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## Earnings volatility in Brazil (2012-2023)

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**EARNINGS VOLATILITY IN BRAZIL  
(2012-2023)**

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## EARNINGS VOLATILITY IN BRAZIL (2012-2023)

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## ABSTRACT

This article provides a comprehensive analysis of labor earnings volatility in Brazil between 2012 and 2023. During this period, Brazil's economy experienced intense economic growth followed by large recessions, allowing us to assess changes in volatility over the business cycle. In addition, Brazil's national household survey follows individuals throughout an entire year, covering both formal and informal sectors of the economy. This offers the perfect setting to study earnings volatility in developing countries, a subject that has been mostly investigated in the context of advanced economies. Apart from documenting the main volatility trends, we also investigate how they vary by income level, employment-nonemployment transitions, and transitions between formal and informal sectors. We also assess how volatility varies by gender, education, race, and marital status. Our results show that earnings volatility is much higher in Brazil than in rich countries, especially among low-wage, informal workers. Transitions into and out of employment account for a large share of wage volatility levels.

**Keywords:** Brazil; wage inequality; income distribution; earnings volatility.

## 1 INTRODUCTION

Earnings volatility – the level of fluctuations in pay over time – has been extensively studied in developed countries, particularly the United States, but also in other economies (Moffitt et al., 2023; Moffitt and Zhang, 2018; Cappellari and Jenkins, 2014; Jappelli and Pistaferri, 2010; Avram et al., 2022; Li, La and Sologon, 2021; OECD, 2011). Interest in this topic arises not only for its own sake, but also due to the links between earnings volatility and inequality and poverty dynamics, consumption patterns, social mobility, economic insecurity, and income risk (Meghir and Pistaferri, 2011; Attanasio and Weber, 2010; Shorrocks, 1978; Western et al., 2012).

Despite the extensive literature on volatility in high-income countries, research on developing economies is limited. This article conducts a comprehensive analysis of earnings volatility in Brazil, a large and highly unequal developing country. There are several reasons to believe that volatility is higher in these countries. Income growth is more volatile in emerging economies (Aguar and Gopinath, 2007), and the presence of large informal markets likely influences the level of earnings risks in these economies (La Porta and Shleifer, 2014; Ulyssea, 2020). High labor market turnover and unemployment are also prevalent (Gerard and Gonzaga, 2021). Additionally, high inequality and low mobility are characteristic features of developing countries, especially Latin America (Chancel and Piketty, 2021; Messina and Silva, 2021; Britto et al., 2022).

Our analysis relies on panel data from the Continuous National Household Sample Survey (PNADC). We focus on year-over-year changes in earnings, using the variance of the arc percent change as our main measure of volatility. This measure can account for changes in earnings arising from nonemployment and has been extensively used to document trends in volatility in other countries (Shin and Solon, 2011; Celik et al., 2012; Ziliak, Hardy and Bollinger, 2011; Dynan, Elmendorf and Sichel, 2012; Moffitt et al., 2023). We calculate separate estimates for men and women, as these groups display different trajectories in high-income countries (Moffitt et al., 2023). We assess how volatility varies over the earnings distribution in the first period and the role of transitions into and out of employment. Our data allow us to investigate how volatility differs between individuals with formal, informal, and self-employed attachments to the labor market, which are important aspects of labor market in developing countries. We also investigate heterogeneity by education, race, and marital status.

Our findings suggest that earnings volatility in Brazil is higher than in the United States and other advanced economies. The volatility of male earnings in Brazil was around 0.25 in 2015, compared to 0.10 in the United States before the Great Recession (Ziliak, Hokayem and Bollinger, 2023). Interestingly, in contrast to high-income countries, the volatility of female earnings in Brazil is greater than that of male earnings.



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However, this relationship was briefly reversed during the peak of the covid-19 pandemic. As documented in other countries, volatility is countercyclical in Brazil, which means that it increases during economic downturns. This effect is stronger among men. These results are robust to several changes in specification and sample definition.

We find much higher earnings volatility among low-income individuals. Volatility reaches the lowest level among those who earn close to the minimum wage, slightly increasing thereafter. To the best of our knowledge, we are the first to document how volatility varies with earnings. We also decompose labor market volatility by transitions into and out of employment. This exercise reveals that Brazil's high volatility is partly driven by more frequent periods with zero earnings. When considering the type of attachment to the labor market, we see that informal and self-employed workers experience the most volatile earnings. This pattern is primarily driven by the nature of informal work itself, rather than frequent sector transitions, as workers who hold informal jobs in both periods have similar volatility as those who change from formal to informal or vice versa. The heterogeneity analysis indicates that one reason for the greater earnings volatility among men is the higher prevalence of self-employment.

