structured within the Ministry of Social Development[5] in 2001. Over the decades, CadÚnico has emerged as an important tool in supporting public policies design aimed at improving the lives of the low-income households. It provides managers with information on the risks and vulnerabilities to which the poor and extremely poor population of Brazil is exposed to.

In 2012, the system underwent a major improvement after Ordinance No. 177/2011 (Brasil, 2011). The information on Bolsa Família Program beneficiaries was, then, restructured within version 7 of CadÚnico, a newer and better connected infrastructure. Thus, it began to include a wider range of socioeconomic and demographic variables of registered households and individuals. Particularly important for our analysis, the introduction of the address information for each household. However, this information was not fully registered since the beginning. For instance, there is no address information for 42% of the households in 2012. It only significantly improved by 2015, when 96% of the households presented reliable address information; from 2016 onward, missing addresses

[3]Unified Registry for Social Programs, in free translation

[4]Low-income households are defined as those with a monthly *per capita* income of up to half the current minimum wage or a total household income of up to three times the minimum wage.

[5]Between the years 2019 and 2022, it was called the Ministry of Citizenship.

were less than 1% of the households. Thus, we decided to use active records for households and individuals from 2015 until 2020, period of highly reliable data.

3.3.2 *Declaração de Aptidão ao Pronaf (DAP/Pronaf)*

The *Declaração de Aptidão (DAP) ao Programa Nacional de Fortalecimento da Agricultura Familiar (Pronaf)*[6], is a federal government administrative record that identifies and qualifies Family Agricultural Production Units and their organized associative forms of Brazil. The DAP system identifies family farmers and beneficiaries of agrarian reform who can apply for rural credit and access to other government programs. We use DAP information to identify vulnerable individuals and households whose primary income is derived from crop production, making them particularly susceptible to the significant impacts of extreme drought on household income. Their climate and socioeconomic vulnerability is underscored by the fact that all of them are also registered in the *CadÚnico* for social programs.

3.3.3 *CHIRPS: Climate Hazards Group InfraRed Precipitation with Station data*

The Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) is a 43 plus years quasi-global daily, pentadal, and monthly precipitation dataset. Spanning 50^o S - 50^o N (and all longitudes) and ranging from 1981 to near-present, CHIRPS incorporates the climatology, CHPclim, 0.05^o resolution satellite imagery, and in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought monitoring. CHIRPS was developed to support the United States Agency for International Development Famine Early Warning Systems Network (FEWS NET). Building on approaches used in successful thermal infrared (TIR) precipitation products and current

[6]Declaration of Aptitude (DAP) for the National Program for Strengthening Family Farming (Pronaf), in free translation

state-of-the-science interpolated gauge products, CHIRPS uses a "smart interpolation" approach, working with anomalies from a high resolution climatology.

We use monthly precipitation information at the grid-level of 0.05^o[7] for the Brazilian territory between January 1981 to December 2019 to develop a standardized historical precipitation index for each household address in our sample.

3.3.4 *Sistema Integrado de Informações sobre Desastres* (S2iD)

The *Sistema Integrado de Informações sobre Desastres* (S2iD)[8] is a national dataset compiled by the Ministry of Regional Integration of the federal government.[9] It works as a platform of the National Civil Protection and Defense System, integrating various systems from the National Civil Protection and Defense Secretariat (Sedec). Its aim is to enhance and provide transparency in risk and disaster management in Brazil through the digitization of processes and the availability of systematized information and resources. We used S2iD data to control for the occurrence of any publicly acknowledged weather disaster in the Brazilians municipalities between 2015 and 2020.

3.3.5 *Garantia Safra*

The *Garantia Safra*[10] is an initiative within the Pronaf aimed at ensuring minimum living conditions for family farmers in municipalities that are systematically subject to severe crop losses due to drought or excessive rainfall. It works as a subsidized insurance, which rural producers, local- and higher-levels governments contribute to a fund available to cover confirmed crop losses due to extreme weather events. We use *Garantia Safra* information as a control for other governmental programs that may be linked to individual exposure to extreme drought and the benefits provided by social programs.

[7] 0.05^o = 5.55 km or 3.44 miles, approximately.

[8] Integrated Disaster Information System, in free translation.

[9] This dataset was made available by the ministry through a Freedom of Information Act (LAI) process, number 59016.001820/2022-14.

[10] Crop-Guarantee, in free translation.

3.3.6 *Portal da Transparência*

The *Portal da Transparência*[11] is a Brazilian government portal dedicated to making public all expenditures of the federal government. It lists all expenses and cash transfers the federal government, including the individuals receiving social benefits, such as the *Bolsa Família* and the *Garantia Safra*, and how much they have received.

3.4 Methodology

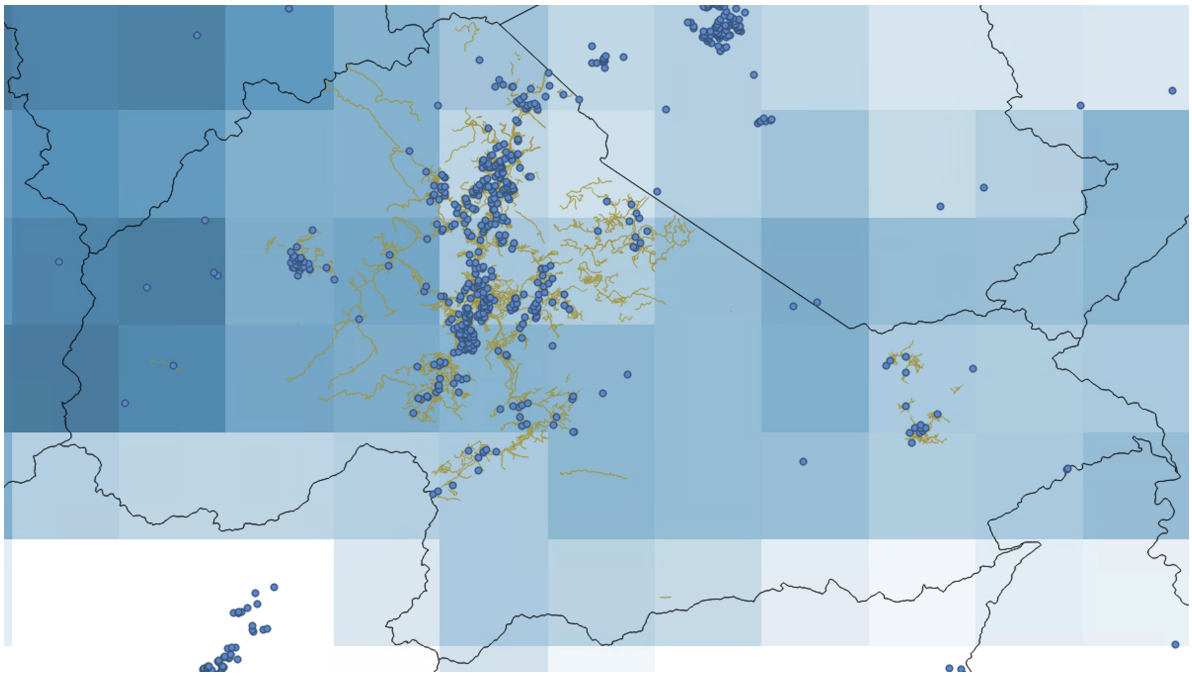
One of the biggest concerns over the geospatial analysis of climate change and extreme natural events is the ability to observe affected units with high precision. Previous work relied on observation at the municipality-, county-, or district-levels, which misses a lot of variation for individual and household analysis (Cattaneo et al., 2019). In this paper we develop a new methodology which is able to overlap each place of residence (at the street level) of vulnerable households members and historical precipitation associated to small grids of 0.05° by 0.05°.[12] The high-resolution grids of precipitation data, combined with the proximity of agricultural producer families to their crop fields, enable us to accurately estimate the impact of extreme weather events on their income.

