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The Heterogeneous Effects by Education of COVID-19 on the Change in Position in the Labor Market: Evidence from Brazil

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There is a lot of beauty in ordinary things — Pam Beesley

Abstract

I analyze the heterogeneous impacts of the COVID-19 pandemic on changes in the position in the labor market by education level and occupational group. I take advantage of the PNAD Contínua, a robust panel from 2012 to 2021 that tracks individuals in up to five consecutive quarters. By distinguishing formal and informal positions, I elaborate transition matrices and multinomial logit regressions to identify the impact of education on the likelihood of rotating to specific labor positions. I find that higher educated individuals are more likely to continue at formal employment and less educated people were more prone to transit to non-employment during the recession. Moreover, there is a decrease in movements towards formality and informality for all educational levels throughout the crisis. The results confirm the importance of, in particular, tertiary education as an attribute that helps ensuring jobs in turbulent economic conditions.

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1 Introduction

Job reallocation is a widely debated theme in economics. Its implications for the labor market dynamics may vary tremendously regarding job stability. Job-to-job changes generally reallocate workers from lower-wage firms to higher-wage firms, and this reallocation grows as the economy grows (Haltiwanger et al., 2015). Additionally, workers may have benefits from fewer reallocations, such as less regular job seeking and an increase in human capital accumulation (Weingarden, 2017). However, important issues may arise from low job-finding rates. Decreasing dynamism could negatively impact endangered groups of workers—those with lower skills, the recurrent unemployed, or young people who may find obstacles in order to enter the labor market (Davis and Haltiwanger, 2014). Furthermore, job reallocation is associated with long-term joblessness (Davis and Haltiwanger, 1992). Therefore, job reallocations can exert a huge influence on the economic future of many people.

This paper aims to investigate in detail the heterogeneous dynamics of turnover and non-employment in the Brazilian labor market in the context of the COVID-19 economic downturn. Specifically, the study highlights the role of educational attainment as a tool to expand or mitigate the flow of changes in the labor position by occupational group. Through a thorough analysis of individuals' movements, it becomes possible to answer questions such as: Does more education imply higher chances of moving towards formality? Where do informal workers transit towards? Are the less educated more likely to rotate to non-employment? In addition, it will be known whether the pandemic affected all educational levels similarly on the likelihood of transit to both formal and informal employment.

A compelling data panel from the first quarter of 2012 to the fourth quarter of 2021 bases my analysis. This tool allows the monitoring of individuals for up to 5 consecutive quarters, which makes it possible to check their employment status before, during, and after the pandemic outbreak. Moreover, this data structure allows us to identify which occupational groups are affected the most by educational level. With that in mind, I disentangle the formal and informal market into four different work positions: private sector, public sector, self-employed, and employer. Including both unemployed and inactive, there are a total of ten positions. Using this framework, I built several transition matrices grouped by educational level in 2019 to understand labor market dynamics before the economic crisis. In addition, I check how the proportion of these positions varies by educational level through 2019 to 2022 and use descriptive statistics to gain an accurate view of each position's main characteristics before 2020. Then, I

reduce the number of positions to three (formal, informal, and non-employed) and expand my analysis by looking at multiple transitions from 2012 to 2021. The purpose behind this decision is to monitor labor market trends over a long period and understand the dimension of the disruption caused by the crisis. Finally, to add more depth to the analysis, I perform multinomial logistic regressions to identify the impact of education on the transition between occupational positions while controlling for other covariates. To my knowledge, no other work provides a more in-depth analysis, whether in terms of (1) the number of positions, (2) transitions based on educational levels, (3) the period covered, and (4) individual variable controls. All this considering the context of the COVID-19 crisis in Brazil.

There are several findings from this study. Firstly, higher educated individuals are more likely to remain at a formal employment even during turbulent economic conditions. Although non-employment movements occur, the formal market still promotes job stability for the most educated. Secondly, there is an explosive rotation of the less educated individuals towards non-employment in the height of the recession. Informal employment is usually a safe option to fired workers in anti-cyclical economic times, specially in Latin America (David and Roldos, 2020). However, this phenomenon does not happen during the pandemic crisis. Thirdly, the COVID-19 pandemic crisis is a shock that drastically reduces rotations towards formality and informality, regardless of educational level.

This study intends to contribute to the literature on how allocative shocks, such as the impact of war on demand patterns or the tax changes effects on specific sectors (Ricardo, 1821), contribute to labor market fluctuations and unemployment. Allocative disturbances have a significant impact on unemployment (Davis and Haltiwanger, 1990). Furthermore, allocative disturbances consistently play a commanding role as driving forces on job reallocation (Davis and Haltiwanger, 1999). On top of that, economic recessions are permeated by a rapid rate of job loss (Davis, 1987). In addition, reallocation shocks accounted for a notable increase on both unemployment and fluctuations of unemployment of longer durations (Brainard and Cutler, 1993). The loss of occupation in the pandemic was a widespread event. In Latin America, a survey found that approximately 50% of respondents had a household member who lost a job in the early stages of the pandemic (Bottan et al., 2020). During the COVID-19 crisis, job losses were focused among workers with fewer years of education in many nations (Bottan et al., 2020). The link between education and less job displacement is well-documented, as the job loss rate for college graduates was substantially lower compared to groups with less education (Farber, 2005, 2015). However, there are few attempts to evaluate the causal impact of education on preventing job losses in times of

an economic recession. (Beuermann et al., 2021).

Further, I complement the literature on labor market transitions within the context of an economic recession. Cuesta and Bohorquez (2014) analyze mobility between 2008-2009 in Colombia. They use multinomial logit regressions to predict transitions between inactivity, informality, unemployment, and formality. They find disproportionate movements from formal to informal employment. Karamessini et al. (2016) studies the impact of the 2008 crisis in Europe in terms of transition probabilities of young workers. They find a significant increase in transition to unemployment in several countries during the recession. Gong et al. (2004) focuses on the case of an economic crisis in Mexico in 1994-1995. They also use multinomial logit regressions and find heterogeneous mobility patterns within the labor market. Several papers apply similar methodologies to study the COVID-19 impact on transitions. Adams-Prassl et al. (2020) use data on the US, UK, and Germany and find that women and less educated workers are the most affected by the pandemic crisis. Courseil and Franca (2020) also looks at the impact on young workers in 2020 in Brazil, finding a massive migration to inactivity. Bouvier et al. (2022) analyzes transition probabilities between 2018-2021 in Brazil, highlighting the role of the pandemic in exacerbating gender inequalities. Beccaria et al. (2021) focus on transitions in Latin American countries and find high rotations towards inactivity.

Despite the vast literature on labor market transitions which examines the influence of the pandemic, this study makes contributions on two aspects. On one hand, it highlights in detail the impact of education on the probability of several transitions, considering specific definitions of labor market statuses. On the other hand, it covers a long period (2012 to 2021), which provides an in-depth view of before, during, and after the COVID-19 pandemic.

The rest of the paper is structured as follows. Section II describes Brazil's context. Section III introduces the household survey data which bases the analysis. Section IV presents baseline characteristics from before the emergence of the pandemic. Section V shows imagery analysis regarding the labor market. Section VI details the empirical strategy and presents the regression analysis. Finally, section VII concludes.

2 Context

This section describes the Brazilian context and why it is an interesting setting to understand labor market dynamics during the pandemic. It encompasses a series of characteristics, such as high inequality, exorbitant informality, high job-to-job rotations, and an elevated educational premium in the labor market, which allows a richer analysis before and post-COVID-19.

Brazil has the second highest level of inequality among OECD and partner countries (OECD, 2018). The top 10% income earners receive more than four times as much as the bottom 40% (OECD, 2020b). In 2021, the poverty rate increases by about 6 percentage points, and it is estimated that inequality grew as well, with the Gini Coefficient reaching 0.506 - compared to 0.474 in 2020 (Ibarra et al., 2022). Moreover, the informality rate escalates and almost 40% of householders report that they could not fulfill their basic needs in comparison to before the COVID-19 pandemic (Ibarra et al., 2022).

In Brazil, informality is a key component in the labor market, as nearly half of workers belong to this sector (Menezes-Filho and Scorzafave, 2009). These informal workers not only are more vulnerable in terms of stable employment, but also their poverty levels are four times higher than the national average (OECD, 2020b). Furthermore, informal workers imply no coverage by labor regulations and social security (Ulyssea, 2020) and there is typically higher volatility in earnings (Gomes et al., 2019; Engbom et al., 2022). Earnings changes of workers who transit from formal to informal employment are relatively negative and large in magnitude (Engbom et al., 2022).

Another main characteristic of Brazil is its remarkably high job and worker turnover rates (Gonzaga et al., 2003). During the COVID-19 pandemic peak, the unemployment rate rises gradually to above 14% (Lameiras and Cavalcanti, 2020) and many sectors perform notable adjustments as demand for in-person services drops (Corseuil and Russo, 2020). This substantial increase in job losses is one of the highest compared to other Latin America countries (OECD, 2020a). Moreover, the annual turnover rate at the firm level in Brazil fluctuates near to 50% (da Rocha et al., 2019). Additionally, transitions out of the formal market are consistently and strikingly high, except for workers with intensive use of cognitive skills who experience relatively low probabilities of occupational and sectoral switching (Adamczyk et al., 2022).

High educational levels bring multiple benefits to Brazilian workers. Firstly, more years of education are associated with significantly higher salaries within the Brazilian labor market environment (Menezes-Filho and Kirschbaum, 2019). Moreover, education plays a fundamental role in reducing inequality by alleviating wage differentials (Menezes-Filho and Kirschbaum, 2019). Added to that, workers with more education tend to find better-paid occupations in case of occupational changes, which shows the high educational prize within Brazil (Adamczyk et al., 2022). However, the COVID-19 downturn contributes to a decrease in educational access, since more than 5 million children and adolescents from 6 to 17 years lose access to school by November 2020 (UNICEF, 2021). A Brazilian kid born in 2019 reaches, on average, 60% of their potential human capital (Junior, 2022). On top of that, considering employment rates, Brazilians reach only 38% of their potential human capital (Junior, 2022). In a catastrophic scenario pre-pandemic, one can say that these numbers may worsen after including the pandemic's effects on education. Therefore, human capital downsizing can strongly impact higher labor market inequalities as it affects future work productivity (Junior, 2022).

In light of these features, Brazil offers an opportunity to explore the influence education may have during periods of economic disruption on both formal and informal labor markets.

3 Data

3.1 PNAD Contínua Panel

The PNAD Contínua (*Pesquisa Nacional por Amostra de Domicílios Contínua*) is a quarterly survey produced by IBGE (*Instituto Brasileiro de Geografia e Estatística*) since January 2012. The main purpose of the survey is to provide information regarding Brazilian population fluctuations in the labor force and other socioeconomic indicators. The results produced embark on the national, federation states, metropolitan regions, and capital cities levels. [1]

The interviews follow a rotation pattern of households as a sampling method. Particularly in this rotation scheme, the household is interviewed for one month and exits the sample for the next two months before returning to be surveyed again. This sequence is repeated five times and, then, the household is removed from the sample. Thus, panel data, which includes individual information from up to five consecutive quarters, can be designed. This paper will use data from 2012.1 to 2021.4, allowing us to track individuals over multiple measures of labor market participation before, during, and after the pandemic crisis.

The survey is carried out through a probabilistic sample of households, extracted from a master sample of census tracts, to guarantee the representativeness of the results for the different geographical areas in which the survey is produced. Every quarter, the PNAD Contínua visits around 211.000 households in approximately 16.000 census tracts. The collection of the 16.000 sampling units in a quarter is spread over 12 weeks to maintain balance in the workload. Thus, each week, approximately 1/12 of the sampling units are interviewed.

Beyond the possibility of tracking individuals through time, the PNAD Contínua has the advantage of including information regarding the informal labor market. This allows us to disentangle different work groups into formal and informal categories, expanding the capacity to analyze and understand the dynamics of the Brazilian labor market.

[1] See (IBGE, 2020).

3.2 Definition of Variables

In this section, I give details on the definitions employed in the variable's construction in the study. It involves information on both Brazilian labor market indicators and educational indicators.

The workforce corresponds to people aged 14 and over who were either occupied or unoccupied when interviewed. If the person has worked for at least one hour in a paid or unpaid job helping the family, he is considered to be occupied. On the other hand, if the person had no occupation and took steps to get it within 30 days, he is classified as unoccupied. [2]

The definition of a formal and informal worker varies according to the employment categories. Public and private sector workers with a signed work card are formal. Moreover, self-employed workers, who work alone or with the help of an unpaid worker, are formal if they contribute to social security. Additionally, the employer is considered formal if he has a National Registry of Legal Entities (CNPJ), issued by the Federal Revenue. If workers do not meet these standards in these respective employment categories, they are classified as informal. [3] [4]

Each educational level has a specific categorization. People with zero years of schooling are defined as uneducated and people with one to nine years of schooling belong to primary school. Furthermore, students with ten to twelve years of education are part of the high school. If someone has thirteen to fifteen years, it means that one has an incomplete college. Sixteen years or more represent the completion of tertiary education. To simplify the analysis, I created a new education-related categorical variable that groups educational levels: if someone is uneducated or has an incomplete primary school, the variable value is 1. If one finishes primary school or lacks concluding high school, the variable returns 2. If a student ends high school or does not complete college, the variable assumes 3. Finally, if one has a college degree, the variable returns 4. Therefore, this educational variable is the variable of interest in both the descriptive and regression analysis of this study.