Our heterogeneity analyses by educational levels, race, and marital status confirm that white individuals and those with higher educational attainment experience lower earnings volatility. However, the differences between married and single individuals are more subtle. We do not observe significant differences for men, while the results for married and single women depend on whether we include individuals with zero earnings.

A substantial body of research has investigated the dynamics of earnings volatility in high-income countries, such as the United States, Europe, and Australia. Earlier research focused on estimating the variance of transitory income using parametric or nonparametric models (Gottschalk et al., 1994; Moffitt and Gottschalk, 2012), which requires long longitudinal panel surveys or administrative data. This literature has been complemented by more descriptive and transparent analyses based on the variance of earnings changes between two periods, often relying on shorter panels such as the Current Population Survey – CPS (Celik et al., 2012; Dahl, Deleire and Schwabish, 2011; Shin and Solon, 2011; Moffitt et al., 2023; Ziliak, Hokayem and Bollinger, 2023). Our paper follows the latter approach. More recently, a new line of research has focused on not only documenting the variance but also higher moments of earnings changes, highlighting how these innovations are far from normally distributed, showing asymmetry and high kurtosis (Guvenen, Ozkan and Song, 2014; Hoffmann and Malacrino, 2019; Guvenen et al., 2021; Arellano, Blundell and Bonhomme, 2017; Busch et al., 2022).

Our paper complements a small literature on earnings volatility in developing countries. Beccaria et al. (2022) investigate income mobility in seven Latin American countries.



Contrary to us, they use household income and focus on individual-level mobility measures. Santos and Souza (2007) and Arabage and Souza (2019) use data restricted to the Brazilian formal labor market to estimate models for the variance of transitory and permanent incomes. Engbom et al. (2022) document long-term trends in earnings volatility using data on formal employment and data on formal and informal jobs, but only encompassing six Brazilian metropolitan regions. Martinez and Mello (2024) investigate how increased trade exposure affects the higher moments of earnings risk in Brazil using administrative records, which cover only the formal sector of the labor market.

Gomes, Iachan and Santos (2020) use PNADC data to investigate earnings changes in the formal and informal labor markets but investigate higher moments among workers with positive earnings only. We complement their analysis by including individuals with zero earnings and calculating gross measures of volatility. Thus, we uncover how transitions into and out of employment are much more common in Brazil than in developed countries and contribute decisively to the overall higher levels of volatility. In addition, we show how earnings volatility is much higher at lower income levels, likely a combination of worse labor market attachment in the form of higher informality and more likely transitions out of employment. This finding has important policy implications, indicating that means-tested cash transfers might be inadequate to cover individuals with high risk of losing their employment and falling into poverty if they are targeted too narrowly.

This paper proceeds in the following way. The next section discusses the data and methodology used. Section 3 presents the main results. Heterogeneity analyses based on employment transition, type of employment, education, race, and marital status are shown in section 4. Section 5 concludes.

## 2 DATA AND METHODS

### 2.1 Data sources

We use data from the PNADC, Brazil's flagship national household survey, conducted since 2012 by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE).<sup>1</sup> The PNADC is a nationally representative rotating panel survey that collects information on demographics, education, the labor market, and other topics. Households are interviewed once per quarter for five consecutive

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1. PNADC replaced two previous surveys: the annual National Household Sample Survey (Pesquisa Nacional por Amostra de Domicílios – PNAD), a nationally representative, multi-purpose, cross-sectional household survey, and the Monthly Employment Survey (Pesquisa Mensal do Emprego – PME), a labor market survey with a rotating panel that covered only six metropolitan regions. Both surveys coexisted with the PNADC until 2015 and 2016, respectively, when they were discontinued.

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quarters. Thus, about 80 percent of the sample is retained from quarter to quarter, and, for each household, the first and fifth interviews are one year apart. We focus on these year-over-year changes in earnings to minimize noise introduced by earnings seasonality.

Very few analyses take advantage of the panel structure of the PNADC because the public-use microdata published by IBGE only includes household-level, but not individual-level, unique identification keys. We bypass this problem using the matching algorithm developed by Osorio (2022) to link the same individuals across survey waves. Thus, we created short, two-period panel datasets for each quarter from 2012 to 2023.