The following subsections detail our process for retrieving the geographic coordinates (latitudes and longitudes) of all vulnerable households in the *CadÚnico* between 2012 and 2020. We then explain how we overlapped this data with the historical precipitation index from the CHIRPS project using geographic information system software, QGIS. An example of the monthly snapshots with geographical points associated with the precipitation data can be observed in Figure 3.1.

[11] Transparency Portal, in free translation: https://portaldatransparencia.gov.br/download-de-dados

[12] The same methodology is applied in our paper with preliminary title "Resilience in Adversity: How Social Policies Amend Labor and Capital Mobility in the Face of Extreme Weather Events" in collaboration with the UNU-WIDER and IMDS.

Figure 3.1: Household units and CHIRPS precipitation index for the city of Nova Friburgo, RJ/Brazil



Source: The authors, with data from the CHIRPS project and *CadÚnico* in the QGIS software. Blue dots are the geographic coordinates of household's addresses, in yellow the streets covered by IBGE in the Census, in black the municipality's territory limits, and in shades of blue squares the precipitation index for each grid and month/year.

3.4.1 Retrieving the geographical coordinates of households' addresses

We retrieved the geographical coordinates for the entire period of *CadÚnico* data available from 2012 to 2020, although we decided to include only data from 2015 until 2020 in our sample, as explained in Subsection 3.3.1. We began by concatenating all available address location information for each year in the *CadÚnico* household datasets.[13] Next, we combined the datasets from 2012 to 2020, ensuring that each identical entry was represented only once, along with the relevant variables. This resulted in a dataset with 14,701,031 uniquely identified addresses, which we then processed through the HERE platform's Geocode algorithm to obtain the most accurate latitude and longitude coordinates.

Table 3.2 presents summary statistics of the quantity and quality of this methodology by groups of municipalities. We were able to retrieve geographic coordinates for 99.3% of the addresses. Among these, only 15% were accurately matched to the municipality's geocentric coordinates by the algorithm, while the remaining 85% matched within-municipality locations.

After a thorough analysis, we concluded that the quality of information provided by end-users correlates directly with the municipality size; smaller towns with larger rural areas tend to present greater challenges for the algorithm find street-level address geographic coordinates approximations. This is a result of the quality of the data registered in the *CadÚnico* system and the territorial coverage of the HERE algorithm. In many cases, we were unable to retrieve a more accurate address placement due to improper registration of street address information by end-users or the algorithm's inability to find a perfect match within the available datasets.

Tables C.1 and C.2 in Appendix C do also present the Geocoding outcomes for a panel with all the household and individual observations, respectively. Relevant to our coming

[13] Variables: $cod\_munic\_ibge\_fam$, $nom\_localidade\_fam$, $nom\_tip\_logradouro\_fam$, $nom\_tit\_logradouro\_fam$, $nom\_logradouro\_fam$ + the name of the municipality and state.

Table 3.2: Geocoding of households' unique addresses in the 2012-2020 *CadÚnico*

Groups	Capitals		Inhab. > 100,000		40k < Inhab. < 100k		15k < Inhab. < 40k		Inhab. < 15k		**Total**	
Addresses	N	%	N	%	N	%	N	%	N	%	N	%
Processed	2,227,957	100%	3,918,161	100%	2,676,148	100%	3,406,160	100%	2,472,605	100%	**14,701,031**	**100%**
Geocoded	2,221,164	99.7%	3,899,134	99.5%	2,652,450	99.1%	3,375,225	99.1%	2,452,639	99.2%	**14,600,612**	**99.3%**
Not found	6,723	0.3%	19,027	0.5%	23,698	0.9%	30,935	0.9%	19,966	0.8%	**100,349**	**0.7%**
Quality of the Geocoding												
Street or similar	1,958,402	88%	3,359,339	87%	2,121,535	80%	2,332,668	69%	1,421,619	57%	**9,751,466**	**77%**
Locality:	262,832:	12%:	539,795:	14%:	530,915:	20%:	1,042,557:	31%:	1,031,020:	42%:	**3,407,119:**	**23%:**
Postal Code	41,984	2%	87,745	2%	33,691	1%	35,353	1%	29,549	1%	**228,322**	**2%**
District	181,939	8%	303,972	8%	137,365	5%	159,142	5%	134,944	6%	**917,362**	**6%**
Municipality	38,909	2%	148,078	4%	359,859	14%	848,062	25%	866,527	35%	**2,261,435**	**15%**

Source: Authors, with household data from the *CadÚnico* for Social Programs from 2012-2020. HERE Platform Geocoding API. The quality analysis conveys the information from the output variable retrieved from the HERE Geocoding algorithm.

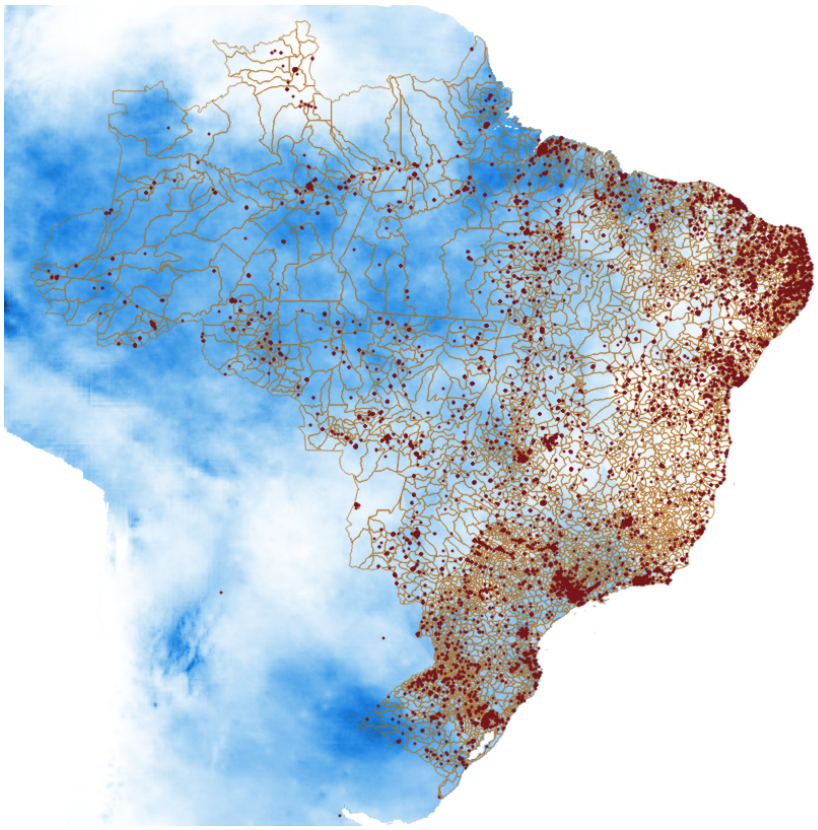
analysis is the result for the addresses of vulnerable agricultural households between 2015 and 2020: 57% at the street-level or similar; 6% at the district-level; 37% at the municipality-level.

3.4.2 Associating the Precipitation Index with Household Addresses

We linked the precipitation index to the geographic coordinates of vulnerable households to analyze how variations in precipitation impact household income, particularly in the context of extreme weather events. First, we imported the historical precipitation data from the CHIRPS project into the QGIS software. This dataset contains high-resolution (0.05° by 0.05°) precipitation measurements from January 1981 until December 2019. We then overlaid the precipitation data onto the geographic coordinates of the households. Using spatial analysis tools in QGIS, we extracted precipitation values for each household based on their geographic location. This allowed us to create a comprehensive dataset that includes not only household coordinates but also corresponding historical precipitation data, facilitating our subsequent analysis of the effects of extreme weather on income and migration patterns. By correlating these two datasets, we can better understand the relationship between precipitation extremes and the socioeconomic vulnerabilities of the affected populations.