[2] People temporarily away from work are considered to be occupied. In addition, unoccupied also include people who took action before the 30-day reference period and would start their job within four months.

[3] CNPJ serves to identify the business in the most diverse types of activities, such as issuing invoices or paying taxes.

[4] Some labor rights guaranteed by a signed work card are: 13th salary, paid vacations, and maternity license.

3.3 Matching Algorithm Method

In the PNAD, to have greater security in the quarterly comparisons of results on the labor market, the same informants should be interviewed over time. However, the PNAD follows a panel rotation scheme, which means that households enter the sample for one month and leave the sample for the following two months, with this sequence being repeated five times. Despite that, IBGE does not generate a code that makes it possible to accurately identify the same individual in different periods. Therefore, there is a need for a matching algorithm to precisely recognize these individuals.

The matching algorithm is a process of searching for the same person interviewed in a previous position in the database, optimizing this search according to the variables that identify this person.

Ribas and Soares (2008) propose two matching methods to overcome the panel building challenge with a different monthly labor force survey (PME), which was later replaced by PNAD. The first approach is the basic strategy, which means that matching is built through time-fixed physical characteristics such as sex and birth data. Adding to that, some authors use household conditions as pairing criteria.

However, this basic method is not an optimal solution due to a considerable number of observations that become lost. This is because, firstly, these characteristics are sensitive to changes in time, as people are born, die, or move and, consequently, change the household composition. Furthermore, they do not add much rigor to the pairing, since, except for twins, it is very difficult to find people with the same date of birth in the same household. Secondly, there might be cases in which the households interviewed in a period become non-existent or are closed or the inhabitants themselves refuse to give a new interview. Therefore, household pairing can be imperfect. Thirdly, interviewers and respondents may make mistakes in filling out the survey, which allows the possibility of inconsistencies. Fourthly, this lack of consistency may cause selection sample issues, as less educated individuals can be recurrently discarded from the panel, which compromises the sample representativeness for Brazil.

The second approach is an advanced matching methodology. Designing a more advanced matching algorithm is important to eliminate as much as possible errors declared in the sample, but with due precautions to avoid pairing different people. This algorithm, available in the Data Zoom Stata package, uses criteria not only of accuracy in the identification variables but also of proximity in the responses. The advanced matching strategy has several differences in comparison to the basic method. First of all, a new

variable measuring estimated age is created, which is a variable calculated from the difference between the person's birth date and the interview date. In case the birth date is unknown, the interviewer asks what age the informant assumes this person is. As it is a variable that requires less rigor in its precision, the probability of error in the presumed age is lower than in the date of birth. Next, this advanced method manages to use education level information as a pairing mechanism even in households where individuals have been already identified. Then, more accuracy is achieved in the identification process. Lastly, this strategy allows the possibility of the person having disappeared in some trimesters and appearing in some late quarter. [5]

[5] Data Zoom is an initiative developed by the Economics Department of the Pontifical Catholic University of Rio de Janeiro, which aims to provide free access to databases through the use of packages offered in Stata and R. The objective is to make the data extraction process easier and speed up research by leaving the databases properly cleaned to be used in the best possible way.

4 Descriptive Statistics

In this section, I present some descriptive information on the Brazilian labor market in 2019 on Table 1. In particular, I am interested in observing the disparities between formal and informal workers regarding quantity, education, and earnings. Furthermore, another aspect which I am attentive is the difference between people in and out of the labor force.

The choice of analyzing 2019 is due to trying to understand the structure of the labor market before the arrival of the COVID-19 pandemic. In section V, I detail through multiple graphics the changes in the proportion of formal and informal workers after the escalation of the pandemic.

To disaggregate the formal and informal categories to have a better understanding of the labor market, Table 1 is organized through specific formal and informal definition criteria according to each labor position. [1]

The formal market covers 65% of Brazilian workers. Most of this contingent is composed of the private sector, which represents more than 33 million people. Moreover, formal ones are the most educated relative to the informal ones, with all categories with an average of at least 11 years of schooling. In addition, the average monthly income of formal workers is much higher compared to informal workers. A striking fact is the abysmal wage gap between those who are part of the public sector, in which formal workers earn more than twice as much as informal workers. Therefore, one can argue that higher human capital favors formalization, and transitioning to formality is a vital step towards financial stabilization.

The informal market comprises a large portion of the Brazilian labor market. Most of them are self-employed and private sector workers who, together, cover almost 90% of the total informal workers. Besides that, informal ones are always less educated compared to formal workers, which suggests a negative correlation between education and becoming informal. On top of that, being informal, on average, means substantial less monthly income relative to formal categories. For instance, the salary discrepancy between informal and formal employers is shocking, with formal ones earning nearly 60% more. Hence, it is possible to infer that informality is related to less schooling and lower incomes.

[1] The criteria is defined in the section 3.2 - "Definition of Variables"

The inactive represent an astounding 36% of Brazilians. This information shows that there is a high level of unproductivity since there is a significant number of people who are not part of the workforce. Additionally, the average years of education of this segment represents the lowest one, with approximately 8 years of schooling. Consequently, it is indicated that less education jeopardizes the likelihood of becoming employed.

Table 1 – Description of Variables

Variables	Obs	Mean	Sd
Gender			
Female	107 044 501	0.51	
Male	102 432 638	0.49	
Race			
Non-White	119 585 547	0.57	
White	89 891 592	0.43	
In/Out Labor Force			
Workforce	107 099 789	0.64	
Inactive	61 246 227	0.36	
Formal Workers		0.65	
Formal Private Sector	33 344 232		
Formal Public Sector	7 569 277		
Formal Employers	3 465 386		
Formal Self-Employed	6 793 142		
Informal Workers		0.35	
Informal Private Sector	10 759 462		
Informal Public Sector	2 316 973		
Informal Employers	795 689		
Informal Self-Employed	14 980 545		
Years of Education			
Inactive		7.86	4.54
Formal Private Sector		11.62	3.35
Informal Private Sector		9.93	4.06
Formal Public Sector		14.0	2.96
Informal Public Sector		12.98	3.50
Formal Employers		12.81	3.39
Informal Employers		9.95	4.38
Formal Self-Employed		10.98	4.02
Informal Self-Employed		9.13	4.28
Monthly Labor Earnings			
Formal Private Sector		2332.31	2934.94
Informal Private Sector		1423.76	2647.42
Formal Public Sector		4353.52	5004.34
Informal Public Sector		1944.32	2659.90
Formal Employers		6142.47	9845.29
Informal Employers		3636.39	7735.10
Formal Self-Employed		2637.53	4129.58
Informal Self-Employed		1283.79	1819.85

Data Source: PNAD Contínua 2019

5 Descriptive Analysis

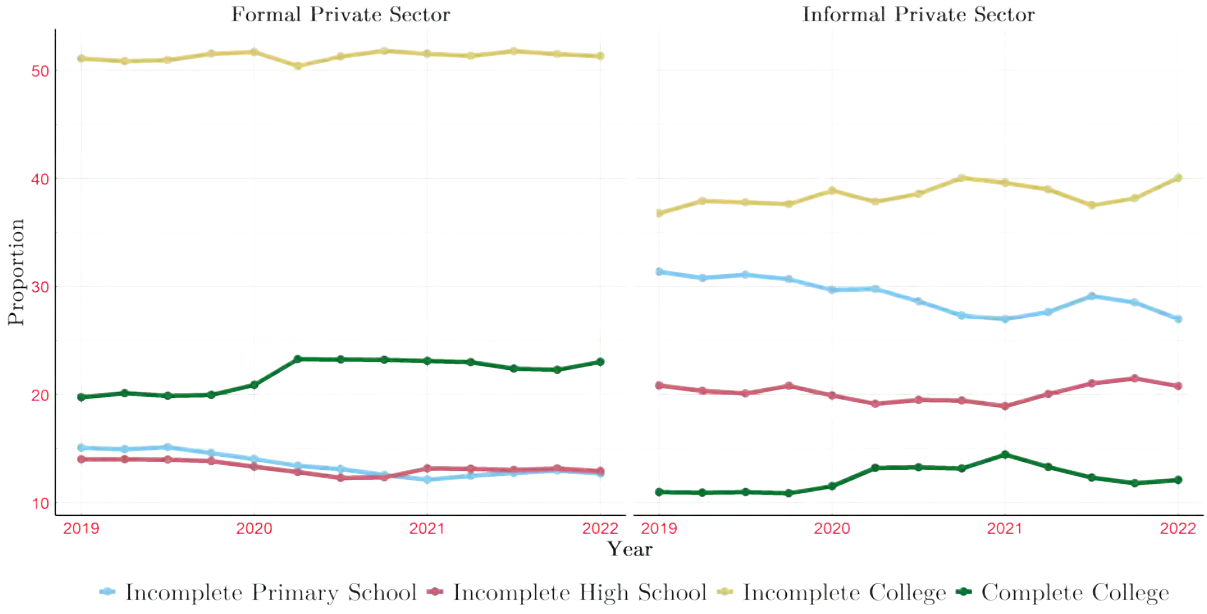
5.1 Evolution of Occupation Position by Education

In this section, I display some graphics about how the proportion between formal and informal workers changes throughout 2019-2022.1 by accounting their educational level. The separation of formal and informal workers uses the same pattern shown on Table 1. In addition to that, I look at the proportion variation among inactive and unemployed throughout that same period. The reason to investigate before and after the pandemic is to get a better sense of the role played by education with regard to the position in the labor market in times of a recessionary shock. Higher educated individuals are expected to account for the majority in formal employment and to be outnumbered on both unemployed and inactive.

Figure 1 exhibits the private sector. Before 2020, workers who completed high school account for about 50% of the total. By 2022, this number practically stays the same, whereas lower-educated ones decreases from 15% to 12%. Education, therefore, appears to be a relevant factor in contributing to social security and ensuring future retirement perks.

Individuals without a high school diploma account for nearly 40% of the informal market total, while college graduates are scarce. At the beginning of the pandemic, there is a drop in the ratio at the lowest educational levels, followed by a slight recovery towards the end of 2020. Once again, individuals with a college degree are less likely to be informal in comparison to the other educational levels.

Figure 1 – Education Level of Private Sector Workers in 2019-2022

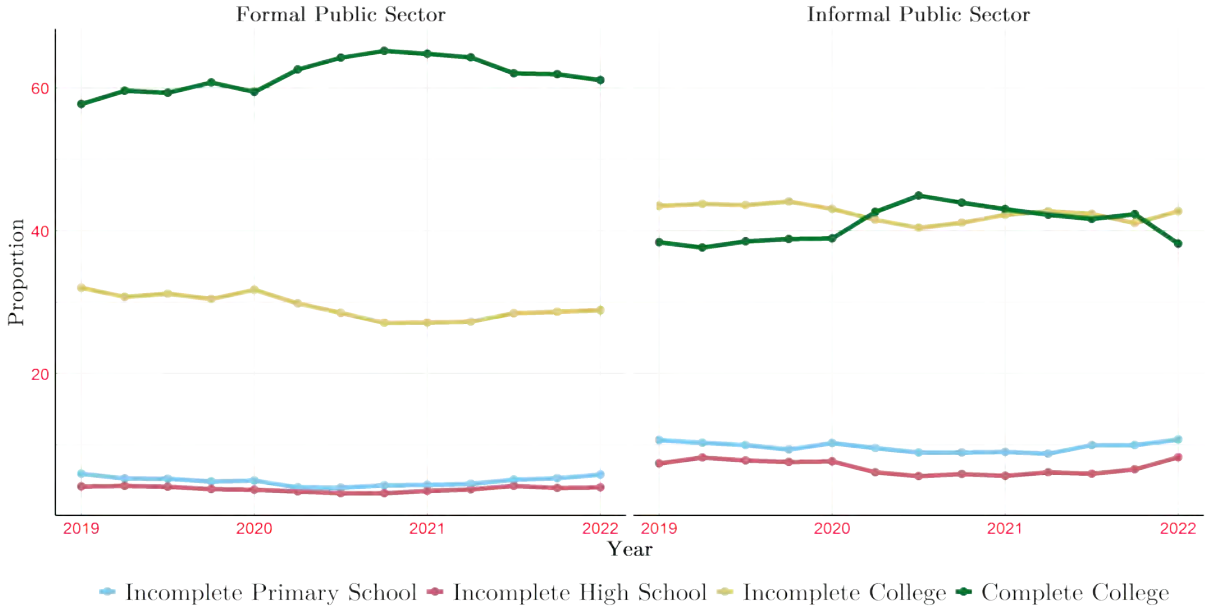


Source: author elaboration based on household surveys.

Figure 2 highlights the public sector. Formality is marked by an abyssal disparity between workers who have completed tertiary education and the others. While the first consists of about 60% of the total formal workers, the second added together form a little less than 40%. One curious fact is that, throughout the most turbulent period of the economic recession in 2020, formal jobs in the public sector are increasing only for the college complete level. Therefore, it is possible to infer that advancing to superior educational tiers is a crucial step towards acquiring job stability within the formal public sector, even in difficult economic times.

