

# The Labor Market in the Post-Pandemic: Reflections on Occupational Dynamics from the longitudinal analysis of individuals

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*Summary* The study analyzes the occupational dynamics in Brazil before, during, and after the COVID-19 pandemic, using longitudinal data from the Continuous PNAD. The results indicate that the pandemic has increased vulnerabilities, affecting more the informal workers, women, young people, the elderly, and people with less schooling. Although the initial shock was severe, the labor market showed recovery in the post-pandemic period, returning to pre-crisis levels of stability. The analysis highlights the importance of schooling and formalization for resilience in employment and points to the need for public policies that protect the most vulnerable workers, promoting inclusion and stability.

## Introduction

The transformations in the Brazilian labor market in recent decades have been marked by significant structural changes, many of which have been accentuated by the COVID-19 pandemic. The global health crisis has intensified pre-existing weaknesses in the labor market, such as informality and the vulnerability of certain occupational groups. The effect was particularly severe among informal workers, women, young people, and individuals with less schooling, who faced greater risks of job loss and difficulties in reintegrating into the labor market.

Recent studies show that the pandemic has exacerbated already existing inequalities in several labor markets around the world (Albanesi and Kim, 2021; Blundell et al., 2020). In the Brazilian case, it is important to consider the vulnerabilities that affect workers from specific demographic groups, such as women and informal workers, especially in times of crisis. The increase in informality and the difficulty in adapting certain sectors to remote work are related to the increase in turnover and unemployment (Béland et al., 2020). However, even before the pandemic, the labor market was already facing challenges related to automation, globalization, and occupational polarization, as highlighted by (Autor, 2019).

This study aims to analyze the occupational dynamics in Brazil, with emphasis on the post-pandemic period, and to provide a detailed understanding of the factors that influence the permanence or loss of employment in different segments of the population. Using data from the Continuous National Household Sample Survey (PNADC), both in its quarterly

and annual versions, this paper examines how the type of occupation, skin color/race, sex, age group, and level of education affect the probability of remaining in or leaving the labor market.

In addition, the study employs a survival model (Cox, 1972) to assess the probabilities of occupational loss over time, controlling for demographic and occupational factors. This approach makes it possible to identify which groups have been most affected by the crisis and which characteristics are associated with greater resilience in the occupation, offering a solid basis for the formulation of targeted public policies.

The post-pandemic scenario requires a careful analysis of the occupational inequalities that persist in Brazil and the new dynamics that have emerged in the labor market. This study aims to contribute to this debate by highlighting the need for interventions that reduce disparities in access to and maintenance of occupation, especially for the most vulnerable workers.

## Database

This study uses data from the Continuous National Household Sample Survey (PNADC), both in its quarterly and annual versions. The quarterly editions of the PNADC in the period from 2017 to the first quarter of 2024 were analyzed, complemented by data from the 5th visit of the annual PNADC for the years 2018 to 2022.

The PNADC is a highly relevant survey for monitoring labor market conditions in Brazil. Through it, detailed information is collected on unoccupancy rates, occupancy levels, informality, among other socioeconomic variables. The collection is carried out through interviews in households selected through probabilistic sampling, with the objective of covering the entire national territory.

Each household can be interviewed up to five times at quarterly intervals, allowing for longitudinal follow-up of individuals and dynamic analysis of working conditions. However, due to operational or logistical limitations, not all households are able to be interviewed in all five planned visits. Thus, to ensure the robustness of the longitudinal analysis, the study considered only those individuals who participated in all five interviews.

To enable individual follow-up of respondents over time, it

was necessary to create a unique identifier. This identifier was constructed from key variables such as age, date of birth, and the household identifier, ensuring that individuals were correctly tracked throughout the visits. It is important to highlight that longitudinal analyses such as the one carried out in this study require caution in interpreting the results, especially due to the impact of sample attrition and possible limitations of representativeness (Osorio, 2022).