As an example, Figure 3.2 presents the CHIRPS precipitation data (squares in shades of blue) for the Brazilian territory with the municipalities' administrative borders in brown and the geographical distribution of vulnerable agricultural households in red dots for January 2019.

Figure 3.2: CHIRPS precipitation index for January 2019 - Brazil



Source: Author's elaboration with data provided by the CHIRPS project and *CadÚnico* with the QGIS software.

3.4.3 A Standardized Historical Precipitation Measure

We build on Bobonis et al. (2022); Hidalgo et al. (2010) a standardized precipitation measure based on historical precipitation in the grid (area) of interest - the region where a household's address is located, for each month of the year. Differently from them, however, we develop this historical precipitation assessment at the smallest area possible,

the grids of size 0.05° by 0.05° from the CHIRPS datasets.[14]

This historical assessment is important to ensure meaningful comparisons across areas with differing climatic conditions. As Bobonis et al. (2022), extreme natural events are measured as the difference between the current period's precipitation index and the historical mean of precipitation in the grid during identical periods of time, divided by the grids' historical standard deviation of precipitation for a given period of time.

Following Corbi et al. (2024), we use two measures of weather shock. The first relies on the cumulative rainfall during crop growing season in Brazil, between Spring (November) and Autumn (April), a vital period of rainfall for agricultural output.[15] The other uses yearly cumulative rainfall over an area. The standardized index is computed as follows:

$$\text{Standardized Precipitation}_{g,t} = \frac{(Precipitation_{g,t} - \overline{Precipitation}_{g,t})}{\sigma_{g,t}}$$

where $Precipitation_{g,t}$ refers to precipitation in grid g in time period t (a Growing Season or year); $\overline{Precipitation}_{g,t}$ refers to the average historical precipitation in grid g and time period t; and $\sigma_{g,t}$ is the historical standard deviation of precipitation in grid g and time period t.

This measure is useful to assess the extent to which the precipitation index over the Growing Season GS or year y was historically extreme. It's important to note that our standardized index is based on historical deviations for each grid and time period. For longer periods, we employ a similar strategy by calculating the cumulative precipitation for the same months across different years. For example, the cumulative precipitation in

[14]We exploit two distinct phenomena with the precipitation index based on the heterogeneous effects of rainfall on agricultural and urban areas. The first case is analyzed in this paper; the second one exploits high volumes of rainfall in short periods of time. The latter has is forthcoming with preliminary title "Resilience in Adversity: How Social Policies Amend Labor and Capital Mobility in the Face of Extreme Weather Events" in collaboration with the UNU-WIDER and IMDS.

[15]The growing season (GS) is very similar for different regions of Brazil. We use the months between November and April as an approximation:

$$Precipitation_{g,GS} = \sum_{m \epsilon [Nov, Apr]} Precipitation_{g,m}$$

grid g is derived from the sum of precipitation between years t and *t-1*.

3.5 Migration decisions

We begin the analytical section of this paper by presenting a simple model of individual migration decision-making. Migration decisions in the context of climate change involve a complex interplay of political, socioeconomic, and behavioral factors (Black et al., 2011; Martin et al., 2014). Nevertheless, migration remains one of the most common strategies for vulnerable individuals to cope with the impacts of extreme natural events (Berlemann and Steinhardt, 2017; Hunter, 2005; Ober, 2019). Economic hardship, along with direct income and wealth losses resulting from these events, is identified as a primary driver of migration, particularly for households facing climate and economic vulnerability. Consequently, social protection policies hold significant potential for enabling vulnerable individuals to adapt and develop resilience strategies in response to climate shocks. (Cattaneo et al., 2019; Premand and Stoeffler, 2020).

We outline a locational choice model where the migration decisions is a function of both financial and non-financial factors, along with a random shock component, as follows:

$$\text{Migration Decision}_{i,t} = \ f(I_i, S_i, C_i, \varepsilon_{i,t})$$

where $MigrationDecision_{i,t}$ is the individual i decision to migrate or not assessed in time t. This assessment is a comparison between financial factors, as income I and social benefits S, and non-financial factors, as community links C. A key component for our analysis is the random shock ε, such as an extreme natural event. We are mostly interested in understanding the relationship between the random shock component and financial factors on migration decisions.

3.6 Empirical Strategy

The migration model presented in section 3.5 is applied to the migration decision-making of vulnerable agricultural households exposed to extreme weather events. Take a scenario where crop output, highly dependent on precipitation, is the main income source of a vulnerable family firm;[16] they are beneficiaries of social programs, such as the BFP; preferences for non-financial factors are fixed over short periods of time; and they are subject to the occurrence of extreme weather events.

We rely on the hypothesis that extreme negative deviations from the historical precipitation over a grid/residence are quasi-random events. Consequently, exposure to high instances of drought is considered an unanticipated negative shock to agricultural productivity. To reinforce this assumption, we also account for longer periods of cumulative precipitation up to years *t-1* and *t-2*.

We estimate the reduced-form equation of the relationship between being a social program beneficiary and exposure to extreme natural events in a panel of vulnerable agricultural individuals between the baseline year t and the following periods *t+1* and *t+2*, as follows:

$$
\begin{aligned}
y_{i,t+n} = \alpha_{i,t} + \theta\ Income_{i,t} + \beta_1\ &(\text{BFP Beneficiary}_{i,t} * \text{Extreme Drought Exposure}_{i,t}) \\
&+ \gamma_1\ \text{BFP Beneficiary}_{i,t} + \eta_1\ (\text{Extreme Drought Exposure})_{i,t} + \\
&+ \beta_2\ (\text{BFP Beneficiary}_{i,t} * \text{Severe Drought Exposure}_{i,t}) \\
&+ \gamma_2\ \text{BFP Beneficiary}_{i,t} + \eta_2\ (\text{Severe Drought Exposure})_{i,t} + \\
&+ (\text{Cumulative Historical Neg. Std. Precipitation})'_{i,[t,t-1,t-2]}\ \Omega + \\
&+ X'_{i,t}\ \Delta_1 + HH'_{i,t}\ \Delta_2 + M'_{i,t}\ \Delta_3 + O'_{g,t}\ \Delta_4 + \phi_i + \rho_t + \epsilon_{i,t}
\end{aligned}
$$

[16] Rainfall indices are vastly used as proxies for rural household's income in the literature, as seen in (Hidalgo et al., 2010; Jayachandran, 2006; Dell et al., 2014).

where $y_{i,t+n}$ is a dummy variable that assumes the value of 1 if the individual i relocated any time in the following period, $t+n$ years, measured as a probability;[17] The coefficient of interest β conveys the association between the individual being a beneficiary of the BFP and their exposure to extreme (1%) or severe (10% to 1%) drought instances as a dummy variable (in quantiles of the historical rainfall distribution) in year t. Thus, the variables BFP Beneficiary$_{i,t}$ and Extrene or Severe Drought Exposure$_{i,t}$ are individual components of the mentioned interaction, respectively. Cumulative Historical Neg. Std. Precipitation$_{i,t}$ and the cumulative rainfall for *t-1* and *t-2* are continuous variables in Standard Deviations of the Distribution of the negative precipitation index historically assessed for a grid unit. $X_{i,t}$ the matrix of time-varying controls containing the individual characteristics in year t, including, for instance, education level and individual income; $HH_{i,t}$ the matrix of time-varying controls containing the household characteristics in year t, including, for instance, average income and residence characteristics; $M_{i,t}$ the matrix with information on any natural disasters acknowledge by the federal authorities from the S2iD dataset; $O_{g,t}$ the matrix of time-varying controls containing average characteristics of the households located in the same geographic coordinates of origin g in year t; ϕ_i the individual fixed effects; ω_t the year fixed effects; and $\epsilon_{i,t}$ the idiosyncratic error term. All estimations are clustered at the panel unit of analysis, individuals.