The informal market follows a similar path. Higher educated individuals are also the majority, as well as lower-educated are outnumbered. The educational factor being similar in both formal and informal markets might be a sign of a high appreciation of education on the part of the public sector. Furthermore, it may indicate that the sector is highly competitive as there is a massive difference in the proportions of more and less educated people.

Figure 2 – Education Level of Public Sector Workers in 2019-2022

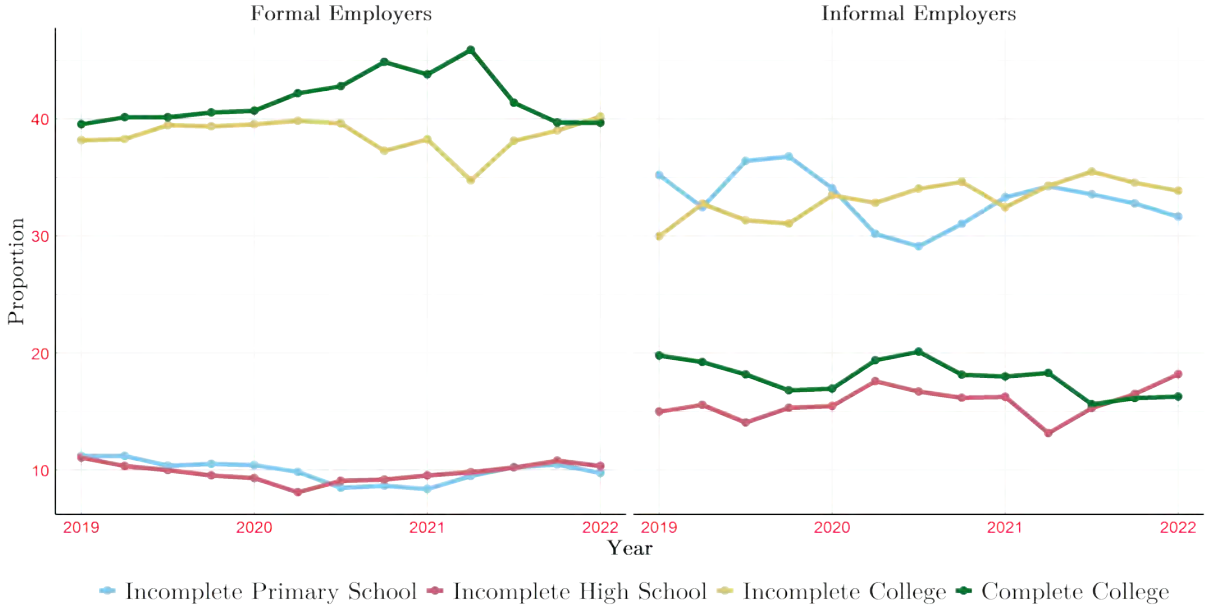


Source: author elaboration based on household surveys.

Figure 3 shows the employers. Once again, there exists an overwhelming difference between employers with higher education levels in comparison to others when it comes to formalization. In 2019, about 70% of the total number of representatives, nearly seven times more than students, who do not complete primary school. With the emergence of the pandemic, the proportions declines for all groups, except the ones with complete tertiary education.

Meanwhile, incomplete primary and college workers compose the majority of the informal market. While the first group experiences a decrease in the proportion during the pandemic, the second increases compared to 2019. This reinforces that education is an important attribute to be an employer. The reduction in the number of less educated informal employers may be related to the closing of several companies due to the COVID-19 economic crisis.

Figure 3 – Education Level of Employers in 2019-2022

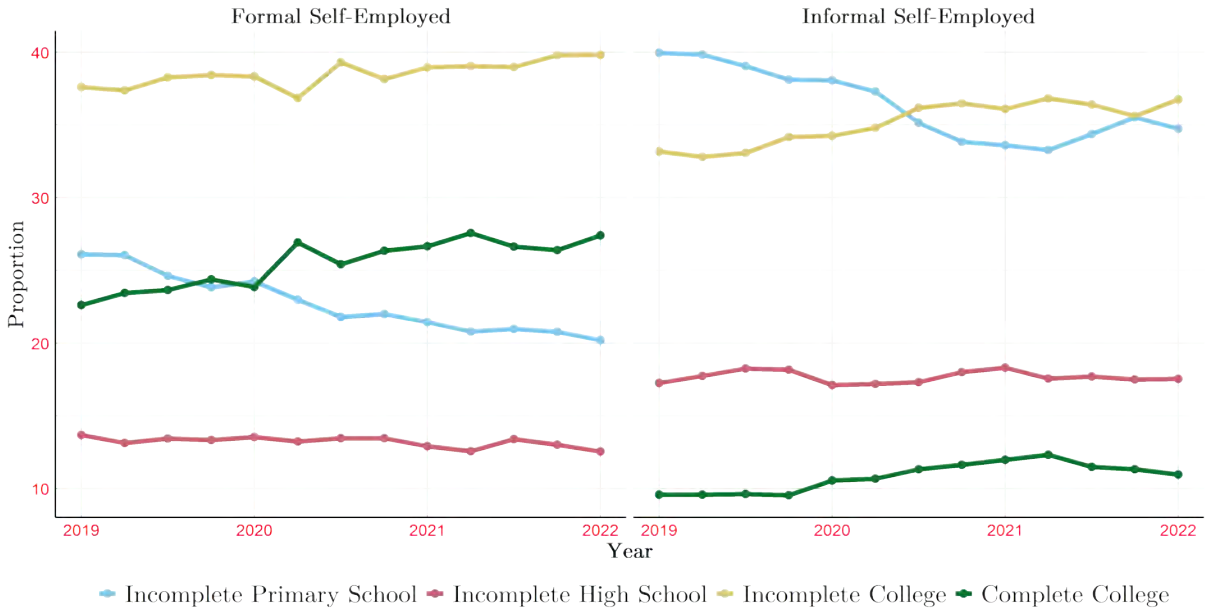


Source: author elaboration based on household surveys.

Figure 4 illustrates the self-employed. More educated individuals dominate the formal market. Even at the height of the crisis, workers with high school represent 35% of the formal private sector. This percentage rises to nearly 40% by 2022.1. On the other hand, less educated workers remain at a constant rate of 15% of the total.

On the other hand, workers without a primary school are the largest share on the informal market, with approximately 40%. On the contrary, workers who finishes college make up only 5% of the total. While the ratio of the less educated workers declines during the most critical moment of the recession, the ratio of higher educated workers increases. Therefore, the ones most affected by the crisis are the least educated.

Figure 4 – Education Level of Self-Employed Workers in 2019-2022

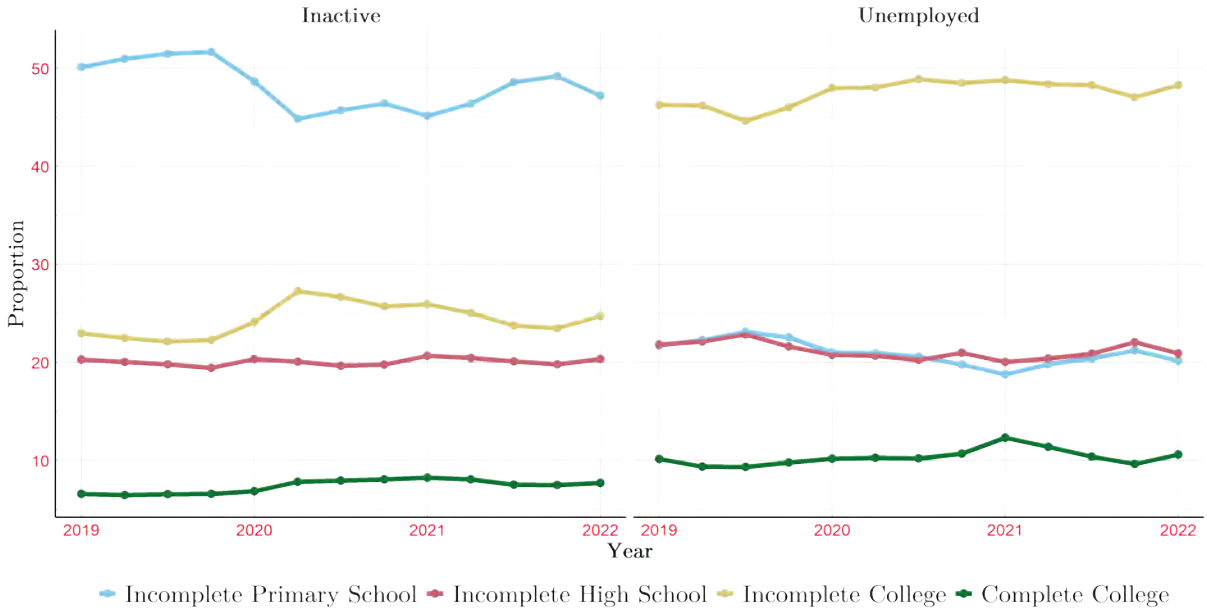


Source: author elaboration based on household surveys.

Figure 5 details both inactive and unemployed individuals. Inactivity is highly correlated with education level. People who have not completed primary and secondary education represent nearly 70% of that total. This shows how those with fewer years of schooling face more difficulties to enter the workforce on both prior and post-pandemic.

The unemployed, on the other hand, have different characteristics. Firstly, individuals who have not completed college are the ones with the highest proportion of unemployment, with approximately 45%. During the economic downturn, it increases to almost 50%. Secondly, individuals with a college degree represent 10% of the total. This highlights that unemployment is characterized by high heterogeneity within the educational levels.

Figure 5 – Education Level of Inactive and Unemployed in 2019-2022



Source: author elaboration based on household surveys.

The graphs show that higher levels of education favors formality and reduces the likelihood of leaving the labor market, even in a recessive economic period. On the contrary, less levels of education favors informality and increases the chances of non-employment, as crisis affects these groups more intensely. Hence, moving forward into a new educational tier appears to be highly relevant when it comes to securing jobs with more worker benefits.

5.2 Transition Matrices by Occupational Position in 2019

In this section, I look more deeply into labor market transitions throughout 2019. The aim is to get a more accurate perspective on where the worker was moving to. Looking specifically at the year before the economic crisis, one gains an understanding of how the labor market behaves before a downturn. Therefore, answers to key questions may be reached, such as: Does being a formal worker guarantee more job stability? Was there a lot of transition from informality to formality? Where do informal workers usually transit to?

For a more detailed examination, I build several occupational transition matrices in 10x10 format. They display the conditional probability P_{ij} of having an individual in position j in the following quarter, given that the same individual was in position i in the previous quarter.

$$P\left(X_{t+1} = j \mid X_t = i\right) \tag{5.1}$$

The final result of the matrix is already the weighted average by the quarters. The analyzed positions are the same as specified in Table 1. I began, initially, inquiring about the transitions without looking directly at any educational level division. After gaining more insight into the overall picture, I turn to exploring the transitions grouped by four educational levels. More educated individuals are expected to have a higher rate of participation in the formal market and a lower rate of inactivity. On the contrary, less educated people are expected to outnumber more educated people in the formal market while making up the majority in the informal market. Therefore, one may be able to detect the influence education has in terms of helping to define labor positions.

Table 2 shows the generalized transition data. Firstly, it is possible to note that the formal market is characterized by being highly stable. Formal workers from the public and public sector have almost 88% of chance to stay in their current position on the next quarter. On the other hand, formal self-employed and formal employers are less likely to hold their current employment status, with 60% and 74% of chance respectively. This matrix corroborates previous research findings on the large proportion of formal workers who maintain their work status in comparison to informal workers (Maurizio and Monsalvo, 2021). Therefore, in general, formality reduces the likelihood of transitioning to informality or non-employment.

The informal market, however, is marked by a lot of turnover, especially towards the inactive group. While public sector and self-employed workers are more likely to persist in their jobs with approximately 60% chance, employers and private sector workers are less stable. They have, respectively, 55% and 36% chance to remain where they are. On

top of that, informal workers are much more likely to transit towards inactivity. Self-employed individuals, for instance, have a nearly 11% possibility of becoming inactive. Thus, informality is positively associated with instability and favors transitions out of the labor market.

As for unemployment and inactivity, the fact that many people rotate from unemployment to inactivity stands out. About 30% of individuals are likely to move from unemployment to inactive. This represents an astronomical loss of both productivity and use of human capital in the labor market. Additionally, inactive people face difficulties to moving into the labor market, given that 88% of them tend to remain in their current status. Hence, the pre-pandemic scenario is delicate and alarming.