Although the sample design of the PNADC is relatively similar to the CPS, there are some significant conceptual and methodological differences between them, particularly concerning the measurement of earnings. The Brazilian survey collects earnings information in two ways: earnings usually earned in a given month, excluding bonuses (such as overtime pay or the holiday bonus) and penalties (for example, for unscheduled absences); and earnings effectively received in the prior month, which include these extra payments and penalties. We employ the latter as our main earnings definition. We restrict our analysis to earnings from individuals' main occupation.

Another contrast between the PNADC and the CPS – and more generally other surveys in the United States – is that the Brazilian survey only collects data on monthly payments. Given Brazil's historical struggles to curb inflation, it is customary to negotiate and report wages monthly rather than annually. Although one might suspect that monthly earnings would be more volatile than annual earnings due to the shorter reference period, Cappellari and Jenkins (2014) contrast monthly and annual earnings in Britain and find that annual earnings are actually more volatile. Hence, it is likely that the higher volatility we observe in Brazil when compared to the United States and Britain is not only the result of the different earnings definitions but reflects actual differences between the labor markets of these economies.

Another concern for cross-country comparisons is that IBGE imputes missing income information in the PNADC but does not flag the imputed cases. Therefore, we cannot estimate volatility measures excluding imputations. As Ziliak, Hokayem and Bollinger (2023) have shown, volatility levels are higher when imputed values are included, and they recommend dropping these observations. In the case of Ziliak, Hokayem and Bollinger (2023), the variance of the arc percent changes almost doubles with the imputed values. However, income non-response rates are very low in Brazil. Between 2011 and 2015, missing earnings information in the old PNAD was around 3%, and there is no reason to assume this figure increased substantially in the PNADC. In contrast, Ziliak, Hokayem and Bollinger (2023) report that 12% of individuals had their earnings imputed in the CPS over a 20-year period. Moreover, there was a large increase over time, as this percentage was close to 25% in 2015 (Bollinger et al., 2019).

## 2.2 Sample selection

Our sample restrictions follow Ziliak, Hokayem and Bollinger (2023) and Cappellari and Jenkins (2014). We keep only individuals aged between 25 and 59 years at the time of the first interview and exclude students. We also exclude unpaid family workers and employers in any given period.

On average, attrition hovers around 20% of households, that is, the probability of completing the fifth interview, conditional on having completed the first one, ranged from 77% to 85% across most cohorts. This percentage dipped to approximately 70% for the 2019-2020 cohort due to the onset of the covid-19 pandemic, which peaked in 2021. The pandemic was also the only period when differential attrition rates were a cause for concern; otherwise, the probability of attrition was essentially uncorrelated with reported income levels. Poor families were disproportionately likely to drop out of the PNADC sample due to the switch from in-person to phone interviews amidst the covid-related shocks (Hecksher, 2021).

Lower-income individuals experience higher volatility (Moffitt et al., 2023), so this surge in differential attrition rates during the pandemic may bias down volatility levels. We corrected attrition using inverse probability weighting (IPW) as a robustness exercise and contrasted the results with those obtained with original PNADC weights. Results were essentially the same, with only minor differences during the pandemic.

## 2.3 Measuring earnings volatility

There are several ways in which earnings volatility, risk, or instability have been measured in the literature. Here, we focus on “gross” measures, as defined by Moffitt and Zhang (2018). In contrast to measures that aim to estimate the variance of transitory income shocks, gross measures favor transparency and capture the overall volatility of earnings over time, thus not distinguishing between permanent and transitory income innovations.<sup>2</sup> We rely on the variance of the arc percent change in earnings, defined as:

$$varc_t = var\left(\frac{y_{it} - y_{it-1}}{\bar{y}_i}\right) \quad (1)$$

In equation (1),  $\bar{y}_i = (y_{it} + y_{it-1})/2$  is the average (absolute value) of inflation-adjusted earnings in adjacent years.

There are two main advantages associated with this measure over alternatives. First, it is bounded between  $\pm 200\%$  (or  $\pm 2$ ), making interpretation easier. In the cases with no

2. Cappellari and Jenkins (2014) provide a short summary of different methodologies.

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change in income across periods, the arc change is zero. The greater the dispersion in the earnings changes, the higher the volatility. Second, it allows the inclusion of observations with zero earnings, which cannot be done with traditional volatility measures that rely on the change in log earnings (Shin and Solon, 2011; Moffitt and Zhang, 2018). Including zero earnings is particularly important in the context of high levels of nonemployment, which is the case in Brazil.