The total number of observations in the study was 1,540,075 individuals, with an average of 61,603 people per quarter. This dataset allows a detailed and robust analysis of occupational dynamics, providing a basis for investigating transformations in the labor market over time, with special attention to the pandemic period and its post-pandemic developments.

## Descriptive Analysis

The analysis of the dynamics of occupation loss reveals important nuances when we consider factors such as type of occupation, skin color/race, sex, age group, and education.

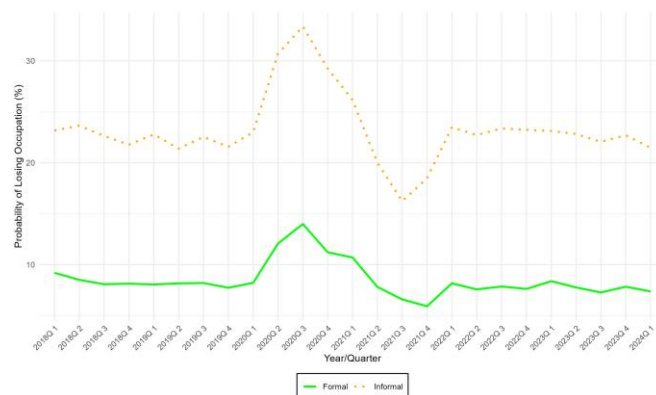
**A. Type of Occupation.** Graph 1 compares the probability of occupation loss between formal workers (continuous line) and informal workers (dotted line), showing the greater vulnerability of informal workers<sup>1</sup>. Before the pandemic, the probability of occupation loss among informal workers ranged from 22% to 24%, while among formal workers it was less than 10%. This reflects the precariousness of informal occupations, which are less protected by contracts and labor benefits.

With the 2020 pandemic, the probability of loss of occupation among informal workers exceeded 30%, reflecting the severe impact of the crisis on the most vulnerable workers. Among formal workers, the increase was more modest, with the loss rate reaching about 14%. It is observed that the formal market faced a more gradual recovery, with the minimum point of stability being reached later, around the third and fourth quarters of 2021. It is important to mention that during this period, the Emergency Program for the Maintenance of Employment and Income (BEm)<sup>2</sup> played a key role in subsidizing part of the salaries to avoid layoffs in the formal market.

<sup>1</sup>The following categories were considered informal: Employed in the private sector without a formal contract; Domestic employee without a formal contract; Employer without registration with CNPJ; Self-employed worker without registration with CNPJ; Auxiliary family worker.

<sup>2</sup>The program was instituted by the Federal Government, through the Ministry of Economy, through Provisional Measure No. 1,045/2021, allowing the reduction of working hours and wages or the suspension of contracts with financial compensation paid by the government, avoiding mass layoffs during the COVID-19 pandemic.

**Figure 1.** Probability of Losing Occupation by Type of Occupation: 2018.1-2024.1



Source: Prepared by the authors based on the National Household Sample Survey between 2018 and 2024.

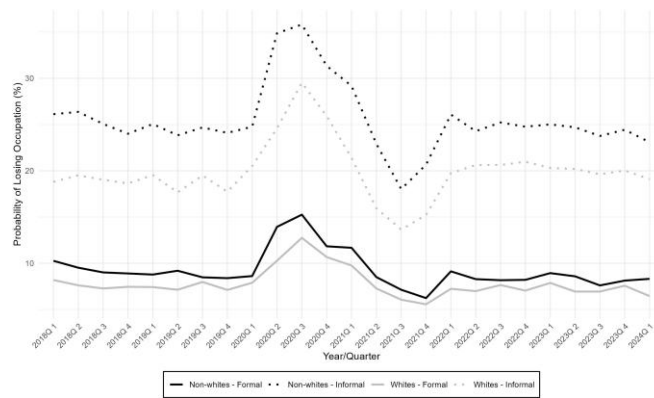
The chart shows that the pandemic acted as a transitory shock in both markets – formal and informal. While workers faced a higher likelihood of being dismissed in 2020, the data shows that starting in 2021, both markets gradually returned to historical levels. For example, at the point of greatest recovery, the probability of dismissal among informal workers approached 15%, while in the formal market the index was once again below 10%. This stability of the curves, except for the pandemic period and immediately after, suggests that the effects of the crisis were mostly short-term, with no long-term changes in the dynamics of the markets analyzed.