Table 2 – Transition Matrix in 2019 (%)

		Subsequent Quarter								
Current Quarter	Inactive	Unemployed	Formal Private Sector Employee	Informal Private Sector Employee	Formal Self-Employed	Informal Self-Employed	Formal Employer	Informal Employer	Formal Public Sector	Informal Public Sector
Inactive	**88.8**	5.2	1.2	1.3	0.5	2.4	0.09	0.07	0.2	0.2
Unemployed	29.2	**50.1**	7.3	6.2	0.9	5.4	0.1	0.09	0.2	0.5
Formal Private Sector Employee	1.5	3.0	**87.9**	4.2	0.6	1.1	0.3	0.04	1.1	0.2
Informal Private Sector Employee	9.6	8.9	10.7	**55.2**	3.0	9.4	1.1	0.4	0.6	1.1
Formal Self-Employed	3.9	1.6	2.7	4.7	**60.5**	20.1	4.6	1.3	0.3	0.2
Informal Self-Employed	10.6	5.3	2.5	6.7	9.3	**62.8**	1.1	1.3	0.2	0.2
Formal Employer	1.5	0.4	3.4	3.2	8.8	4.5	**74.1**	3.6	0.2	0.1
Informal Employer	4.9	1.6	1.8	5.9	9.8	23.0	15.6	**36.9**	0.4	0.08
Formal Public Sector	1.0	0.5	5.0	0.8	0.3	0.3	0.1	0.04	**87.2**	4.7
Informal Public Sector	6.8	5.0	2.7	4.4	0.8	1.8	0.2	0.08	14.9	**63.3**

Table 3 shows transitions now grouped by individuals without a complete primary school. To begin with, the rates of maintenance in formality drop for all positions compared to Table 2. The public sector and employers have a significant reduction in the chance of permanence, with 81% and 66% respectively. Contrastingly, private sector and self-employed workers had a slighter decline, with 87% and 58% probability of continuing in the position they were in. Consequently, it is clear that a low educational level impairs the stability of workers in formal employment.

The informal market follows the exact opposite path to the formal one. Percentages of persistence in informality grows for most positions. The most notable growth is that of self-employed, which is now 65%. This is an important indicator that less educated individuals struggle more to move up the job ladder and, for that reason, confirms preceding research from (Maloney, 2004). In addition, there is a substantial increase in the ratio of informal workers transitioning to inactivity. Private sector and self-employed workers are 11% and almost 14% likely to switch to the inactive, respectively.

For the unemployed group, there are two intriguing facts. Firstly, there is a decrease in the unemployment rate compared to Table 2, with a new value of 40%. Secondly, however, there has been an increase in the rotation of the unemployed towards informal jobs, which do not guarantee labor benefits. For example, the rate of unemployed people moving to be a informal self-employed increases to almost 10%, which is nearly double what it is in Table 2. Therefore, informality expands considerably among less educated groups even before the onset of the economic recession. In addition, the proportion of people which stays inactive increases to nearly 93%, a rise compared to Table 2. Thus, lower-educated individuals are more likely to remain inactive.

Table 3 – Transition Matrix - Incomplete Primary School in 2019 (%)

	Subsequent Quarter									
Current Quarter	Inactive	Unemployed	Formal Private Sector Employee	Informal Private Sector Employee	Formal Self-Employed	Informal Self-Employed	Formal Employer	Informal Employer	Formal Public Sector	Informal Public Sector
Inactive	**92.9**	2.9	0.3	1.1	0.3	2.3	0.03	0.06	0.03	0.05
Unemployed	34.2	**40.4**	4.8	9.1	1.0	9.9	0.04	0.1	0.08	0.3
Formal Private Sector Employee	3.1	2.5	**87.5**	3.9	0.6	1.6	0.2	0.05	0.4	0.1
Informal Private Sector Employee	11.6	7.4	8.2	**56.4**	2.1	12.9	0.3	0.5	0.1	0.5
Formal Self-Employed	7.2	1.6	1.5	3.7	**58.4**	23.3	2.6	1.5	0.1	0.1
Informal Self-Employed	13.8	4.1	1.5	6.7	6.8	**65.0**	0.5	1.4	0.05	0.1
Formal Employer	2.2	0.6	2.5	2.9	11.3	8.2	**66.2**	6.0	0.07	0.0
Informal Employer	7.9	1.6	0.9	5.8	9.6	30.4	8.3	**35.3**	0.07	0.07
Formal Public Sector	3.5	0.4	6.5	0.9	0.3	0.9	0.06	0.07	**81.2**	6.1
Informal Public Sector	5.9	2.9	3.2	5.9	0.7	4.0	0.0	0.04	11.4	**65.9**

Table 4 explores the transitions of individuals who have not completed high school. First, there are changes in the formal market compared to Table 3. Employment retention rates for the private and public sectors show a minor setback, at 87% and 80% respectively. In contrast, employers and self-employed grow in proportion to 71% and 59% correspondingly. One can argue that achieving higher levels of education can spur more independent work like entrepreneurship and self-employment. The most impactful changes, however, take place within the informal market.

The upgrade in years of schooling provided significant drops in informality rates for all positions in relation to Table 3. The decline was more pronounced in the public and private sectors, with a 61% and 55% chance of remaining in the same position as in the previous quarter, respectively. On the other hand, employers and self-employed have their proportions little changed, with 34% and 64%. Moreover, there is an increase in informal-to-formal movements. For example, the proportions of workers who leaves the informality of the public sector and self-employment towards the corresponding formal market are much higher than in Table 3. These results confirm previous work from (Romanello and de Oliveira Gonçalves, 2017), who advocates that the level of education is a key characteristic to understanding the exit towards formality.

Inactivity and unemployment have different effects compared to Table 3. On the one hand, there is a reduction to 86% in the probability of remaining inactive. On the other hand, there is an increase to 47% in the chance of remaining unemployed. In addition, fewer people transit from unemployment to inactivity, which could be a sign that more education simplifies finding jobs. Furthermore, transitions from unemployment or the inactive to the formal market increases, especially for the private sector. On that account, education seems to be a powerful tool to ensure formality jobs.

Table 4 – Transition Matrix - Incomplete High School in 2019 (%)

	Subsequent Quarter									
Current Quarter	Inactive	Unemployed	Formal Private Sector Employee	Informal Private Sector Employee	Formal Self-Employed	Informal Self-Employed	Formal Employer	Informal Employer	Formal Public Sector	Informal Public Sector
Inactive	**86.6**	7.9	0.9	1.9	0.3	2.0	0.05	0.04	0.05	0.2
Unemployed	32.4	**47.5**	6.2	7.6	0.5	5.1	0.01	0.1	0.1	0.4
Formal Private Sector Employee	2.9	3.0	**87.0**	4.1	0.5	1.5	0.3	0.06	0.4	0.2
Informal Private Sector Employee	9.8	9.1	12.8	**55.2**	2.2	9.3	0.4	0.4	0.3	0.5
Formal Self-Employed	4.4	1.4	2.8	4.0	**59.3**	23.0	3.7	1.1	0.04	0.2
Informal Self-Employed	10.0	5.4	2.6	7.2	7.9	**64.3**	0.8	1.5	0.08	0.2
Formal Employer	2.2	0.2	2.6	3.1	9.8	6.7	**71.3**	4.0	0.03	0.04
Informal Employer	4.0	1.4	1.9	6.5	11.0	28.1	12.4	**34.2**	0.1	0.2
Formal Public Sector	3.1	0.9	7.4	1.3	0.3	0.8	0.09	0.0	**80.1**	5.9
Informal Public Sector	9.3	4.6	3.5	6.5	0.3	2.0	0.1	0.0	12.6	**61.0**

Table 5 reveals transitions among individuals who have not ended college. In this case, there are substantial changes in the composition of the formal market compared to Table 4. For all formal positions, there is an upgrade in stability from one quarter to another. Employers and public sector workers have retention rates of 73% and 84% respectively, a sign that advancing one educational step has potent effects in terms of leveraging participation in these sectors. Private sector workers and self-employed also experiences growth, but in smaller magnitude. Moreover, impressive changes occurs within the informal market.

The levels of maintenance in informality drop for most positions, with the exception of the public sector, which shows growth, relative to Table 4. Self-employed and private sector workers now account for 63% and 53% respectively. Furthermore, transitions from informal to formal jobs have become more frequent compared to individuals without a high school diploma. For example, the rate of informal employers who became formal employers rises to almost 19%, while informal self-employed people migrates more to the private sector, with a rate of approximately 4%. These results confirm previous findings that more education is correlated with more rotations from informality to the formal market (Filho and de Moura, 2012).

As in the previous table, two opposing effects take place with the inactive and the unemployed. On the one hand, the proportion of people who remain inactive drops significantly to 81%. On the other hand, the rate of people who remain unemployed in the following quarter rises again, this time to 53%. On top of that, more people moved from inactivity and unemployment towards formal jobs, especially in the private sector. This is yet another sign of how education is highly valued in the job market.

Table 5 – Transition Matrix - Incomplete College Degree in 2019 (%)

		Subsequent Quarter								
Current Quarter	Inactive	Unemployed	Formal Private Sector Employee	Informal Private Sector Employee	Formal Self-Employed	Informal Self-Employed	Formal Employer	Informal Employer	Formal Public Sector	Informal Public Sector
Inactive	**81.2**	10.0	1.7	2.2	0.6	3.1	0.2	0.06	0.2	0.6
Unemployed	22.7	**53.8**	9.9	6.5	0.7	4.9	0.08	0.09	0.3	1.0
Formal Private Sector Employee	2.4	2.9	**88.7**	3.0	0.5	1.0	0.3	0.04	1.0	0.1
Informal Private Sector Employee	6.9	7.9	17.1	**53.4**	3.1	7.9	1.2	0.4	0.6	1.4
Formal Self-Employed	3.8	1.4	3.4	4.6	**61.5**	18.7	5.1	0.9	0.3	0.2
Informal Self-Employed	8.3	5.2	3.5	6.2	10.9	**63.0**	1.3	1.1	0.2	0.3
Formal Employer	1.9	0.4	3.5	3.2	9.1	4.5	**73.7**	3.5	0.1	0.1
Informal Employer	4.3	1.1	2.3	4.8	11.2	23.0	18.8	**34.2**	0.2	0.05
Formal Public Sector	1.7	0.7	6.4	0.9	0.2	0.4	0.07	0.05	**84.3**	5.2
Informal Public Sector	6.9	4.8	3.2	6.2	0.4	1.4	0.1	0.04	12.6	**64.2**

Table 6 exhibits transitions of individuals who have completed tertiary education. In this group, the proportions of people who remain in their formal positions are the highest compared to all the matrices analyzed previously. Nearly 90% of public and private sector workers remain in the same place, while nearly 78% of employers secure their job status. It is an overwhelming growth that demonstrates the high Brazilian educational premium. These results corroborate previous findings that workers who have more education are more likely to be part of the formal category (Maurizio and Monsalvo, 2021).

Regarding the informal sector, there was a decrease in retention rates, with considerable reductions in the private sector and for the self-employed, which now have rates of 51% and 57%. Furthermore, there was a significant shift from informality to formality. An illustrative case is that of informal workers in the private sector who had an 8% turnover rate for self-employment. Therefore, people who have completed university education are more inclined to belong to formality and less prone to be informal.

Inactivity have its maintenance ratio increased to 86%, while the proportion of unemployed had a slight drop to 52%. The pattern of the previous table regarding the greater transitivity of these two positions towards formality is maintained. Moreover, there is a massive reduction in the probability of people moving out of unemployment towards inactivity, to 20%. For this reason, achieving a higher educational level ensures better odds of moving into the labor market.

After analyzing the transition matrices of occupational positions by education, it becomes clear that educational attainment is relevant. It generates more stability in formal jobs, less propensity to belong to informality and makes it easier to get out of unemployment. On top of that, there is a clear appreciation of education by the market, given that more competitive sectors such as the private and public are populated in greater numbers by individuals who have had more access to education. It can be seen that, even before the economic recession of 2020, the Brazilian labor market is characterized by a lot of turnover between sectors. The next objective is to understand how the large-scale and unexpected economic shock of COVID-19 impacted transitions according to different educational levels.