We should expect that β is a robust estimate of the causal effect of social policy benefits and exposure to climate change's effects on migration decision, given the quasi-random occurrence of extreme natural events. Exposure to drought is measured at both the intensive and the extensive margins, based on historical conditions for each grid/area. As a result, farmers cannot predict the extent of drought exposure in any given year. This uncertainty helps explain why half of our sample migrates in the first year following a major drought event. At the same time, the comparison groups are very similar vulnerable households registered in the *CadÚnico* for social benefits. Beneficiaries and non-beneficiaries of the

[17] Migration is assessed cumulatively for one, two, or three years after the baseline year t if the geographic coordinates of the address registered in each year for each individual in the *CadÚnico* changed.

BFP differ by a small margin given the program's eligibility criteria.

3.7 Observed units

For the empirical analysis we wanted to observe as close as possible the universe of vulnerable agricultural producers in Brazil, their households' addresses and exposure to extreme natural events. We have special interest in the small, family units, the most exposed to negative income shocks, stemming from effects of climate change. After observing that the occupational information from family-members registered in the *CadÚnico* was not optimal for such,[18] we managed to link the *CadÚnico* datasets with the DAP/Pronaf, a registry of vulnerable agricultural household producers maintained by the Ministry of Agrarian Development and Family Agriculture. Notwithstanding, we were able to find all of the benefit holders in DAP/Pronaf between 2015 and 2020 also in the *CadÚnico* by using their social security number (CPF) as the key. This way, we secured a match between the universe of social program beneficiaries that are vulnerable agricultural producers. All other datasets were merged by individual and/or administrative territory for the analysis, with close to perfect matching results.

We took a few steps to select our final sample. Firstly, we restricted the *CadÚnico* sample for only household units with "active" entries, so we guarantee the record is up-to-dated and with reliable information.[19]. Then, we compiled the information in DAP/Pronaf by observing any individual, benefit holder of secondary, who was ever registered between 2012 and 2020.[20] Given the household structure of benefits, we kept in our sample any individual member of households in which at least one member was listed in DAP/Pronaf.

[18]For instance, we should be able to observe with variable "ind_parc_mds_fam" agricultural and agrarian reform households. However, many of those are not listed as agricultural producers in the corresponding occupation variables "cod_agricultura_trab_memb" and "cod_principal_trab_memb".

[19]This is important to observe only those actively receiving social benefits and with non-missing address information, which were, on average, less than 1% over the 2015-2020 years.

[20]We use the information back to 2012, because the DAP/Pronaf dataset contains only the stock of information ever registered in the system and entries were updated on a biannual basis.

Finally, we keep in our analysis only individuals observed in the resulting dataset for more than one year in our panel, in order to observe migration by comparing their addresses over time.[21]

3.8 Summary Statistics

The sample of individuals in vulnerable agricultural households has 55,213,451 observations of 14,362,945 unique individuals across the years 2015 and 2020, which 76% were beneficiaries of the BFP. Of those, 26,793,027 observations were from the 6,661,156 unique individuals directly found in DAP/Pronaf as main benefit holders.[22] Notice that we can only observe the migration status of individuals in t+1 years between 2015 and 2019; in t+2 years between 2015 and 2018; and t+3 years between 2015 and 2017.

Moreover, one of the main contributions of our analysis is to observe individual migration across the territory, not restricted to administrative areas. Table 3.3 presents the average share of individuals in our panel who migrates in t+1, t+2, and/or t+3 years after the baseline year t,[23] when exposure to extreme drought is assessed. We constructed three outcome variables as migration assessments: "Moved Out", which compares the geographical coordinates of individual's household addresses between time periods; "Within": compares the geographical coordinates of individual's household addresses conditional on belonging to a same municipality; and "Between": compares the geographical coordinates of individual's household addresses conditional on belonging to different municipalities. It is striking to observe that migration within a municipality's territory is five times higher than longer-distance ones to a different municipality.

Although individuals more frequently migrate to areas of better socioeconomic and

[21] Notice that we are not able to observe individuals who left the *CadÚnico* over the years. This could lead to censored-data bias to our estimates. However, we observe an average migration rate similar to that of the Brazilian Census and to what is found in the literature (Oliveira and Chagas, 2018).

[22] There was missing information for some individuals among those who migrated between and within municipalities in very few instances.

[23] We take the cumulative instances of migration over the years.

Table 3.3: Individual migration of vulnerable agricultural producers between t and t+n, panel 2015-2020

Migrated between t and:	t+1			t+1 / t+2			t+1 / t+2 / t+3		
Address changed	Migrated	Within	Between	Migrated	Within	Between	Migrated	Within	Between
any member of the family									
Share of ind. (in %)	7%	6%	1%	14%	12%	2%	20%	17%	3%
N of ind. (in millions)	3.81	3.21	0.60	6.18	5.27	0.91	6.68	5.74	0.94
benefit holder									
Share of ind. (in %)	6%	5%	1%	12%	10%	2%	18%	15%	3%
N of ind. (in millions)	1.63	1.38	0.25	2.68	2.28	0.40	2.92	2.51	0.41

Source: Authors, with data from the CadÚnico and DAP/PRONAF. Migration of individuals in vulnerable agricultural-producer families between 2015 and 2020. The columns stand for "Migrated": addresses with different geographical coordinates between time periods; "Within": different geographical coordinates within a same municipality; and "Between": different geographical coordinates in different municipalities.

infrastructure than their places of origin, the same cannot be taken for granted for those displaced by extreme weather events. Table 3.4 presents the average characteristics of areas of origin and destination of vulnerable individuals exposed to the extreme (1%) and severe (10% to 1%) instances of drought and beneficiary of the BFP in our sample. We can observe that among those who migrated, they have indeed chosen places of better characteristics than of their places of origin. However, individuals affected by extreme droughts tended to migrate to areas only marginally better than their places of origin, whereas those exposed to severe (but less extreme) droughts selected destinations that were comparatively better. This pattern can be understood by considering that extreme events may constrain decision-making, leaving affected individuals with fewer opportunities to optimize their migration choices, unlike those facing milder shocks. Moreover, the data reveal the extent of this population's vulnerability: nearly half have access only to public water and waste collection services, while less than a quarter, on average, have access to a public sewage system.

Table 3.4: Test of the difference in means between the average characteristics of the locations of origin and destination of individuals who migrated between 2015 and 2020 - Beneficiaries of the BFP affected by extreme drought (1% of the distribution))

Drought Instance	Extreme (1% Highest)			Severe (10% to 1% Highest)		
Average of households	Destination	Origin	Difference (t-test)	Destination	Origin	Difference (t-test)
average per capita income (in BRL)	209.96	182.62	27.34***	190.60	166.41	38.71***
monthly household expenses (in BRL)	402.74	362.02	40.72***	376.95	338.25	38.70***
house with finished floor (share)	0.86	0.83	0.03***	0.89	0.87	0.02***
house with concrete finished walls (share)	0.49	0.48	0.01***	0.57	0.55	0.02***
access to public water provision (share)	0.48	0.47	0.01***	0.53	0.51	0.02***
access to public sewage system (share)	0.14	0.13	0.01***	0.17	0.15	0.02***
access to trash collection (share)	0.46	0.43	0.03***	0.47	0.43	0.04***
access to public energy system (share)	0.75	0.75	0.00**	0.80	0.79	0.01***
N of individuals	36,554	36,554		352,291	352,291	

Source: Authors, with data from the CadÚnico and DAP/PRONAF. Comparison of origin-destination average characteristic of households located in a same geographical point for those in areas with the highest instances of drought, 1% and 10% most severe.