**B. Differences by Characteristics.** Graph 2 evaluates the differences by skin color/race, showing marked inequalities between white and non-white workers<sup>3</sup>. In the formal market (continuous lines), the probability of dismissal among non-whites was higher than that of whites over time. In the informal market (dotted lines), this disparity is even more pronounced, especially during the pandemic.

Before the pandemic, non-white workers in informal occupations already faced an average probability of loss of 25%, while informal whites recorded rates close to 20%. With the arrival of the pandemic, the situation worsened significantly, with the probability of loss among informal non-whites reaching 35.8%, while for informal whites the peak was 29.5%. Even in the formal market, non-whites continued to face greater risks of loss of occupation. The recovery in the post-pandemic period was more favorable for formal whites, although racial inequality remained evident in both segments.

<sup>3</sup>In this study, the 'non-white' category includes individuals who self-declare as black or brown, according to the classification used by the IBGE.

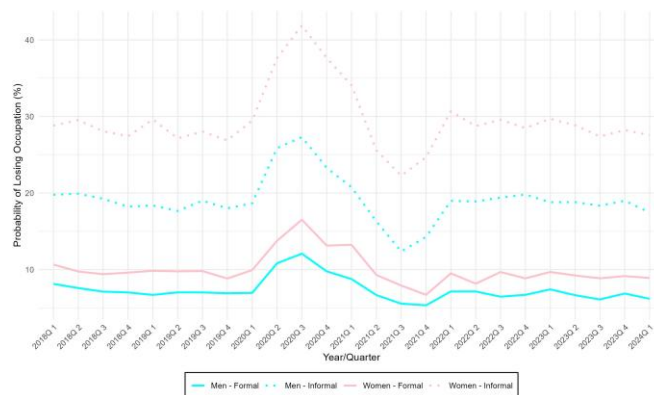
**Figure 2.** Probability of Losing Occupation by skin color and/or race: 2018.1-2024.1



Source: Authors' elaboration based on the National Household Sample Survey between 2018 and 2024.

In graph 3, which compares men and women, the differences in the probability of losing occupation are also clear. Women in the informal market were consistently more likely to lose occupation compared to men. In the pre-pandemic period, the loss rate for informal women was, on average, 28.1%, while among informal men the average rate was around 18.7%.

**Figure 3.** Probability of Losing Occupation by Sex: 2018.1-2024.1



Source: Authors' elaboration based on the National Household Sample Survey between 2018 and 2024.

During the pandemic, the probability of losing occupation among informal women reached 41.8%, while for informal men the value was lower, 27.3%.

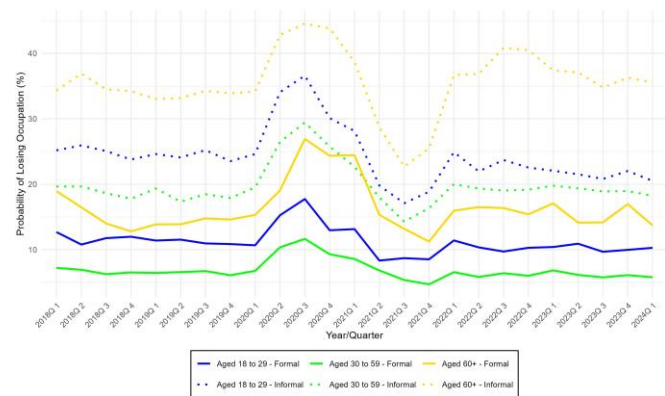
This disparity is due, in part, to the greater concentration of women in more vulnerable sectors, in addition to the overload of domestic responsibilities, especially during the crisis. In the formal sector, women were also more impacted than men, although the magnitude of the differences was smaller than in the informal market. Post-pandemic recovery was slower for women, revealing greater gender occupational vulnerability.