Table 6 – Transition Matrix - Complete College in 2019 (%)

		Subsequent Quarter								
Current Quarter	Inactive	Unemployed	Formal Private Sector Employee	Informal Private Sector Employee	Formal Self-Employed	Informal Self-Employed	Formal Employer	Informal Employer	Formal Public Sector	Informal Public Sector
Inactive	**86.4**	6.0	1.4	0.9	1.0	2.2	0.4	0.1	0.8	0.8
Unemployed	20.2	**52.2**	9.7	5.2	2.7	5.5	0.5	0.04	1.3	2.6
Formal Private Sector Employee	1.5	1.8	**88.8**	2.6	0.8	0.8	0.7	0.04	2.5	0.4
Informal Private Sector Employee	3.0	3.8	16.5	**50.8**	8.2	7.6	4.8	0.9	2.3	2.2
Formal Self-Employed	2.6	2.1	4.0	5.5	**61.6**	15.7	6.2	1.0	0.8	0.5
Informal Self-Employed	7.0	3.7	3.5	5.0	18.1	**57.6**	2.7	0.9	0.8	0.7
Formal Employer	1.7	0.3	3.1	3.6	7.9	2.5	**77.8**	2.4	0.5	0.2
Informal Employer	3.0	0.8	1.8	3.4	12.5	11.3	25.0	**39.4**	1.9	0.8
Formal Public Sector	1.3	0.3	3.5	0.6	0.3	0.2	0.1	0.05	**89.6**	4.0
Informal Public Sector	4.4	2.6	3.1	2.9	0.8	1.1	0.4	0.06	20.2	**64.4**

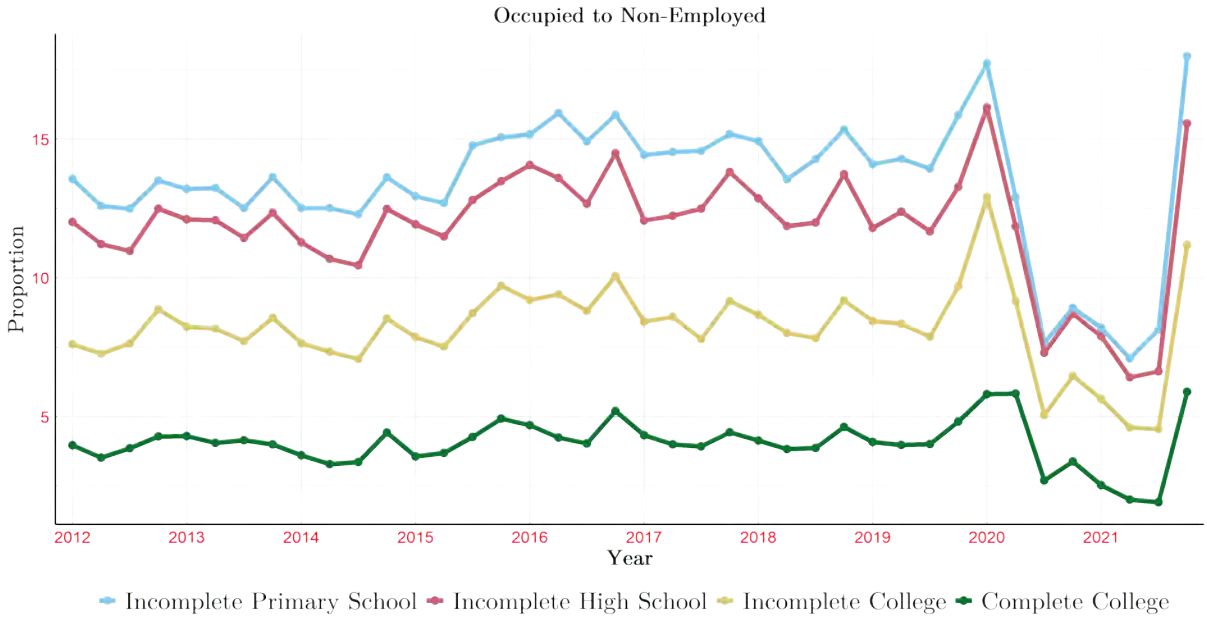
5.3 Transitions Between Occupational Positions by Educational Levels from 2012 to 2021

In this section, I present the results of 3x3 transition matrices in multiple graphs by the four educational levels from 2012.1 to 2021.4. To facilitate the visualization, I aggregate all the formal and informal positions to form a single group composed of the formal ones and a single group formed by the informal ones. Furthermore, I aggregate the inactive and unemployed into a group called "Non-Employed". The timeline allows for an expanded view of the dynamics of the labor market in periods before and after the arrival of the pandemic. With that in mind, one can gain a confirmation of the magnitude that the pandemic crisis affects the transition patterns of the Brazilian labor market. In addition, one can also gain more sense of the role played by education in maintaining employment in an economic recession. On one hand, the pandemic is expected to have harmed less educated workers the most, increasing both the level of informality and the level of non-employment. On the other hand, it can be assumed that more educated workers moved less towards both informality and non-employment even during the recessionary shock. The first graph contemplates the transitions of the employed, without distinction between formal and informal, towards non-employment, while the subsequent graphs contain the separation between formal and informal.

Figure 6 shows the trimester-by-trimester probability of transitioning from occupied to non-employment. Between 2012-2019, less educated groups have a non-employment transition rate that fluctuated around 15%. The severe economic crisis of COVID-19 changes the scenario. The probability of rotation between quarter 2019.4 to quarter 2020.1, which is the beginning of the pandemic, increases to around 16%. At the most severe moment of the pandemic, between the 2020.1-2020.2 quarters, the chances of transition rises even higher to approximately 18%. After this time interval, the transitions begin to fall. However, in 2021.4 the high rates of transitivity returns again to the pandemic peak level. Therefore, the economic crisis not only increases movements towards non-employment, but also primarily affects less educated individuals.

On the other hand, more educated individuals, especially those who completed university, transit with less intensity. This group, until 2019, have turnover rates that remain close to 5%. During the quarters from 2019.4 to 2020.3, the rates reach and then surpass 5%. After this period, the levels fall again and only return to the growth trajectory in 2021.4. Then, education seems to matter deeply when it comes to avoiding job loss.

Figure 6 – Probability of Transition from Occupied to Non-Employed

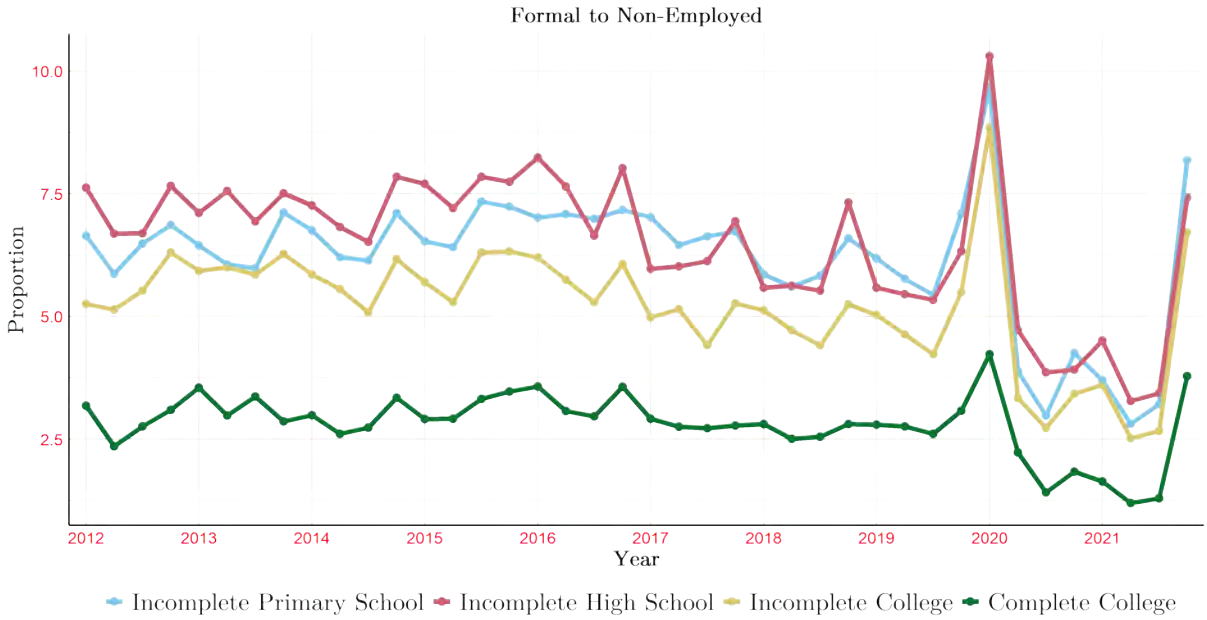


Source: author elaboration based on household surveys.

Figure 7 exposes the likelihood of rotating from the formal market towards non-employment. Until 2019, individuals belonging to the two lowest educational levels have displacement rates close to 7.5%. At the height of the pandemic, between 2020.1-2020.2, turnover rates reaches 10%. Additionally, people who did not complete high school are also hit hard, as the transition rate jumps from 5% between 2019.4-2020.1 to 9% between 2020.1-2020.2. Rates starts to fall after that break, returning to grow at an alarming rate in 2021.4. Consequently, it is noted that the educational range has a shocking impact on the probability of transition in times of extreme economic downturn.

With regard to individuals with a university degree, the probability of continuing in the formal market is astonishingly higher. Before the economic shock, their turnover rates ranges around 2.5% and grow to 4% between 2020.1-2020.2. Transition rates drop shortly after this period. That is, completing tertiary education substantially helps to maintain job stability even in drastic times of the economy.

Figure 7 – Probability of Transition from Formal to Non-Employed

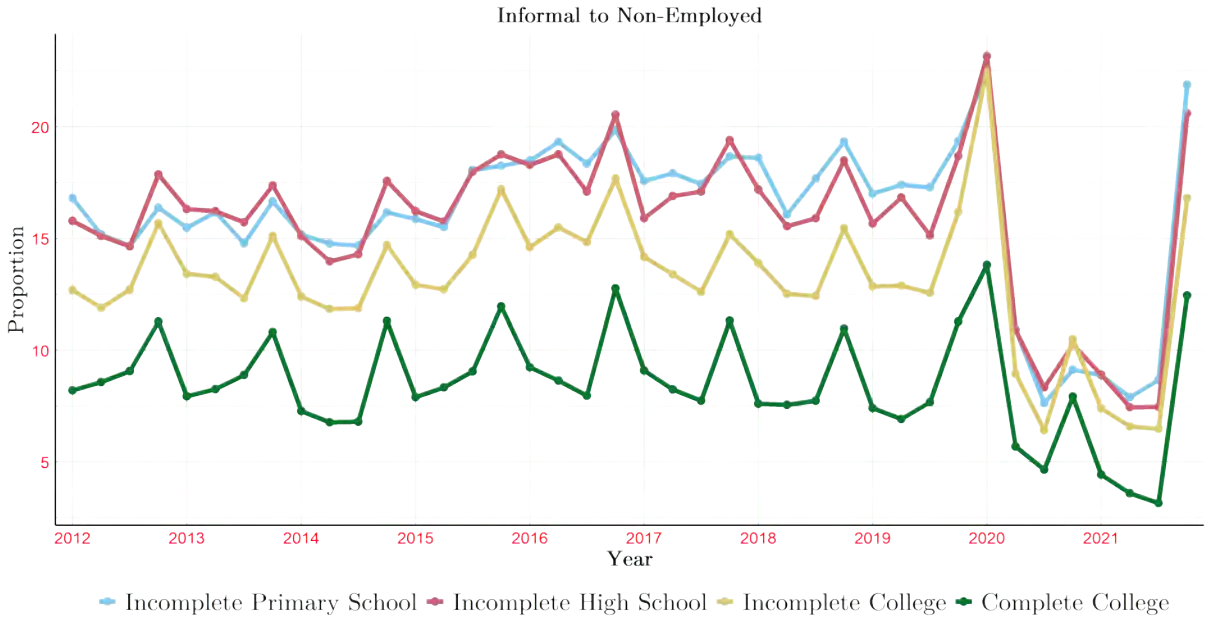


Source: author elaboration based on household surveys.

Figure 8 reveals the probability of moving from the informal market towards non-employment. Firstly, it is noted that informality is associated with greater volatility even in stabilized economic situations, as transitions follow an up-and-down pattern. Rotation rates of the fewer educated varies around 15% until 2019. During 2020.1-2020.2, these rates escalates to over an impressive 20% ratio. Adding to that, incomplete college individuals also suffers a massive impact, as moving rates goes from 13% to around 20% at the beginning of the pandemic. As expected, a higher education level is correlated with less likelihood of leaving to non-employment even in a recession.

On the other hand, people who have completed college are less hit by the economic crisis. Prior 2020, transitions rates are consistently fluctuating around 8% and, by 2020, it reaches the peak of 13%. Thus, recession affects the chances of moving to non-employment, but on a much smaller scale. On one side, completing college is a comparative advantage for workers. On the other, being informal strikingly increases the risk of transition to non-employment compared to Figure 7.

Figure 8 – Probability of Transition from Informal to Non-Employed

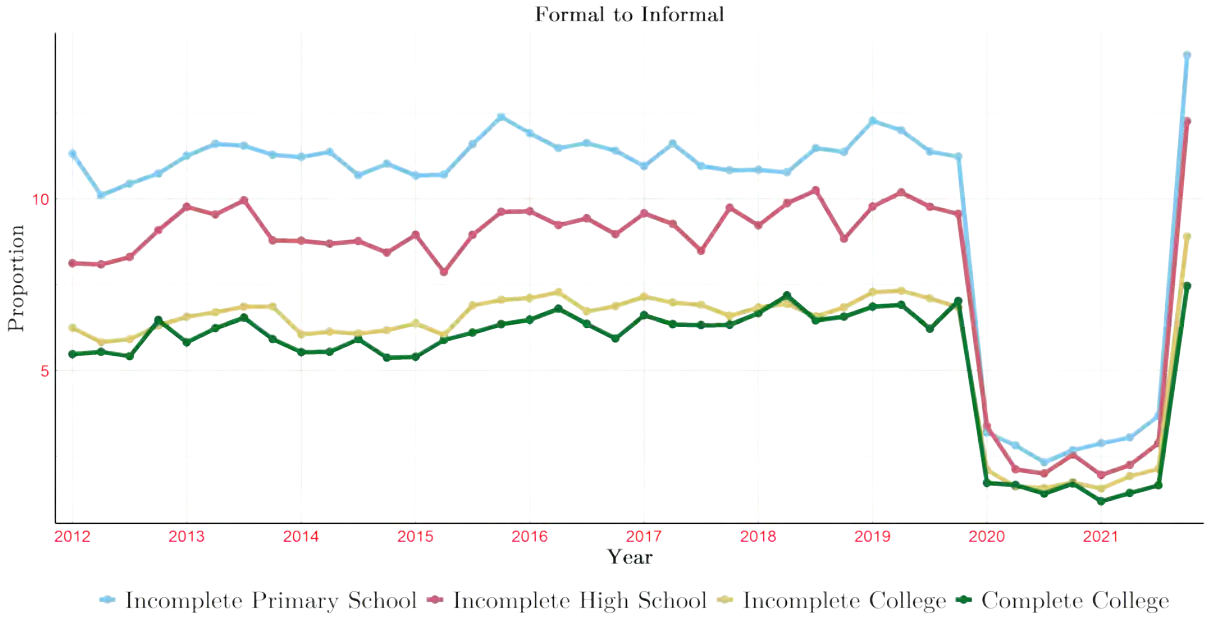


Source: author elaboration based on household surveys.