3.9 Results

We start by presenting our main results for the social policy effect on individual migration decisions in t+1, t+2, and/or t+3 years after a vulnerable agricultural producer is highly affected by an extreme drought between 2015 and 2020, as presented in Section 3.6.[24] Subsection 3.9.1 focus on the migration decisions of any members of the vulnerable agricultural families, given the family-firm characteristics and structure of the social benefits; while 3.9.2, on the migration decisions of the main benefit holders, as they are, most commonly, the main providers of the family-firm unit.

Our results reconcile different strands of the literature by showing that individuals strategically use cash benefits to enhance their resilience, with responses varying according to the characteristics of the extreme natural event. We find that being a CCT beneficiary during an extreme drought event (top 1%) increases the probability of individual migration in subsequent periods by 7% in the first year, 4% over the next two years, and 2% over the following three years, with relatively greater effects for migration between municipalities. In contrast, among those exposed to severe droughts (between the top 10% and 1%), the

[24]The results remain robust in our yearly assessment, although the identification is less precise.

receipt of cash benefits reduces the probability of migration by 4% in the first year, 3% over the next two years, and 5% over the following three years, with a stronger effect observed for relocations within the same municipality. These effects are particularly pronounced among the main benefit recipients (see subsection 3.9.2) and remain robust when estimated using a Poisson panel model (see subsection 3.9.3).

3.9.1 Any Members of Agricultural Producer Households

Table 3.5 presents the results for members of agricultural producer households affected by the extreme (1% highest) drought instances. Notice that the interaction between being a BFP beneficiary and exposure to these extreme drought instances has a significant positive effect on individual migration probability across all cases. Similarly, Table 3.6 shows the results for households affected by severe (between 10% and 1% highest) drought instances. Here, the interaction term is significant but reveals a negative relationship between social benefits and exposure to "less extreme" drought instances, with the exception of migration between municipalities, which shows a positive, though very small and not significant.

The results relate to and contribute to the literature in two main ways. First, drought severity is strongly associated with greater crop losses stemming from unanticipated income shocks. While social benefits can enable migration by providing the financial means for highly exposed or displaced individuals, they may also help those less severely affected to build resilience and remain in place, mitigating moderate income losses from crop damage. Second, by distinguishing between the effects of severe and extreme drought events at the individual level, our analysis helps reconcile contrasting findings in the literature by revealing differences in treatment exposure and behavioral responses.

Table 3.5: Migration decisions of members of agricultural producer households in CadÚnico between 2015 and 2020: Effects of droughts by groups of extreme drought events and benefits of the BFP.

Precipitation in SDs for the Growing Season (Nov to Apr)	Moved Out	Within	Between
relocation between t and t+1			
Interaction BFP * 1% extreme drought instances	0.0047	0.0029	0.0019
	(0.0010)	(0.0009)	(0.0004)
Relative Effect (Δ % Mean Dep. Var. given β)	**7%**	**5%**	**17%**
relocation between t and t+2			
Interaction BFP * 1% extreme drought instances	0.0058	0.0029	0.0030
	(0.0011)	(0.0010)	(0.0005)
Relative Effect (Δ % Mean Dep. Var. given β)	**4%**	**5%**	**13%**
relocation between t and t+3			
Interaction BFP * 1% extreme drought instances	0.0030	0.0004	0.0030
	(0.0009)	(0.0009)	(0.0004)
Relative Effect (Δ % Mean Dep. Var. given β)	**2%**	0%	**10%**

Source: Authors with data from the CadÚnico, DAP/PRONAF, and CHIRPS Precipitation. Precipitation in SDs for the Growing Season (Nov to Apr) at the grid level. OLS panel estimations with fixed effects at the year and individual levels, time-varying controls for individuals, households, municipalities, and places of origin. Coefficient estimated for the effect of being a *Bolsa Família* beneficiary when affected by an extreme drought on the probability of migration of individuals in vulnerable agricultural-producer families between 2015 and 2020. The columns stand for "Moved Out": addresses with different geographical coordinates between time periods; "Within": different geographical coordinates within a same municipality; and "Between": different geographical coordinates in different municipalities. Standard-errors in parenthesis and relative effects are in bold for those significant at the 1% level.

Table 3.6: Migration decisions of members of agricultural producer households in CadÚnico between 2015 and 2020: Effects of droughts by groups of severe drought events and benefits of the BFP.

Precipitation in SDs for the Growing Season (Nov to Apr)	Moved Out	Within	Between
relocation between t and t+1			
Interaction BFP * btw. 10% and 1% severe drought instances	-0.0028	-0.0031	0.0002
	(0.0005)	(0.0004)	(0.0002)
Relative Effect (Δ % Mean Dep. Var. given β)	**-4%**	**-5%**	2%
relocation between t and t+2			
Interaction BFP * btw. 10% and 1% severe drought instances	-0.0047	-0.0052	0.0004
	(0.0005)	(0.0005)	(0.0002)
Relative Effect (Δ % Mean Dep. Var. given β)	**-3%**	**-4%**	2%
relocation between t and t+3			
Interaction BFP * btw. 10% and 1% severe drought instances	-0.0102	-0.0103	0.0002
	(0.0005)	(0.0004)	(0.0002)
Relative Effect (Δ % Mean Dep. Var. given β)	**-5%**	**-6%**	1%

Source: Authors with data from the CadÚnico, DAP/PRONAF, and CHIRPS Precipitation. Precipitation in SDs for the Growing Season (Nov to Apr) at the grid level. OLS panel estimations with fixed effects at the year and individual levels, time-varying controls for individuals, households, municipalities, and places of origin. Coefficient estimated for the effect of being a *Bolsa Família* beneficiary when affected by an severe drought on the probability of migration of individuals in vulnerable agricultural-producer families between 2015 and 2020. The columns stand for "Moved Out": addresses with different geographical coordinates between time periods; "Within": different geographical coordinates within a same municipality; and "Between": different geographical coordinates in different municipalities. Standard-errors in parenthesis and relative effects are in bold for those significant at the 1% level.

3.9.2 Benefit Holders in Agricultural Producer Households

The previous analyses considered the migration behavior of all individuals in agricultural households affected by drought. However, one might argue that migration decisions are primarily driven by a key household member, typically the main income earner or social benefit holder, who plays a central role in navigating risk and allocating resources. To test this hypothesis, Table 3.7 presents the results for benefit holders, members of agricultural producer households exposed to extreme droughts (top 1%), while Table 3.8 reports results for those exposed to severe droughts (top 10% to 1%).

The results are similar to those found when analyzing all household members. Migration probabilities, both for inter- and intra-municipality moves, follow the same patterns and magnitudes. This finding suggests that migration is not limited to, nor disproportionately driven by, the principal decision-maker or benefit holder. Rather, it appears to be a shared household strategy—possibly coordinated among members and shaped by joint exposure to environmental and economic stressors.

This result contributes to the broader literature on household migration and adaptation by emphasizing the collective nature of migration decisions in rural, vulnerable contexts. It resonates with models in which migration is treated as a household-level risk diversification strategy (Stark and Levhari, 1982), rather than an individual-level labor market choice. Under this framework, the role of social protection, such as conditional cash transfers, is to ease credit constraints and provide flexibility in how households allocate migration roles across members.