We follow Cappellari and Jenkins (2014) and focus on two measures of volatility: earnings volatility, which includes only individuals with positive earnings in both periods; and labor market volatility, which also includes individuals with zero earnings. Cappellari and Jenkins (2014) include in their measure of labor market volatility individuals without earnings in both periods, setting their earnings volatility to zero. We also proceed this way but add to our analysis a measure of volatility that restricts non-employment to only one period, as done in Ziliak, Hokayem and Bollinger (2023) and other studies summarized by Moffitt et al. (2023). Following these studies, we also report volatility measures separately for men and women.

Our main analysis follows the standard procedures in Moffitt et al. (2023), Ziliak, Hokayem and Bollinger (2023), and companion studies. Due to evidence of life-cycle changes in earnings risk (Gottschalk et al., 1994), we adjust the arc percent change by age using a quadratic specification, also including quarter fixed effects. We trim the top and bottom 1% of the earnings distribution, trimming only individuals with positive earnings.

The main sample includes self-employed workers, but no employers. This is particularly important in Brazil, as self-employment comprises a large share of the workforce.

We perform several robustness checks. We calculated volatility measures without trimming and trimming the top and bottom 5% of the earnings distribution in each period. We computed the variance of arc percent changes without age or quarter adjustments. We excluded self-employment, as this is also done in other studies (Ziliak, Hardy and Bollinger, 2011), and we also assessed labor market volatility restricting our analysis to those that are actively participating in the labor market, that is, individuals currently employed and/or actively looking for jobs. For brevity, results for all robustness checks are available upon request.

To examine the main components of earnings volatility, we follow Ziliak, Hardy and Bollinger (2011) and Cappellari and Jenkins (2014) and decompose the variance of the arc percent change into within and between components for mutually exclusive population subgroups defined by employment transitions. We classify workers into four groups: nonemployed in both periods (00), nonemployed in the first period but employed in the second (01), employed in the first but not in the second (10), and employed in

both periods (11). Based on these groups, the total variance of the arc percent change can be written as:

$$V = P_{11}V_{11} + P_{00}\bar{M}^2 + P_{01}(2 - \bar{M})^2 + P_{10}(2 + \bar{M})^2 + P_{11}(M_{11} - \bar{M})^2 \quad (2)$$

In equation (2),  $P_{ij}$ ,  $M_{ij}$ , and  $V_{ij}$  are, respectively, the proportion of the population, the average arc percent change and the variance of the arc percent changes in group  $ij$ , and  $\bar{M}$  is the average arc percent change over the full sample.

Equation (2) is just a restatement of the law of total variance, given by  $var(y) = E(var(y|P)) + var(E(y|P))$ , considering that  $M_{00} = V_{00} = 0$  (individuals non-employed in both periods have zero average earnings and no volatility),  $M_{01} = 2$  (the arc percent change equals 200% for all individuals who were nonemployed in the first period but employed in the second),  $M_{10} = -2$  (the arc percent change equals -200% for all individuals who were employed in the first period but nonemployed in the second), and, consequently,  $V_{01} = V_{10} = 0$ . The average arc percent change over the full sample simplifies to  $\bar{M} = P_{11}M_{11} + 2(P_{01} - P_{10})$ .

Because informal labor markets are relevant in developing economies (La Porta and Shleifer, 2014; Ulyssea, 2020), we also examine how earnings volatility varies by labor market status in the first period and by transitions between periods. We consider four types of employment: formal, informal, self-employed, and nonemployed. Formality refers to formal labor contracts that guarantee access to social security and labor rights. We use the law of total variance to decompose labor market volatility into these four groups, considering their labor attachment in the first period. To study job transitions, we divide individuals into three categories: broad formal, broad informal, and nonemployment. “Broad formal” encompasses workers with formal employment contracts, public servants, and self-employed workers who contribute to social security. “Broad informal” comprises workers without formal employment contracts and self-employed workers who do not contribute to social security.

Lastly, we follow Ziliak, Hardy and Bollinger (2011) and also investigate how labor market volatility varies by educational level, race, and marital status. We group individuals into three categories based on their education: less than high school, complete high school, and complete college. We consider only two racial groups: white and non-white.<sup>3</sup> Marital status is restricted to singles and married, but we also compare their volatility

3. Non-white includes blacks (*pretos*) and brown or mixed-race (*pardos*). White includes only *branco*. Native and Asian are excluded but comprise less than 2% of the population.