The analysis by age group<sup>4</sup>, illustrated in graph 4, reveals that young people between 18 and 29 years of age, especially

<sup>4</sup>In the analysis by age group, the age of the individuals was defined based on the first interview.

in the informal market (dotted lines), faced the highest probabilities of losing occupation. In the pre-pandemic period, the probability of loss for informal youth was, on average, 24.7%, but during the height of the pandemic this number jumped to 36.6%. Workers over 60 years of age were also greatly affected, with occupational loss rates in the informal market reaching 44.6%.

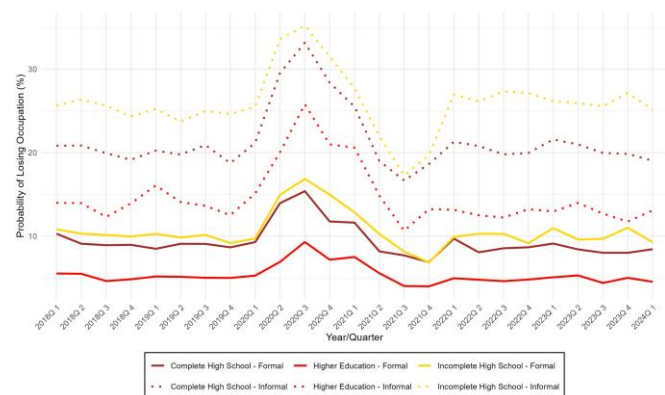
**Figure 4.** Probability of Losing Occupation by age group: 2018.1-2024.1



Source: Authors' elaboration based on the National Household Sample Survey between 2018 and 2024.

On the other hand, workers between 30 and 59 years old showed greater resilience, both in the formal and informal markets, with a significantly lower probability of loss. In the formal sector, this rate remained below 12% even during the pandemic. After the most critical period of the health crisis, informal young people continued to have a high probability of dismissal, highlighting their vulnerability in the labor market.

**Figure 5.** Probability of Losing Occupation by Education: 2018.1-2024.1



Source: Prepared by the authors based on the National Household Sample Survey between 2018 and 2024.

Finally, graph 5, which assesses the probability of loss of occupation by level of education, shows that education is a crucial factor for occupational resilience. Individuals with complete higher education had the lowest probabilities of losing occupation, both in the formal (continuous lines) and informal (dotted lines) markets. Even during the pandemic, the probability of loss for these formal workers was less than

10%, while in the informal market the rate reached 25% at most.

On the other hand, workers with incomplete high school education or less were the most affected, especially in the informal market, where the probability of loss of occupation exceeded 35% at the height of the pandemic. In the formal market, workers with low and intermediate education also had higher rates than those with higher education. After the pandemic, loss of occupation rates remained high for workers with less education, especially in the informal market, demonstrating the importance of education in occupational stability.

### Empirical Strategy

Continuing the descriptive analysis presented in the previous section, this section explores the factors associated with the probability of loss of occupation using the Cox survival model (Cox, 1972). This model is widely recognized for its ability to analyze events as a function of several explanatory variables simultaneously, and in this study it was used to evaluate the relationship between individual and occupational characteristics and the risk of dismissal from the occupation. The model is based on the risk function  $h(t|X)$ , which is proportional to the base risk function  $h(t|X)$ , which is proportional to the base risk function  $h_0(t)$  multiplied by an exponential term of the covariates:

$$h(t|X) = h_0(t) \cdot \exp(\beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k).$$

This formulation allows estimating how observable variables affect the probability of permanence in the occupation over time, without imposing assumptions about the form of the base risk function.