In this sense, the *Bolsa Família* Program may support mobility not only by enabling a single decision-maker to migrate, but by providing the household with the resources to distribute migration responses among its members based on labor needs, caregiving responsibilities, or social ties. This interpretation underscores the importance of considering intra-household dynamics when evaluating the adaptation effects of social policy.

Table 3.7: Migration decisions of the main benefit holders members of agricultural producer households in CadÚnico between 2015 and 2020: Effects of droughts by groups of extreme drought events and benefits of the BFP.

Precipitation in SDs for the Growing Season (Nov to Apr)	Moved Out	Within	Between
relocation between t and t+1			
Interaction BFP * 1% extreme drought instances	0.0056	0.0039	0.0018
	(0.0013)	(0.0012)	(0.0006)
Relative Effect (Δ % Mean Dep. Var. given β)	**9%**	**7%**	**18%**
relocation between t and t+2			
Interaction BFP * 1% extreme drought instances	0.0069	0.0037	0.0033
	(0.0014)	(0.0013)	(0.0006)
Relative Effect (Δ % Mean Dep. Var. given β)	**6%**	**3%**	**16%**
relocation between t and t+3			
Interaction BFP * 1% extreme drought instances	0.0025	-0.0002	0.0029
	(0.0012)	(0.0011)	(0.0005)
Relative Effect (Δ % Mean Dep. Var. given β)	1%	0%	**10%**

Source: Authors with data from the CadÚnico, DAP/PRONAF, and CHIRPS Precipitation. Precipitation in SDs for the Growing Season (Nov to Apr) at the grid level. OLS panel estimations with fixed effects at the year and individual levels, time-varying controls for individuals, households, municipalities, and places of origin. Coefficient estimated for the effect of being a *Bolsa Família* beneficiary when affected by an extreme drought on the probability of migration of individuals in vulnerable agricultural-producer families between 2015 and 2020. The columns stand for "Moved Out": addresses with different geographical coordinates between time periods; "Within": different geographical coordinates within a same municipality; and "Between": different geographical coordinates in different municipalities. Standard-errors in parenthesis and relative effects are in bold for those significant at the 1% level.

Table 3.8: Migration decisions of the main benefit holders members of agricultural producer households in CadÚnico between 2015 and 2020: Effects of droughts by groups of severe drought events and benefits of the BFP.

Precipitation in SDs for the Growing Season (Nov to Apr)	Moved Out	Within	Between
relocation between t and t+1			
Interaction BFP * btw. 10% and 1% severe drought instances	-0.0017	-0.0021	0.0002
	(0.0006)	(0.0005)	(0.0002)
Relative Effect (Δ % Mean Dep. Var. given β)	**-3%**	**-4%**	2%
relocation between t and t+2			
Interaction BFP * btw. 10% and 1% severe drought instances	-0.0053	-0.0057	0.0002
	(0.0006)	(0.0006)	(0.0003)
Relative Effect (Δ % Mean Dep. Var. given β)	**-4%**	**-5%**	1%
relocation between t and t+3			
Interaction BFP * btw. 10% and 1% severe drought instances	-0.0110	-0.0111	0.0002
	(0.0006)	(0.0006)	(0.0002)
Relative Effect (Δ % Mean Dep. Var. given β)	**-6%**	**-7%**	1%

Source: Authors with data from the CadÚnico, DAP/PRONAF, and CHIRPS Precipitation. Precipitation in SDs for the Growing Season (Nov to Apr) at the grid level. OLS panel estimations with fixed effects at the year and individual levels, time-varying controls for individuals, households, municipalities, and places of origin. Coefficient estimated for the effect of being a *Bolsa Família* beneficiary when affected by an severe drought on the probability of migration of individuals in vulnerable agricultural-producer families between 2015 and 2020. The columns stand for "Moved Out": addresses with different geographical coordinates between time periods; "Within": different geographical coordinates within a same municipality; and "Between": different geographical coordinates in different municipalities. Standard-errors in parenthesis and relative effects are in bold for those significant at the 1% level.

3.9.3 Robustness: Poisson Panel Estimation

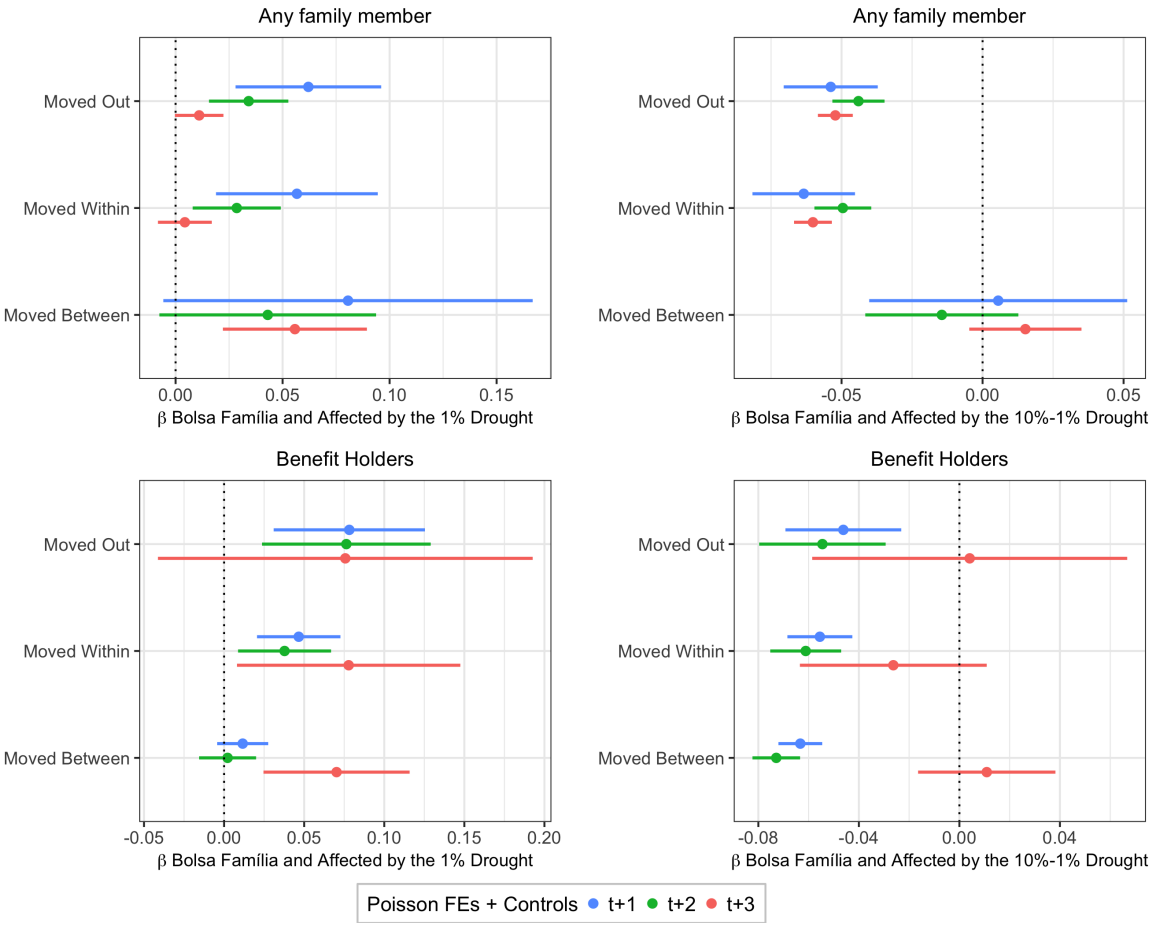
To assess the robustness of the main findings and account for potential issues arising from the binary nature of the migration outcome, we estimated a Poisson panel model with fixed effects. While the primary results rely on linear probability models (LPMs), they may suffer from heteroskedasticity and mis-specification, especially when the probability of the outcome is low.