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with that of couples. In this case, we sum the wages of both partners and restrict the analysis to the head of the household irrespective of their gender. In addition, we also investigate how labor market volatility varies across the earnings distribution (at the time of the first interview).

### 3 MAIN FINDINGS

#### 3.1 Variance of arc percent changes

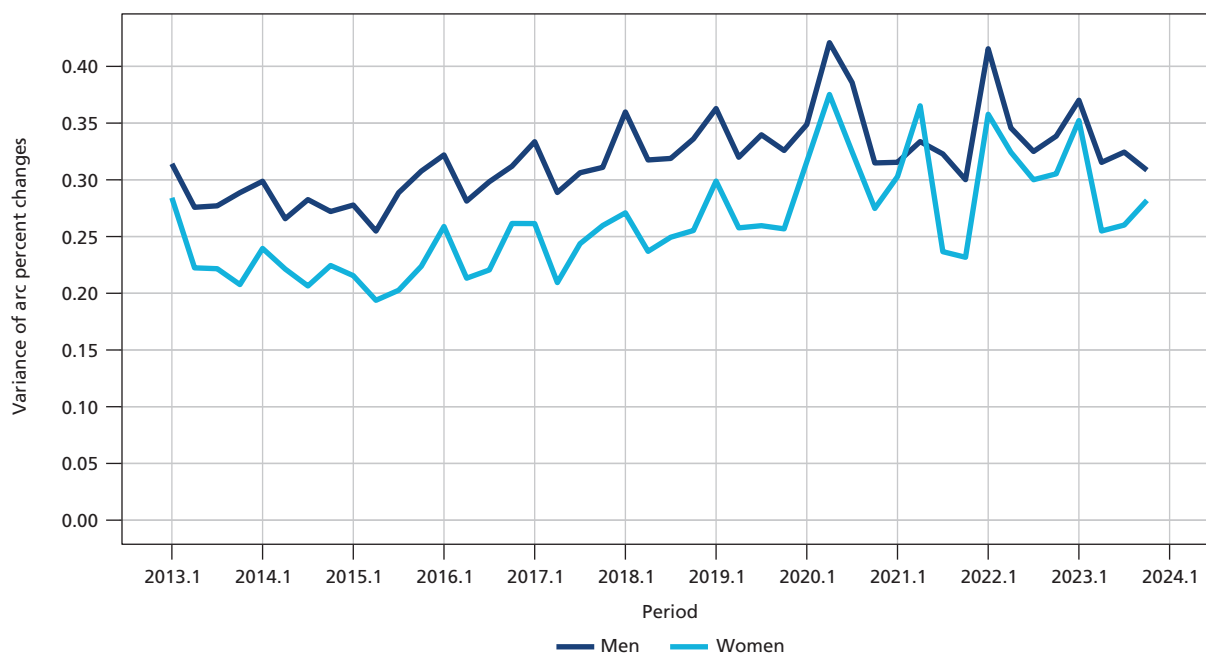
Figure 1 presents our main results on earnings volatility for men and women between 2012 and 2023.<sup>4</sup> The sample is restricted to individuals with positive earnings in both periods. Initially, men's earnings volatility was approximately 0.3, but it trended upward after 2015, when the labor market became less dynamic in Brazil, with high unemployment (Firpo and Portella, 2024). Earnings volatility continued to increase until 2020, when the covid-19 pandemic started, and reached its maximum value that year, above 0.4. From 2020 to 2023, the instability in men's earnings saw significant fluctuations, yet it leveled off in the final period, returning to a state akin to the pre-pandemic levels.

Figure 1 shows that earnings volatility for women is lower than for men in Brazil. Results for the United States and Britain find the opposite pattern (Ziliak, Hokayem and Bollinger, 2023; Cappellari and Jenkins, 2014). The volatility of women started similar to that of men in 2013, just below 0.3, but quickly decreased to 0.2, and remained at this level until 2015. As for men, volatility started rising towards the end of the 2014-2016 recession and peaked in 2020 during the onset of the pandemic.

Overall, our results mirror trends observed in affluent nations insofar as earnings volatility follows a countercyclical pattern, falling during the brief period of growth (2012-2014) and rising notably throughout Brazil's economic downturn.

4. The earnings data covers the period 2012-2023, but, for simplicity, we label the horizontal axes in all figures according to the final year of each panel cohort.



**FIGURE 1****Earnings volatility – Brazil (2013-2023)**

Authors' elaboration.