The coefficients of the Cox model can be interpreted as follows: negative coefficients indicate a lower probability of permanence, that is, a higher risk of loss of occupation. Positive coefficients, on the other hand, indicate a greater probability of remaining in the occupation, that is, a lower risk of dismissal.

**Table 1.** Cox Survival Model Coefficients

Periods	Coefficients
Pandemic	-0.051 *** (0.000)
Post-pandemic	-0.002 (0.475)
Observations	622,214

Note: \*\*\*  $p \leq 0.01$ , \*\*  $p \leq 0.05$ , \*  $p \leq 0.1$ .

Table 1, includes dummies variables for the pandemic and post-pandemic periods, with the aim of identifying the relationship of each context with the probability of

permanence in the occupation. For this, important controls were considered, such as sex, skin color/race, age group, education and position in the occupation, measured in the first interview of each individual. This approach allows you to capture overall differences between periods.

The coefficients indicate that, during the pandemic, the permanence in employment was 5.1% lower, evidenced by the negative and significant coefficient. This result reflects the economic and occupational difficulties faced in a context of recession, company closures and interruptions in the activities of various sectors.

On the other hand, in the post-pandemic period, the coefficient indicates that the probability of permanence in employment returned to levels close to those of the pre-pandemic period, without statistically significant evidence of changes. This result suggests that, in general, the labor market was able to stabilize after the initial shock. While these results capture an overview, they do not detail the specifics of different demographic and occupational groups in each period. To deepen this analysis, Table 2 presents the estimated coefficients for workers' characteristics, segmenting the pre-pandemic, pandemic, and post-pandemic periods. This approach makes it possible to identify important heterogeneities and contributes to a more detailed understanding of inequalities in the labor market.

**Table 2.** Cox Survival Model Coefficients by Period

Variables	Pre-pandemic	Pandemic	Post-pandemic
Women	-0.174*** (0.000)	-0.200*** (0.000)	-0.181*** (0.000)
Mixed race	-0.062*** (0.000)	-0.064*** (0.000)	-0.049*** (0.000)
Black	-0.044*** (0.000)	-0.040*** (0.000)	-0.030*** (0.000)
Others	-0.015 (0.620)	-0.054** (0.011)	-0.054** (0.010)
The Eldery	-0.358*** (0.000)	-0.361*** (0.000)	-0.035*** (0.000)
Young People	-0.092*** (0.000)	-0.084*** (0.000)	-0.069*** (0.000)
Complete High School	-0.061*** (0.000)	-0.064*** (0.000)	-0.077*** (0.000)
Incomplete High School or less	-0.160*** (0.000)	-0.147*** (0.000)	-0.170*** (0.000)
Employed without formal contract	-0.207*** (0.000)	-0.249*** (0.000)	-0.219*** (0.000)
Formal Self-employed	0.032** (0.024)	-0.018** (0.046)	-0.013 (0.121)
Informal Self-employed	-0.221*** (0.000)	-0.249*** (0.000)	-0.252*** (0.000)
Formal Employer	0.091*** (0.000)	0.080*** (0.000)	0.069*** (0.000)
Informal Employer	0.013 (0.632)	-0.038** (0.035)	-0.060*** (0.002)
Military or Civil Servant	0.095*** (0.000)	0.087*** (0.000)	0.077*** (0.000)
Observations	122,681	256,083	243,450

Note: \*\*\*  $p \leq 0.01$ , \*\*  $p \leq 0.05$ , \*  $p \leq 0.1$ .

The analysis of the coefficients presented in Table 2 confirms consistent patterns of inequalities in the Brazilian labor



market. Women face a higher risk of job loss in all periods analyzed compared to men. The probability of permanence was 17.4% lower in the pre-pandemic period, 20.0% lower during the pandemic and 18.1% lower in the post-pandemic period, compared to men. This result indicates that women face greater challenges in the labor market, accentuated during the pandemic, due to the overload of domestic responsibilities and their increased presence in sectors most affected by the crisis, such as services and trade (Albanesi and Kim, 2021).