The Poisson model, although traditionally applied to count data, is a suitable alternative in panel settings when combined with fixed effects, particularly under conditions where the dependent variable is binary but rare.[25] Following the approach of Wooldridge (2010), we estimate a fixed-effects Poisson model with robust standard errors clustered at the individual level to account for serial correlation and unobserved heterogeneity.

The results from the Poisson estimation are consistent with those from the baseline OLS. The interaction between extreme drought exposure and the receipt of social benefits continues to exhibit statistically significant and substantively meaningful effects on migration probabilities, although less precise for migrations between municipalities and among benefit holders. As reported in Figure 3.3, the direction and magnitude of the estimated effects are robust to this alternative specification, reinforcing our central conclusion that conditional cash transfers influence mobility decisions in the aftermath of climate-related shocks.

[25] Overdispersion is a common concern in Poisson models, but as shown in section C.3, the first two moments of our dependent variables are nearly identical and match the Poisson parameter λ, suggesting that the equidispersion assumption holds in our data.

Figure 3.3: Robustness - Poisson Panel Regressions for the main outcomes with Fixed Effects and Time-varying Controls - 2015-2020



Source: Authors with data from the CadÚnico, DAP/PRONAF, and CHIRPS Precipitation. Precipitation in SDs for the Growing Season (Nov to Apr) at the grid level. Poisson panel estimations with fixed effects at the year and individual levels, time-varying controls for individuals, households, municipalities, and places of origin. Coefficient estimated for the effect of being a *Bolsa Família* beneficiary when affected by an extreme drought on the probability of relocation of individuals in vulnerable agricultural-producer families between 2015 and 2020. The columns stand for "Moved Out": addresses with different geographical coordinates between time periods; "Within": different geographical coordinates within a same municipality; and "Between": different geographical coordinates in different municipalities. CIs with 99%.

3.10 Conclusion

This research finds that social policy plays a significant role in shaping the migration decisions of vulnerable agricultural households affected by climate change. Our analysis shows that Conditional Cash Transfer benefits, such as those provided by the *Bolsa Família* Program, affect the likelihood of migration following exposure to climate-related income shocks—specifically, extreme and severe droughts that reduce crop yields. For individuals affected by extreme (1% highest) drought instances, receiving social benefits is associated with an increased probability of migration over the subsequent three years. In contrast, for those exposed to severe droughts (top 10% excluding the top 1%), benefits are associated with a reduced likelihood of migration. These effects apply similarly across all household members, indicating that the influence of social benefits on mobility decisions operates at the household level, rather than being concentrated among specific individuals. The results are robust to alternative model specifications, including a Poisson panel estimation, reinforcing the reliability of the findings.

Our novel methodology allowed us to precisely identify individual migration patterns and exposure to extreme weather events across space and time. We found that 20% of vulnerable individuals migrated at least once between 2015 and 2020. Moreover, migration to nearby areas, within their municipality of origin, are five times greater than long-distance ones, to other municipalities. Those who receive social benefits tend to remain in areas with poorer socioeconomic infrastructure compared to their migrating counterparts.

These results help reconcile existing literature by demonstrating that social benefits—such as Conditional Cash Transfers (CCTs)—can exert both positive and negative effects on individual migration decisions, depending on the nature of the shock and the characteristics of the affected individuals. On one hand, social benefits may facilitate migration by providing the financial means for those who are highly exposed or displaced to relocate. On the other hand, they can help less severely affected individuals absorb

moderate income losses—such as those caused by crop damage—enabling them to remain in place. In this sense, social policy plays a dual role: it can both support household resilience in the face of climate-related shocks and inadvertently discourage migration to areas with greater opportunities for social and economic advancement (Hallegatte et al., 2016).

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Appendix C

Additional Tables and Figures

C.1 Geocoding - Households and Individuals

Table C.1: Geocoded household's addresses in *CadÚnico* between 2012 and 2020 - Total unique households

2012-2020	Total		Urban		Rural	
Households	N	%	N	%	N	%
Processed	221.589.840	100%	172.319.551	100%	48.669.601	100%
Geocoded	220.589.026	99.5%	171.877.924	99.7%	48.166.319	99.0%
Not found	1.000.814	0.5%	441.627	0.3%	503.282	1.0%
Quality of Geocoding						
Street or similar	161.739.074	73%	142.859.622	83%	18.316.102	38%
Street with house number	6.554.705	3%	5.502.506	3%	1.045.837	2%
Public areas	11.822.982	5%	6.303.010	4%	4.905.030	10%
Locality:	40.472.265	18%	16.612.252	10%	23.843.883	50%
Postal Code	2.092.723	1%	1.358.438	1%	731.486	2%
District	9.798.051	4%	6.400.533	4%	3.389.824	7%
Municipality	28.581.491	13%	8.853.281	5%	19.722.573	41%
Correct Municipality	210.649.163	95.5%	166.602.550	96.9%	43.458.847	90.2%

Authors, with household data from the *CadÚnico* for Social Programs from 2012-2020. HERE Platform Geocoding API. The quality analysis conveys the information from the output variable retrieved from the HERE Geocoding algorithm. The groups "Urban" and "Rural" as defined by the CadÚnico variable COD_LOCAL_DOMIC_FAM, which we did not use after finding it not reliable by an analysis in the QGis software.

Table C.2: Geocoded household's addresses in *CadÚnico* between 2012 and 2020 - Total of individuals, household members

2012-2020	Total		Urbano		Rural	
Individuals	N	%	N	%	N	%
Processed	638.010.358	100%	484.152.545	100%	153.231.864	100%
Geocoded	634.905.909	99.5%	483.103.890	99.8%	151.452.791	98.8%
Not found	3.104.449	0.5%	1.048.655	0.2%	1.779.073	1.2%
Quality of Geocoding						
Street of similar	456.334.451	72%	398.679.647	83%	57.069.555	38%
Street with house number	18.916.071	3%	15.570.319	3%	3.338.894	2%
Public areas	35.383.641	6%	19.836.313	4%	15.532.142	10%
Locality:	124.271.746	20%	48.741.482	10%	75.512.200	50%
Postal Code	6.275.820	1%	3.923.428	1%	2.349.246	2%
District	28.871.333	5%	18.149.450	4%	10.713.703	7%
Municipality	89.124.593	14%	26.668.604	6%	62.449.251	41%
Correct Municipality	604.466.704	95.2%	467.200.567	96.7%	136.654.247	90.2%

Authors, with household data from the *CadÚnico* for Social Programs from 2012-2020. HERE Platform Geocoding API. The quality analysis conveys the information from the output variable retrieved from the HERE Geocoding algorithm. The groups "Urban" and "Rural" as defined by the CadÚnico variable COD_LOCAL_DOMIC_FAM, which we did not use after finding it not reliable by an analysis in the QGis software.