Obs.: Earnings volatility is measured using equation (1) and restricts the sample to individuals with positive earnings in both periods, for men and women separately between 2013 and 2023, using data from PNADC. We adjust volatility by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

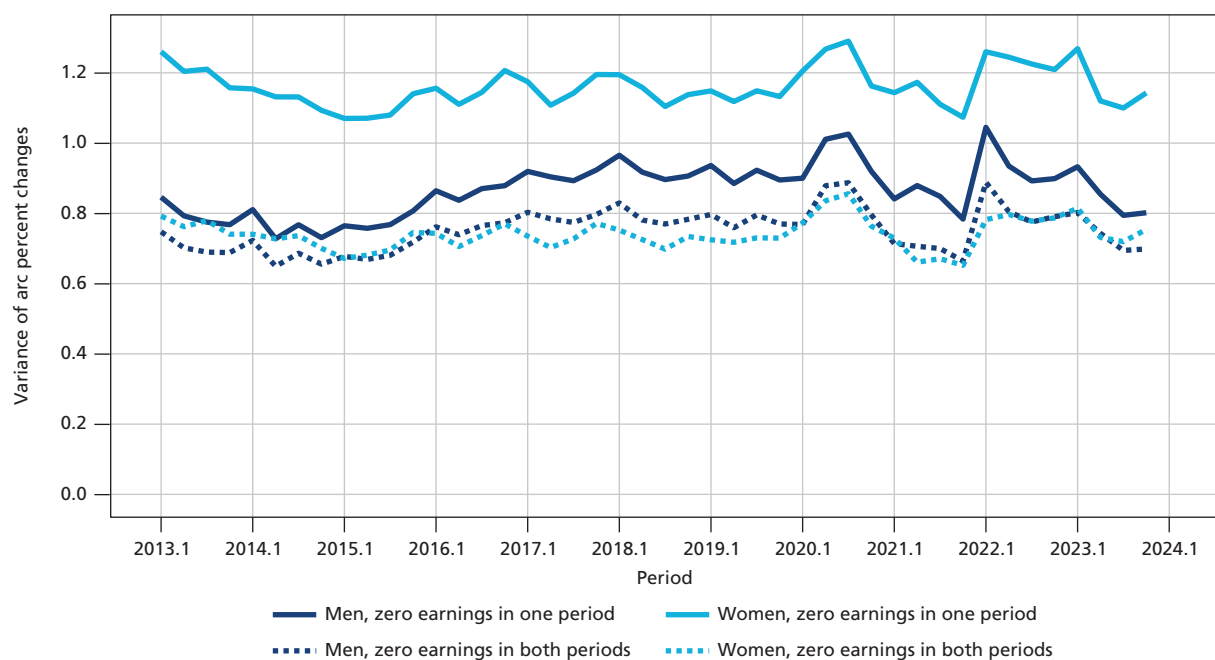
Despite similar cyclical patterns, volatility levels are much higher in Brazil than in the United States. Take, for example, the case of men. In Brazil, earnings volatility was slightly below 0.3 before the recession, while in the United States the corresponding figure was around 0.11 – figure 1 in Ziliak, Hokayem and Bollinger (2023). As previously mentioned, direct comparisons should take into account a few caveats. First, the discrepancies in estimated volatility levels may partially result from the inclusion of imputed earnings in our analysis. Ziliak, Hokayem and Bollinger (2023) report estimate for earnings volatility that do not exclude imputed earnings that hover around 0.25 in the United States – figure 3 in Ziliak, Hokayem and Bollinger (2023). Item non-response rates for earnings are much lower in Brazil – 3% versus 12% reported by Ziliak, Hokayem and Bollinger (2023) –, so this might not be a concern in our context. Second, we analyze monthly earnings rather than annual earnings. Evidence from the United Kingdom suggests that monthly earnings have smaller changes than annual earnings (Cappellari and Jenkins, 2014). If this is also true in Brazil, then earnings volatility is certainly higher in Brazil than in the United States, a stark finding, considering that volatility in the latter is already higher than in Britain and other advanced economies (OECD, 2011).



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We also consider labor market volatility, which includes individuals with zero earnings in one or both periods. We differentiate between these two groups in figure 2. The solid lines refer only to individuals with earnings in at least one period, while the dashed lines include individuals with zero earnings in both.

**FIGURE 2**  
**Labor market volatility – Brazil (2013-2023)**



Authors' elaboration.