With regard to the categories of race/skin color, mixed race and black workers consistently have a lower probability of remaining in the occupation compared to white workers. During the pandemic, for example, the probability of permanence was 6.4% lower for mixed race and 4.0% lower for blacks, compared to white workers. In the post-pandemic period, the differences remain significant, although slightly reduced, with mixed race registering 4.9% and blacks 3.0% less likely to remain employed. The category "others" (including indigenous and Asians) also showed significant disadvantages during and after the pandemic, with a 5.4% lower probability of staying in both periods.

The age group shows that both young people (aged 18-29 years) and the elderly (aged 60 years or older) face marked difficulties in remaining in the occupation when compared to the 30-59 age group. For young people, reductions in the likelihood of staying ranged from 9.2% pre-pandemic to 6.9% post-pandemic, reflecting the higher typical turnover of entry-level positions in the labor market. The elderly, in turn, recorded the greatest reduction during the pandemic (36.1%), while in the post-pandemic period the probability of staying was 34.7% lower in relation to the 30-59 age group. Part of this result may be explained by the proximity of retirement, which leads to voluntary dismissal, in addition to greater exposure to risk in traditional occupations.

Schooling plays a central role in the stability of employment. Workers with incomplete secondary education or less faced the greatest disadvantages, with a probability of staying up to 17.0% lower in the post-pandemic period, compared to those with higher education. Those with complete secondary education, on the other hand, recorded a smaller, but still significant, reduction, ranging between 6.1% and 7.7%. These results reinforce the vulnerability of low-skilled workers in the labor market.

Among the occupational categories, workers without a formal contract and informal self-employed workers had the highest risks of dismissal, in relation to formal employees. During the pandemic, the probability of staying was 24.9% lower for both categories, while in the post-pandemic period the risks remained high, with reductions of 21.9% and 25.2%, respectively. On the other hand, formal employers and military personnel or civil servants continued to show

greater stability in occupation. Military personnel and civil servants, for example, registered a probability of remaining of 8.7% in the pandemic and 7.7% in the post-pandemic.

## Final Considerations

This study presented a comprehensive analysis of occupational dynamics, in the pre-pandemic, pandemic and especially in the post-pandemic period. Using longitudinal data from the Continuous National Household Sample Survey (PNADC), it was possible to identify important patterns in the loss of occupation in different population groups.

The results show that the COVID-19 pandemic caused a significant shock to the labor market, amplifying the vulnerabilities of certain segments, such as informal workers, women, non-whites, young people, the elderly, and people with less education, who faced greater risks of dismissal. However, the data indicate that the post-pandemic period appears to have returned to pre-pandemic normality levels, with occupational loss rates stabilizing for diverse population groups. This return to normality suggests that, despite the initial shock, the labor market has managed to adjust over time.

In addition, factors such as education and type of occupation play crucial roles in determining resilience in the occupation, with more skilled and formally employed workers having greater protection against dismissals, both during and after the crisis.

The analysis also highlighted the importance of public policies that strengthen the inclusion and protection of workers less favored, especially in times of crisis. Interventions that encourage labor formalization, job training, and social protection are essential to reduce labor market disparities and promote a more equitable and inclusive economic recovery.

In short, the study deepens the understanding of the dynamics of the Brazilian labor market, highlighting the effects of the shock in the pandemic and the recovery process in the post-pandemic. While the data show significant changes during the pandemic, evidence suggests that these changes were mostly transitory, reflecting the depth of the economic shock. This scenario reinforces the importance of strategies that not only increase the resilience of the labor market in the face of future crises, but also address existing inequalities, promoting greater equity in access to and permanence in the occupation.

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