Figure 9 displays the probability of rotating from formality into informality. It is noted that transitions towards the informal market are high for less educated workers since before the pandemic, at close to 12%. These results support findings from Bosch and Maloney (2010) that low-skilled workers are more likely to transit from formal jobs into informal employment. However, starting in 2020, there is a huge decline in transitivity rates, which reaches nearly 5%. Consequently, formal-to-informal transitions oscillate negatively. The literature documents counter-cyclical behaviors of informality, expanding during contractions and decreasing during booms (Pages and Stampini, 2009; Bosch and Esteban-Pretel, 2012). However, this pattern is not accurate in the Brazilian labor market, as rotations to informality are overshadowed by a large shift from formality towards non-employment (see Figure 7). Hence, informal employment seems to have lost its role as a refuge to laid-off workers in anti-cyclical periods in Latin America, which goes against findings from (Loayza and Rigolini, 2011; David and Toscani, 2021).

Additionally, Workers with more years of schooling are once again the least affected. By 2019, turnover rates are close to 5%, and with the 2020 recession, it goes to less than 2.5%. Therefore, having a university degree is a factor that prevents workers from moving to the informal market.

Figure 9 – Probability of Transition from Formal to Informal

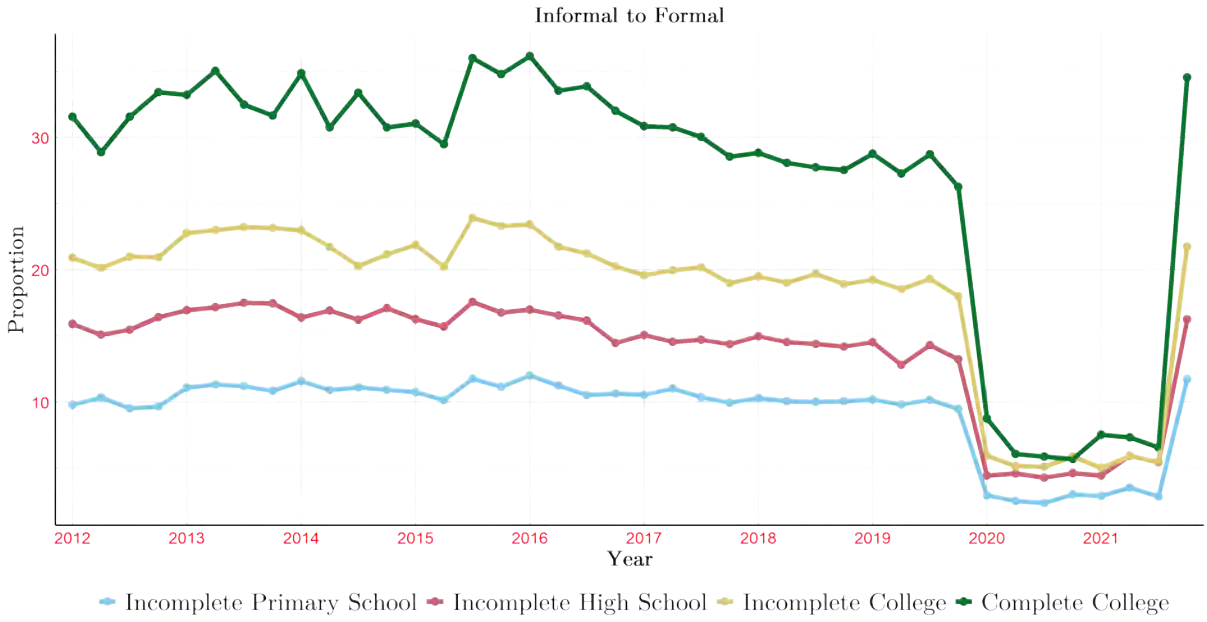


Source: author elaboration based on household surveys.

Figure 10 exhibits the likelihood of moving of informality towards formality. Workers with less education, once again, have greater difficulties in reaching the formal market. Just before 2020, turnover ratios are almost always at close to 10% and, after the onset of the economic crisis, drop to nearly 7%. The results of Figure 8 prove that most transitions are towards non-employment, and not formality. The most astonishing results, however, relate to the group that completes tertiary education.

The turnover level of workers who complete college is astronomical. Most of the time, transition rates hover around 30%, which is stratospheric. One could argue that increasing one's educational level, particularly a university education, is an important differentiator in securing a formal job. On the other hand, during the 2020.1-2020.2 quarters, there is a massive reduction in the turnover rate to close to 10%. This reinforces the pro-cyclical functioning of the formal market in Brazil, growing during booms and declining during downturns (Bosch and Maloney, 2008).

Figure 10 – Probability of Transition from Informal to Formal



Source: author elaboration based on household surveys.

Overall, there is a positive correlation between higher education levels and ensuring a job within the formal market even during economic disruptions. Added to that, higher educated individuals are less prone to moving towards non-employment, which highlights the powerful role that education plays in generating job stability. Furthermore, it clarifies that the COVID-19 economic recession acts as a transforming agent of the transition patterns of the Brazilian labor market.

6 Empirical Analysis

6.1 Empirical Strategy

The main objective of this study is to test whether educational levels affect the probability of individuals staying or moving from their current job positions in the subsequent quarter. Specifically, I seek to analyze (1) the effect of education on the change in position in the labor market over time and (2) if education influences these changes in position within the context of a downturn such as the COVID-19 pandemic. Resorting to econometrics provides an opportunity to control for observable confounding factors and to have a more in-depth assessment. I do not pretend to detect causality on the probability of transition.

As the dependent variable is categorical with six possible transitions, I resort to using the multinomial logit regression model in order to have a reliable empirical analysis. More specifically, the dependent variable corresponds to: (1) formal to formal, (2) formal to informal, (3) formal to non-employed, (4) informal to formal, (5) informal to informal, and (6) informal to non-employed. All models covers the period from 2012 to 2021. Therefore, I now turn to my estimation strategy. Formally, I start the analysis by estimating the following model:

$$P\left(y_{it}=0_j\right)=\frac{\exp\left(\mathbf{x}_{it}\beta_j\right)}{1+\sum_{k=2}^{6}\exp\left(\mathbf{x}_{it}\beta_j\right)}, \tag{6.1}$$

where P denotes the probability that individual i in quarter t is in transition to position j, X_{it} is a set of observed variables of individual i in quarter t, and β_j is the coefficient related to educational levels and the j outcome. Hence, the educational variable has a distinct correlation according to the position transition type.

I expect the estimates from (6.1) to produce significant results if education levels in itself matters in the likelihood of securing the job position. However, the answer on whether the impact of education during the coronavirus crisis is substantial is still missing.

Therefore, I refine my baseline analysis by taking into account the interaction between the educational level and the trimester, in order to have more accurate estimates within the specific quarters of the economic crisis.

If education is significant on explaining positions transitions within the recession, I expect more educated individuals to have a higher probability to remain in formality during the pandemic quarters.

For each regression, the computed results are the marginal effects of each educational level. Therefore, the coefficients represent the predicted probability of transition relative to the base group (incomplete primary school).

6.2 Regression Results

6.2.1 Effect of Education on Position Transition

In this section, I report the first results. Specifically, columns (1) to (6) of Table 7 show the results from the estimates of (6.1), in which the dependent variable is the position transition of an individual from one quarter to the subsequent quarter. In this case, the only independent variable is the education level of a person. As expected, people with tertiary education are more likely to remain at formality, as they are 0.749 percentage points more likely to continue in this sector compared to individuals without a complete primary education. Additionally, people who finishes college graduation are less likely to transit towards non-employment, since 0.023 percentage points is the lowest value among all educational levels.

On the other hand, less educated individuals are more prone to stay at informal employment and to become non-employed in comparison to incomplete primary school people. Incomplete high school people are 0.289 percentage points more likely to continue being informal and 0.067 percentage points more probable to leave a informal job towards non-employment.

However, these estimations may be biased due to omitted variables. Including new variables give more credibility to the results, as it helps to eliminate potential over and underestimation of the education level variable. Therefore, I estimate once again (6.1) with more controls. Table 8 reports my findings. Firstly, the inclusion of other covariates does not seem to have a sizable impact on the main coefficient, which reinforces that education is a key factor when it comes to probability of transitioning. Secondly, the addition of the new controls appear to have more effect when dealing with informality. On one hand, complete college people are less likely to move from formal to informal (coeff. 0.046) than other educational levels. On the other hand, more educated individuals are more inclined to leave a informal job towards being formal (coeff. 0.053). These results differ from Table 7, where these coefficients are smaller.

Overall, the results points to the effect of education on position transition: Specifically, more education means (1) more likelihood to remain at a formal job, (2) more probability to leave informality towards formality and (3) less chance to become

non-employed. On the contrary, less education indicates (4) more propensity to stay at informality, (5) higher tendency to leave a formal position to be informal and (6) much more proclivity to transit towards non-employment.

On the next subsection, I propose a new analysis looking directly to the the effect of education during the economic downturn caused by the COVID-19 pandemic.

Table 7 – Regression 1

	(1) Formal to Formal	(2) Formal to Informal	(3) Formal to Non-Employed	(4) Informal to Formal	(5) Informal to Informal	(6) Informal to Non-Employed
Incomplete Primary School	0.379***	0.047***	0.029***	0.053***	0.403***	0.089***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Incomplete High School	0.497***	0.049***	0.040***	0.058***	0.289***	0.067***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Incomplete College	0.643***	0.043***	0.039***	0.049***	0.189***	0.037***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Complete College	0.749***	0.044***	0.023***	0.047***	0.121***	0.016***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
N	5,092,882	5,092,882	5,092,882	5,092,882	5,092,882	5,092,882

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The dependent variable is the position transition. Education levels are the variable of interest. Other controls are not included here. Standard errors are robust.

Table 8 – Regression 2

	(1) Formal to Formal	(2) Formal to Informal	(3) Formal to Non-Employed	(4) Informal to Formal	(5) Informal to Informal	(6) Informal to Non-Employed
Incomplete Primary School	0.459***	0.045***	0.032***	0.049***	0.339***	0.075***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Incomplete High School	0.530***	0.049***	0.037***	0.055***	0.268***	0.060***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Incomplete College	0.615***	0.047***	0.036***	0.053***	0.210***	0.040***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Complete College	0.699***	0.046***	0.029***	0.053***	0.152***	0.021***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
N	5,091,698	5,091,698	5,091,698	5,091,698	5,091,698	5,091,698

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

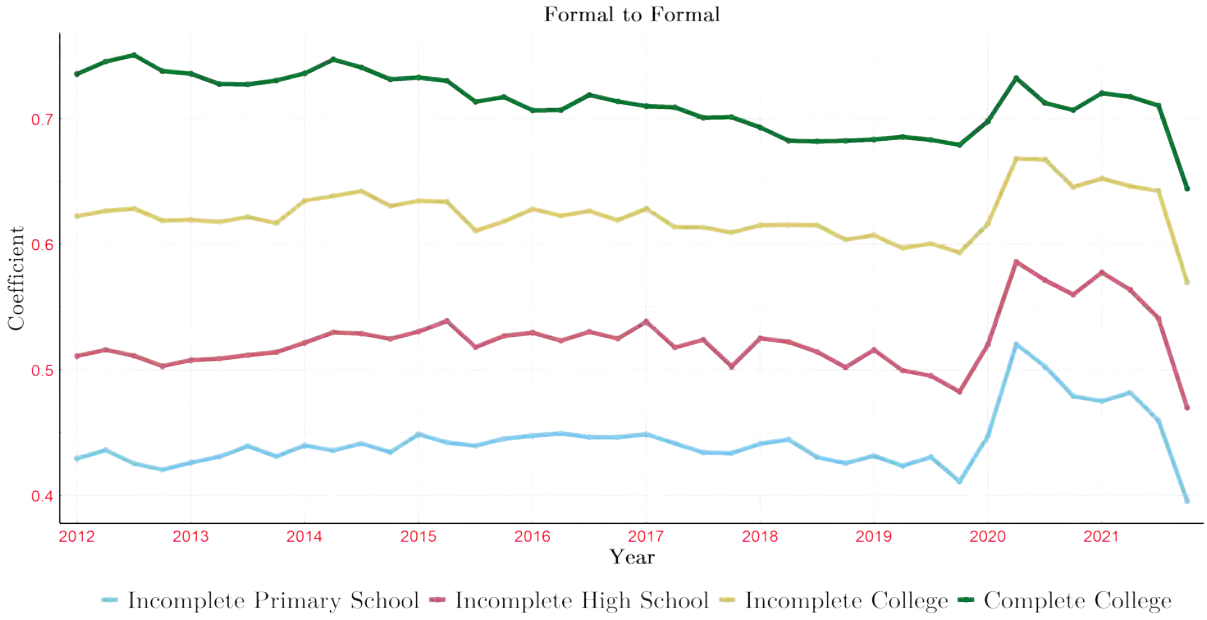
Notes: The dependent variable is the position transition. Education levels are the variable of interest. Other controls included are: gender, race, household location, job experience, age, job sector, job occupation and time-fixed effects. Standard errors are robust.