Obs.: Labor market volatility is measured using equation (1) for men and women separately between 2013 and 2023, using data from PNADC. Solid lines include individuals with at least one period of positive earnings. The dashed lines include individuals with zero earnings in both periods. We adjust volatility by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

Labor market volatility significantly surpasses earnings volatility for both genders in Brazil. The volatility for men was around 0.8 at the beginning of the period and began to increase during 2015. It peaked at the onset of the pandemic, which inaugurated a period of rapid fluctuations with swift declines and rises, presumably mirroring changes in employment rates, a topic we will explore further when decomposing earnings volatility across job transitions. In the last quarter of 2023, labor market volatility reached the same levels as at the beginning of the period. Similar to the findings in Ziliak, Hokayem and Bollinger (2023) for the United States, labor market volatility in Brazil exhibits a more pronounced countercyclical pattern compared to earnings volatility. Specifically,

including individuals with no earnings results in a stronger increase in volatility during economic downturns than when we exclude this group from our analysis.

Contrary to earnings volatility, labor market volatility is higher for women than men in Brazil, a consequence of gender differences in labor market participation. There was a marked downward trend for women at the beginning of the period, probably reflecting this group's increasing workforce participation rates. This downward trend continued after the 2014-2016 recession, while labor market volatility for men rose sharply. Both groups experienced a period of higher instability during the pandemic. By the end of 2023, labor market volatility for men was around the same level as in 2013, but women had a modest drop.

Labor market volatility is similar for men and women if we include individuals with zero earnings in both periods. Because they have zero arc percent changes, volatility decreases when we include these individuals in the analysis. This is especially true for women, as their participation in the workforce is lower than men. Nevertheless, the overall pattern remains consistent regardless of the inclusion of these individuals in our analysis. Volatility declined between 2013 and 2015, then rose amidst the recession, plateauing during the late 2010s, followed by sudden jumps during the covid-19 pandemic. Such contrasting turns did not entail much cumulative change when we compare 2023 to 2013. Interestingly, women showed slightly higher volatility at the beginning of the period, but male volatility rose faster during the recession. Similarly, we observe a faster growth in earnings volatility for men if we consider only individuals with zero earnings in one period.

Ziliak, Hokayem and Bollinger (2023) report much lower estimates of labor market volatility in the United States, which reached 0.4 in the aftermath of the Great Recession for men, much lower than 0.65, the lowest observed value in Brazil at the beginning of 2015. Still, the same caveats mentioned above apply to labor market volatility. Cappellari and Jenkins (2014) report estimates that suggest that volatility levels do not change significantly when imputed earnings are included. In both cases, labor market volatility in the United Kingdom ranges from 0.2 to 0.4, much lower than in Brazil. In any case, direct comparisons with figures for the United States are further complicated because we use monthly rather than annual earnings. By default, the share of individuals with zero earnings in both periods tends to be higher in our data.

We conduct several robustness checks on these main results, all available upon request. The results do not change if we do not adjust for age. Trimming the bottom and top 5% of earnings marginally reduces volatility, while no trimming marginally increases it, but there are no significant changes in the results, especially in trends. Using inverse

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probability weighting to account for attrition increases slightly overall volatility, especially during the pandemic, but barely affects the main results.

Changes in sample selection and the definition of earnings are more consequential, but the main results remain. Restricting the sample to workers with active participation in the workforce in both periods significantly reduces labor market volatility for men and women. Still, the effects on women are larger. Volatility becomes smaller for women than for men during most years in this scenario, dropping to around 0.5 at the beginning of the period, then rising to 0.7 and returning to 0.5 at the end of 2023. In any case, the countercyclical pattern is still noticeable. Either including one or two periods with zero earnings makes almost no difference if we exclude individuals with no participation in the workforce in at least one period. Earnings volatility is not affected because it requires participation in the labor market in both periods. Moreover, it is worth noting that the restriction to those participating in the labor market brings estimates of labor market volatility in Brazil closer to that observed in the United States, especially for women.

The most significant deviation from our main results occurs when we change the definition of earnings and analyze usual rather than effective earnings. Volatility levels drop considerably, especially when we consider only individuals with positive earnings in both periods. Albeit not entirely unexpected, this discrepancy warrants further investigation, as it suggests workers are quite accurate at estimating their average long-run earnings even when facing considerable short-run fluctuations. This should be straightforward for formal wage workers, and indeed the PNADC questionnaire is designed to remind respondents to report effective wages net of bonuses and fines. Still, we would expect this task to be considerably more difficult for informal and self-employed workers.