C.2 Summary Statistics - *CadÚnico*

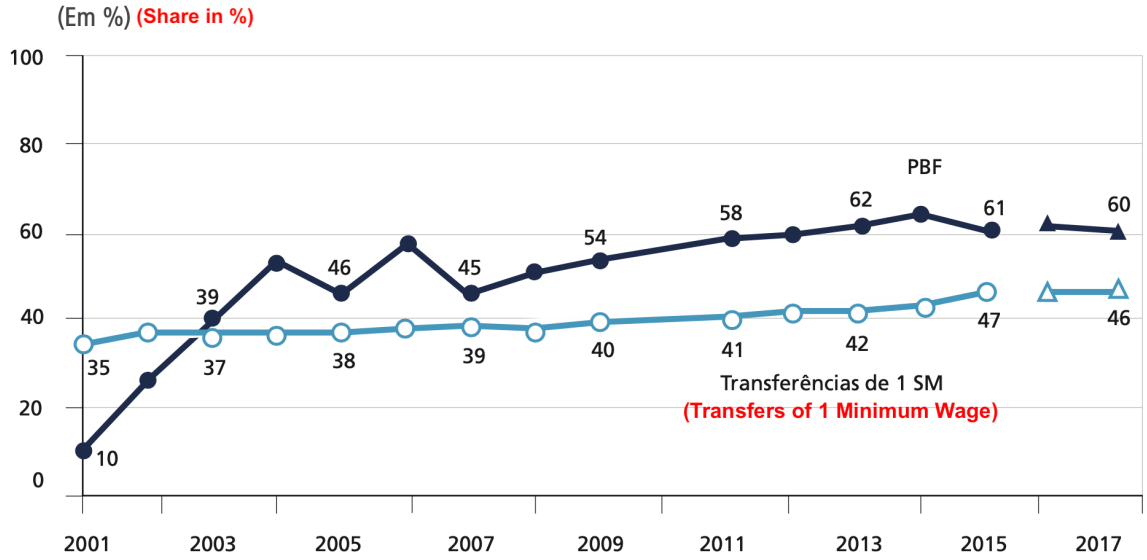
Table C.3: Distribution of households/households according to registration status

households	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2012**
Number of Obs.	53,187,644	48,770,064	44,112,029	40,015,875	37,612,900	35,439,014	32,897,119	30,243,128
	Number of observations per registration status code (cod_est_cadastral_fam)							
in registration	13,663	42,970	53,378	19,001	21,474	30,052	42,670	31,483
without civil registration	951	1,368	2,197	3,200	2,921	2,579	1,915	1,410
registered	28,884,068	26,913,965	26,950,657	26,457,577	27,326,122	29,172,487	27,200,920	25,069,565
excluded	24,288,962	21,811,761	17,105,797	13,536,097	10,262,383	6,233,896	5,651,614	5,140,670

Source: Own elaboration with data from the Unified Registry for Social Programs of the Federal Government and the Payroll of the Bolsa Família Program, from the Ministry of Citizenship/Social Development.

C.3 Poisson Panel Statistics

Figure C.1: Coverage of the Bolsa Família Program (BFP) and transfers equivalent to one minimum wage (Previdência and BPC) among the poorest 20% according to PNAD surveys (2001-2017)



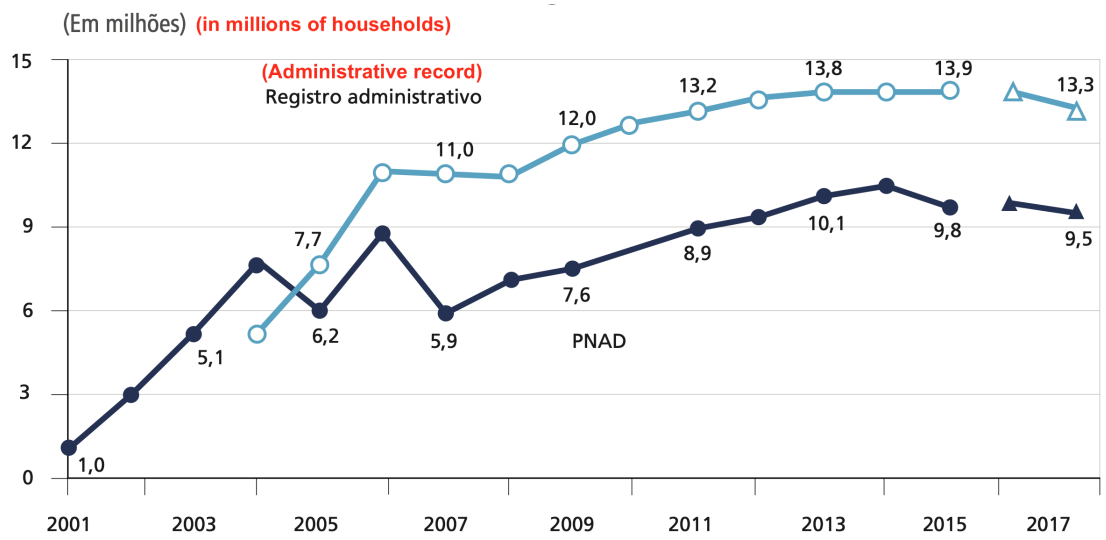
Source: Adapted from (Souza et al., 2019), graph 3, page 15. Created using data from PNAD surveys (2001-2015), Continuous PNAD surveys (2016-2017).
Note: PNAD information includes the predecessor programs of the BFP and excludes rural areas of the Northern states (except Tocantins) until 2003. The population among the poorest 20% was defined based on the net per capita household income of each benefit.

Table C.4: Distribution of individuals according to registration status

Individuals	2019	2018	2017	2016	2015	2014	2013	2012
Number of Observations	175,995,622	165,016,862	153,645,158	143,935,709	136,994,748	130,429,631	123,179,294	115,543,894
	Number of observations per registration status code (cod_est_cadastral_memb)							
in registration	21,344	57,641	70,109	28,182	39,751	41,850	64,146	44,659
without civil registration	8,997	11,678	18,794	26,150	31,310	30,985	23,474	13,384
registered	76,415,223	73,570,482	76,464,300	77,829,966	80,793,612	88,181,943	84,291,806	81,296,980
excluded	99,118,459	90,957,954	76,731,894	66,002,780	55,969,699	41,979,054	37,949,178	34,083,210
awaiting NIS attribution	2,141	64,957	75,444	48,630	56,600	38,418	19,617	9,425
awaiting characterization change	0	0	0	0	103,775	157,376	768,224	66,185

Source: Own elaboration with data from the Unified Registry for Social Programs of the Federal Government and the Payroll of the Bolsa Família Program, from the Ministry of Citizenship/Social Development.

Figure C.2: Households benefiting from the BFP in administrative records and PNAD surveys (2001-2017)



Source: Adapted from (Souza et al., 2019), graph 1, page 11. Created using data from PNAD surveys (2001-2015), Continuous PNAD surveys (2016-2017), and data from the Social Information Matrix of the Secretariat for Evaluation and Information Management (SAGI/MCidadania).
Note: PNAD information includes the predecessor programs of the BFP and excludes rural areas of the Northern states (except Tocantins) until 2003. Information from administrative records includes only the BFP and refers to September (2001-2015) and June (2016-2017).

Table C.5: First two moments of main dependent variables: Individual migration of vulnerable agricultural producers between t and t+n, panel 2015-2020

Migrated between t and:	t+1			t+1 / t+2			t+1 / t+2 / t+3		
Address changed	Moved Out	Within	Between	Moved Out	Within	Between	Moved Out	Within	Between
				any individual					
Mean	0.0703	0.0587	0.0114	0.1394	0.1181	0.0226	0.1959	0.1684	0.0316
Variance	0.0653	0.0553	0.0113	0.1200	0.1042	0.0221	0.1575	0.1400	0.0306
				benefit holders					
Mean	0.0620	0.0519	0.0101	0.1245	0.1058	0.0200	0.1770	0.1524	0.0280
Variance	0.0581	0.0492	0.0100	0.1090	0.0946	0.0196	0.1457	0.1292	0.0272

Source: Authors, with data from the CadÚnico and DAP/PRONAF. Migration of individuals in vulnerable agricultural-producer families between 2015 and 2020. The columns stand for "Moved Out": addresses with different geographical coordinates between time periods; "Within": different geographical coordinates within a same municipality; and "Between": different geographical coordinates in different municipalities.