6.2.2 Effect of Education on Position Transition During the Pandemic

In this section, I report the central results. Although the previous results already point out to the relevance of education in position transition, the purpose of this study is to understand that impact within an economic recessive context. Therefore, I estimate (6.1) again, adding the interaction term between education and the quarter, which informs how education affects position transition throughout the pandemic (2020) most turbulent quarters. [1] The following graphics illustrate a specific position transition and the education coefficient resulted from the regressions. The time interval considered is between 2012 to 2021.

Figure 11 displays the estimations from the formal to formal transition regression. Before 2020, all educational levels follows a similar up-and-down pattern. However, exactly in 2020, there is a shift in the tendency, as the probability of remaining in the formal market increases for all groups. Unsurprisingly, individuals with a college degree have higher probability to secure their formal jobs within the economic disruption (coeff. 0.8) compared to individuals with lower education. These results are an indication that education promotes job stability even in unstable economic conditions and confirms previous findings that formal market is more likely to be composed by workers with more education (Maurizio and Monsalvo, 2021; Gong et al., 2004).

Figure 11 – Formal to Formal Transition Regression

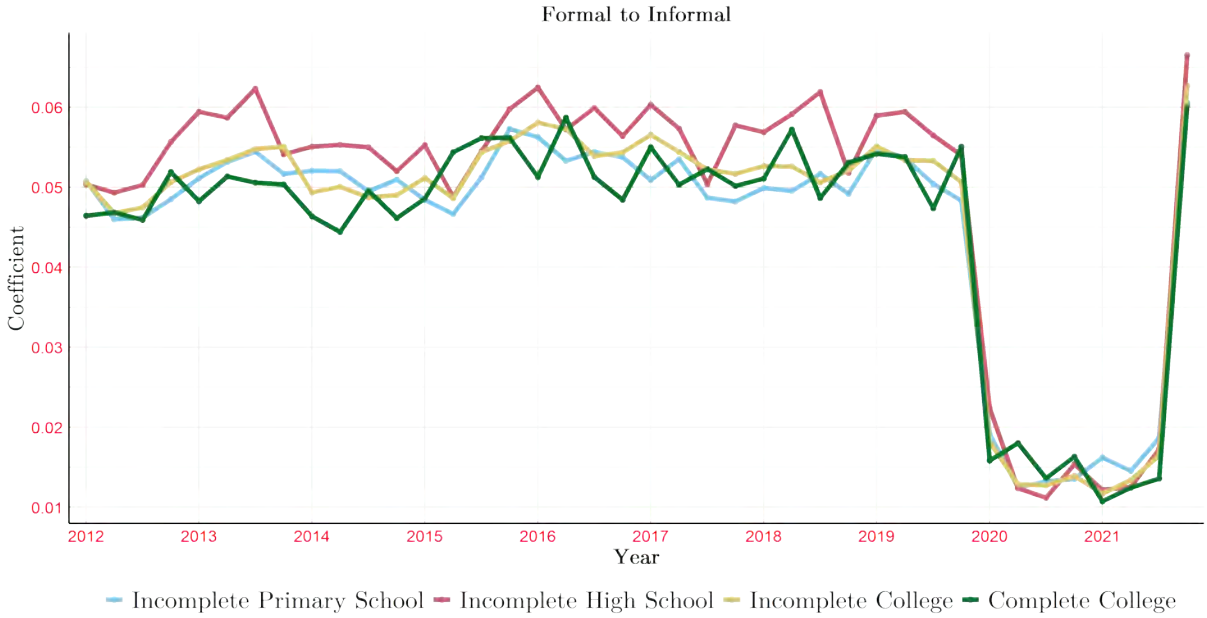


Source: author elaboration based on household surveys.

[1] The marginal effect of a interaction term does not exist. Therefore, I perform a loop that filters the dataframe to a specific quarter and then computes the multinomial logit regression. Since I am dealing with 40 quarters (2012 to 2021), there are 40 regressions. In other words, I chose to run several multinomial logit regressions on a cross-section dataframe in order to capture each education coefficient of each quarter. Hence, individual fixed-effects are not necessary.

Figure 12 highlights the estimations from the formal to informal transition regression. The arrival of the economic crisis coincides with a massive breakdown on the likelihood of moving towards informality. While all educational groups faces this decline, the more educated people are the ones with less chance to transit (coeff. 0.15) in comparison to the the lowest educational level. Therefore, it is an indication that more education increases the probability of not leaving formality towards informality during a problematic and unexpected economic period. Additionally, the results corroborate previous research which finds that less educated people are more susceptible to move from formal to informal employment (Bosch and Maloney, 2010).

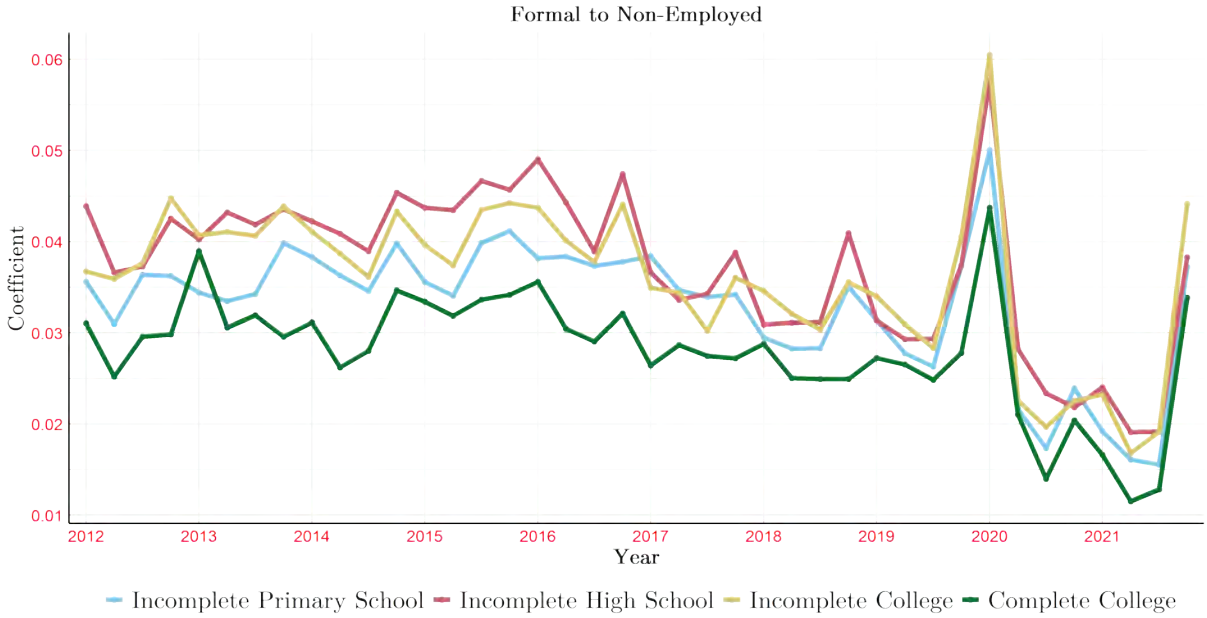
Figure 12 – Formal to Informal Transition Regression



Source: author elaboration based on household surveys.

Figure 13 details the estimations from the formal to non-employed transition regression. Predictably, workers from all educational levels in 2020.1 (beginning of the pandemic) are more likely to become part of the non-employment in 2020.2. Once again, the highest educational level has the smaller likelihood of transitioning (coeff. 0.04) compared to the other educational groups. The results are in line with several previous finding such as: (1) recessions are characterized by rapid job losses (Davis, 1987), (2) unemployment increases during reallocation shocks (Brainard and Cutler, 1993) and (3) college graduates have lower job loss rates than less educated individuals during an economic contraction period (Farber, 2005, 2015).

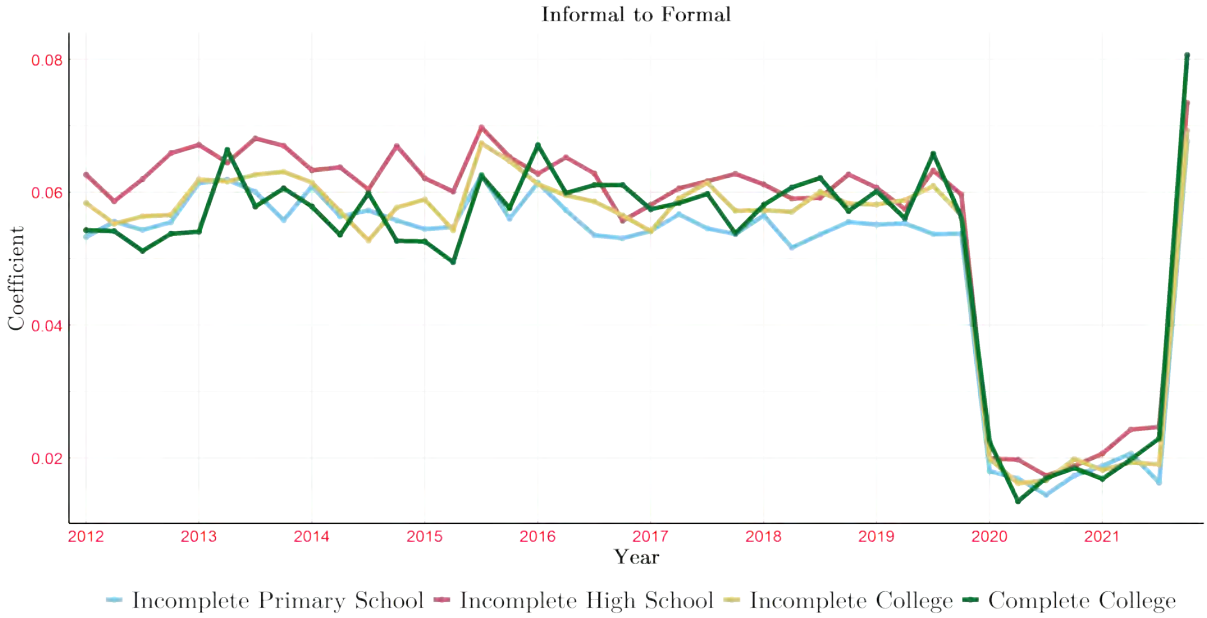
Figure 13 – Formal to Non-Employed Transition Regression



Source: author elaboration based on household surveys.

Figure 14 refers to the informal to formal transition regression. As expected, the 2020.1 and 2020.2 faces an astonishing decline in the probability of moving to formal employment. Although all educational levels follow that pattern, higher educated individuals are more inclined to transit to formality (coeff. 0.02) in comparison to the lowest educational tier. The findings are coherent with previous research such as: (1) less educated workers struggle more to leave informality towards a formal job (Maloney, 2004), (2) more education is positively correlated to more rotations to formal employment (Filho and de Moura, 2012).

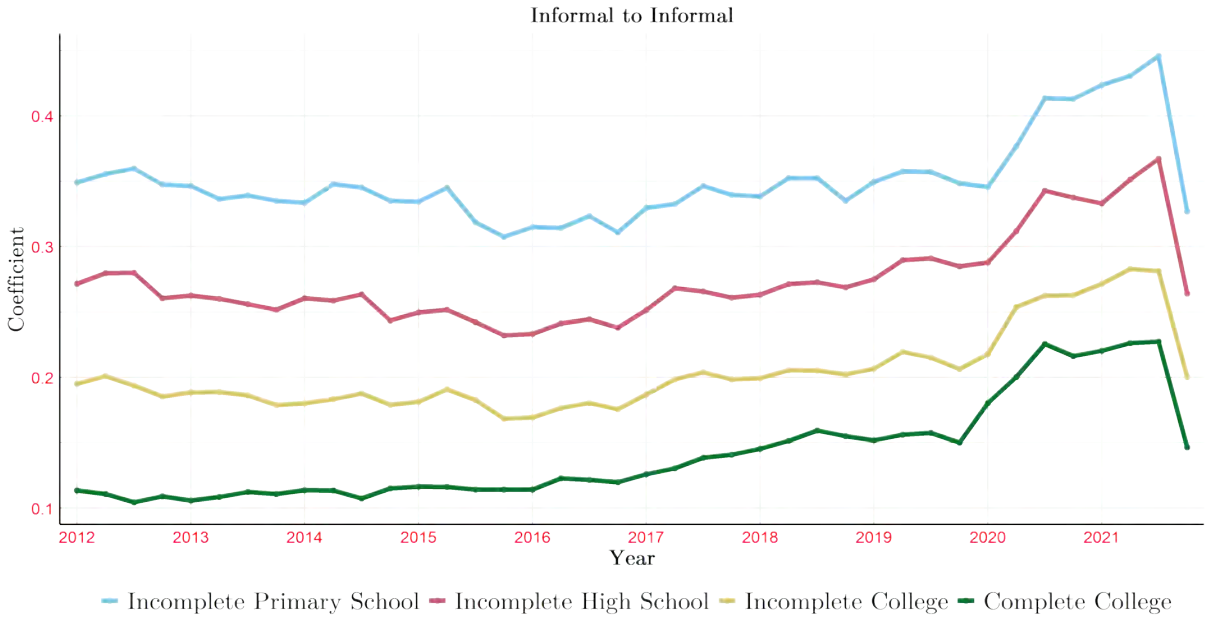
Figure 14 – Informal to Formal Transition Regression



Source: author elaboration based on household surveys.

Figure 15 reports information on the informal to informal transition regression. Prior to the start of the pandemic, the upward trend of maintenance in informality is similar to all workers, regardless of their educational levels. However, by 2020, there is a light increase in the probability of continuing informal. As one could anticipate, higher educated individuals are the less prone to remain informal (coeff. 0.2) when compared to the remainder groups.

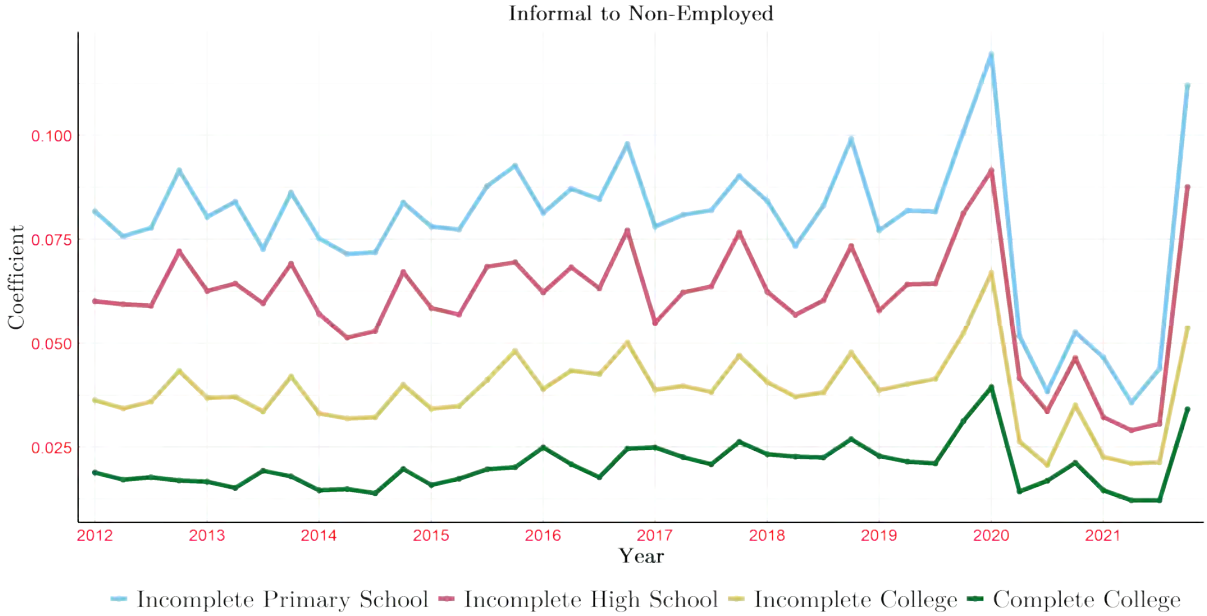
Figure 15 – Informal to Informal Transition Regression



Source: author elaboration based on household surveys.

Figure 16 shows the informal to non-employed transition regression. One can note that, by 2020.1, there is an exorbitant growth in the likelihood of leaving informal employment towards non-employment. Lower educated individuals are the most affected (coeff. 0.13), while higher educated individuals are the least harmed (coeff. 0.04). The results are coherent with previous analysis of the COVID-19 pandemic impact on US and UK, as workers without a college degree are significantly more likely to have lost their jobs (Adams-Prassl et al., 2020).

Figure 16 – Informal to Non-Employed Transition Regression



Source: author elaboration based on household surveys.

7 Conclusion

This paper provides some of the first evidence of the heterogeneous effects of the COVID-19 pandemic on the change in position in the labor market by educational level and occupational group. Using robust panel data from 2012 to 2021, I track individuals in up to five consecutive quarters and disentangle the analysis into three periods: before, during, and after the economic shock. Through a specific description of formal and informal labor positions, I find that individuals with a college degree have a better chance of ensuring formal employment at the peak of the economic breakdown. Furthermore, my analysis shows that less educated people transit more to non-employment amid the crisis, highlighting that the lowest educational levels are the most affected by the downturn. Lastly, the results illustrate a decrease in movements to both formality and informality throughout the pandemic. Hence, informal employment is not a fallback for laid-off workers, as it usually happens in similar economic recessions. From one standpoint, one can suppose that social distancing encourages the interruption of job search. On the other hand, one can assume that uncertain labor market forecasts due to the crisis help to demoralize job-seeking. It is worth underlining the main findings, since these may contribute to significant insights for further public policies. Overall, the study provides one of the first analyses of the relationship between education and labor market transitions during the COVID-19 crisis in Brazil.

This work offers some possibilities for future research. First, one can investigate the gender component in labor market transitions to see whether women are more or less affected than men by educational level during the pandemic. Moreover, this same logic applies to an analysis by race. In addition, exploring other determinants of transitions may be a continuation of this study. Finally, conducting studies in more countries would allow comparing whether the results found in Brazil are an isolated case.

Bibliography

Adamczyk, W., Ehrl, P., and Monasterio, L. (2022). Skills and employment transitions in Brazil. Ilo working papers, ILO.

Adams-Prassl, A., Boneva, T., Golin, M., and Rauh, C. (2020). Inequality in the impact of the coronavirus shock: Evidence from real time surveys. *Journal of Public Economics*, 189:104245.

Beccaria, L., Maurizio, R., Trombetta, M., and Vázquez, G. (2021). Short-term income mobility in Latin America in the 2000s: intensity and characteristics. *Socio-Economic Review*, 20(3):1039–1067.

Beuermann, D., Bottan, N. L., Hoffmann, B., Jackson, C. K., and Vera-Cossio, D. A. (2021). Does Education Prevent Job Loss during Downturns?: Evidence from Exogenous Schools Assignments and COVID-19 in Barbados. IDB Publications (Working Papers) 11608, Inter-American Development Bank.

Bosch, M. and Esteban-Pretel, J. (2012). Job creation and job destruction in the presence of informal markets. *Journal of Development Economics*, 98(2):270–286.

Bosch, M. and Maloney, W. (2008). *Cyclical movements in unemployment and informality in developing countries*. World Bank Publications.

Bosch, M. and Maloney, W. F. (2010). Comparative analysis of labor market dynamics using Markov processes: An application to informality. *Labour Economics*, 17(4):621–631.

Bottan, N., Hoffmann, B., and Vera-Cossio, D. (2020). The unequal impact of the coronavirus pandemic: Evidence from seventeen developing countries. *PLOS ONE*, 15(10):1–10.

Bouvier, M., Roubaud, F., Razafindrakoto, M., and Teixeira, R. (2022). Labour market transitions in the time of covid-19 in brazil:a panel data analysis. Working Papers DT/2022/02, DIAL (Développement, Institutions et Mondialisation).

Brainard, S. L. and Cutler, D. M. (1993). Sectoral Shifts and Cyclical Unemployment Reconsidered*. *The Quarterly Journal of Economics*, 108(1):219–243.

Corseuil and Russo (2020). Análise da evolução recente do emprego setorial. Technical report, IPEA.

Courseil and Franca (2020). Mercado de Trabalho conjuntura e análise . Technical report, IPEA.

Cuesta, J. and Bohorquez, C. (2014). Labor market transitions and social security in Colombia. *Journal of Developing Areas*, 48(3):149–174.

da Rocha, L. P., Pero, V. L., and Corseuil, C. H. (2019). Turnover, learning by doing, and the dynamics of productivity in brazil. *EconomiA*, 20(3):191–210.

David, L. and Toscani (2021). *The Global Informal Economy*, pages 142–163.

David, P. and Roldos (2020). Labor market dynamics, informality and regulations in latin america. *IMF*, page 27.

Davis, S. J. (1987). Allocative Disturbances and Specific Capital in Real Business Cycle Theories. *American Economic Review*, 77(2):326–332.

Davis, S. J. and Haltiwanger, J. (1990). Gross Job Creation and Destruction: Microeconomic Evidence and Macroeconomic Implications. In *NBER Macroeconomics Annual 1990, Volume 5*, NBER Chapters, pages 123–186. National Bureau of Economic Research, Inc.

Davis, S. J. and Haltiwanger, J. (1992). Gross job creation, gross job destruction, and employment reallocation. *The Quarterly Journal of Economics*, 107(3):819–863.

Davis, S. J. and Haltiwanger, J. (1999). On the driving forces behind cyclical movements in employment and job reallocation. *American Economic Review*, 89(5):1234–1258.

Davis, S. J. and Haltiwanger, J. (2014). Labor Market Fluidity and Economic Performance. NBER Working Papers 20479, National Bureau of Economic Research, Inc.

Engbom, N., Gonzaga, G., Moser, C., and Olivieri, R. (2022). Earnings inequality and dynamics in the presence of informality: The case of brazil. Working Paper 29696, National Bureau of Economic Research.

Farber, H. S. (2005). What do we know about job loss in the United States? evidence from the displaced workers survey, 1984-2004. *Economic Perspectives*, 29(Q II):13–28.

Farber, H. S. (2015). Job Loss in the Great Recession and its Aftermath: U.S. Evidence from the Displaced Workers Survey. NBER Working Papers 21216, National Bureau of Economic Research, Inc.

Filho, F. H. B. and de Moura, R. L. (2012). Evolução Recente da Informalidade no Brasil: Uma Analise segundo Características da Oferta e Demanda de Trabalho. Technical report, FGV.

Gomes, D., Santos, C., and Iachan, F. (2019). Labor Earnings Dynamics with a Large Informal Sector. 2019 Meeting Papers 793, Society for Economic Dynamics.

Gong, X., Van Soest, A., and Villagomez, E. (2004). Mobility in the Urban Labor Market: A Panel Data Analysis for Mexico. *Economic Development and Cultural Change*, 53(1):1–36.

Gonzaga, G., Maloney, W. F., and Mizala, A. (2003). Labor turnover and labor legislation in brazil [with comments]. *Economía*, 4(1):165–222.

Haltiwanger, J., Hyatt, H., and McEntarfer, E. (2015). Cyclical Reallocation of Workers Across Employers by Firm Size and Firm Wage. Working Papers 15-13, Center for Economic Studies, U.S. Census Bureau.

Ibarra, G. L., Paffhausen, A. L., Campante, R., Costa, R. D., and Castrillon, C. A. (2022). Brazil Poverty and Equity Assessment : Looking Ahead of Two Crises. Technical report, The World Bank.

IBGE (2020). Pesquisa Nacional por Amostra de Domicílios Contínua Notas técnicas. Technical report, IBGE.

Junior, I. L. (2022). Brazil Human Capital Review : Investing in People - Executive Summary. Technical report, The World Bank.

Karamessini, M., Symeonaki, M., and Stamatopoulou, G. (2016). The role of the economic crisis in determining the degree of early job insecurity in europe, 2016.

Lameiras and Cavalcanti (2020). PNAD COVID-19 – Divulgação de 2/10/2020 – Principais destaques. Technical report, IPEA.

Loayza, N. and Rigolini, J. (2011). Informal employment: Safety net or growth engine? *World Development*, 39(9):1503–1515.

Maloney, W. F. (2004). Informality revisited. *World Development*, 32(7):1159–1178.

Maurizio, R. and Monsalvo, A. P. (2021). Informality, labour transitions, and the livelihoods of workers in Latin America. WIDER Working Paper Series wp-2021-19, World Institute for Development Economic Research (UNU-WIDER).

Menezes-Filho, N. and Kirschbaum, C. (2019). *Education and Inequality in Brazil*, pages 69–88.

Menezes-Filho, N. and Scorzafave, L. (2009). Employment and Inequality of Outcomes in Brazil. Insper working papers, Insper Instituto de Ensino e Pesquisa.

OECD (2018). *Brazil*.

OECD (2020a). Covid-19 in latin america and the caribbean: An overview of government responses to the crisis.

OECD (2020b). *OECD Economic Surveys: Brazil 2020*.

Pages, C. and Stampini, M. (2009). No education, no good jobs? evidence on the relationship between education and labor market segmentation. *Journal of Comparative Economics*, 37(3):387–401.

Ribas, R. P. and Soares, S. S. D. (2008). Sobre o Painel da Pesquisa Mensal de Emprego (PME) do IBGE. Technical report, IPEA.

Ricardo, D. (1821). *On the Principles of Political Economy and Taxation*. McMaster University Archive for the History of Economic Thought, 3 edition.

Romanello, M. and de Oliveira Gonçalves, F. (2017). The transition of worker to formality: evidences from duration analysis. *Economía Sociedad y Territorio*, pages 309–335.

Ulyssea, G. (2020). Informality: Causes and consequences for development. *Annual Review of Economics*, 12(1):525–546.

UNICEF (2021). Out-of-School Children in Brazil. A warning about the impacts of the COVID-19 pandemic on Education. Technical report, UNICEF.

Weingarden, A. E. (2017). Job Reallocation and Unemployment in Equilibrium. FEDS Notes 2017-04-20-2, Board of Governors of the Federal Reserve System (U.S.).