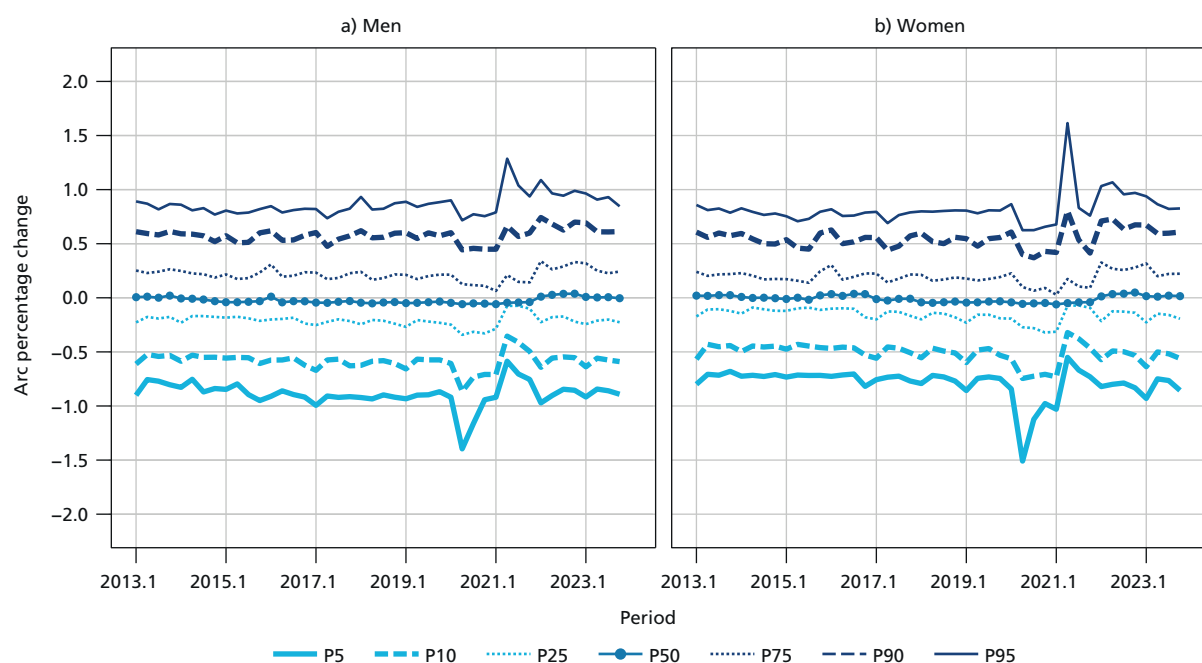
Finally, we also evaluate the effect of excluding self-employed workers from our estimates, as is done in some studies (Shin and Solon, 2011; Ziliak, Hardy and Bollinger, 2011; Ziliak, Hokayem and Bollinger, 2023). In this case, all volatility measures decline in magnitude, but the countercyclical trends do not change. The reduction in earnings volatility is larger for men than for women, and they become similar in magnitude throughout the period. This suggests that self-employment is more important for men as a source of volatility, something we explore in the next section. Labor market volatility also becomes smaller for men and women. If we consider only one period with zero earnings, the reduction in volatility is higher for women, which might suggest that self-employment is a more temporary placement for them. When zero earnings in both periods are considered, the reduction in volatility is similar between the two genders, and they continue to move together throughout the period.

### 3.2 Distribution of arc percent changes

To better understand earnings volatility in Brazil, we analyze selected quantiles of the distribution of the arc percent changes for men and women, including and excluding zero earnings. Figure 3 shows a stable pattern throughout the period for both groups. About 90% of earnings innovations are within the  $[-1, 1]$  interval, and around 50% are close to zero. In other words, 10% of the workforce typically experiences truly large year-over-year earnings fluctuations. As has already been characterized elsewhere and in Brazil, these earnings innovations are far from following a normal distribution (Gomes, Iachan and Santos, 2020; Guvenen et al., 2021; De Nardi et al., 2021). Deviations from this pattern occurred mainly during the pandemic. There was a brief spike in the left (negative) tail of the distribution of arc percent changes in 2020 and an equally short-lived uptick in the right (positive) tail in 2021. The distribution of arc percent changes is slightly more compressed for women, but the spikes observed during the pandemic were larger.

**FIGURE 3**

**Quantiles of the arc percent change among workers with positive earnings – Brazil**



Authors' elaboration.

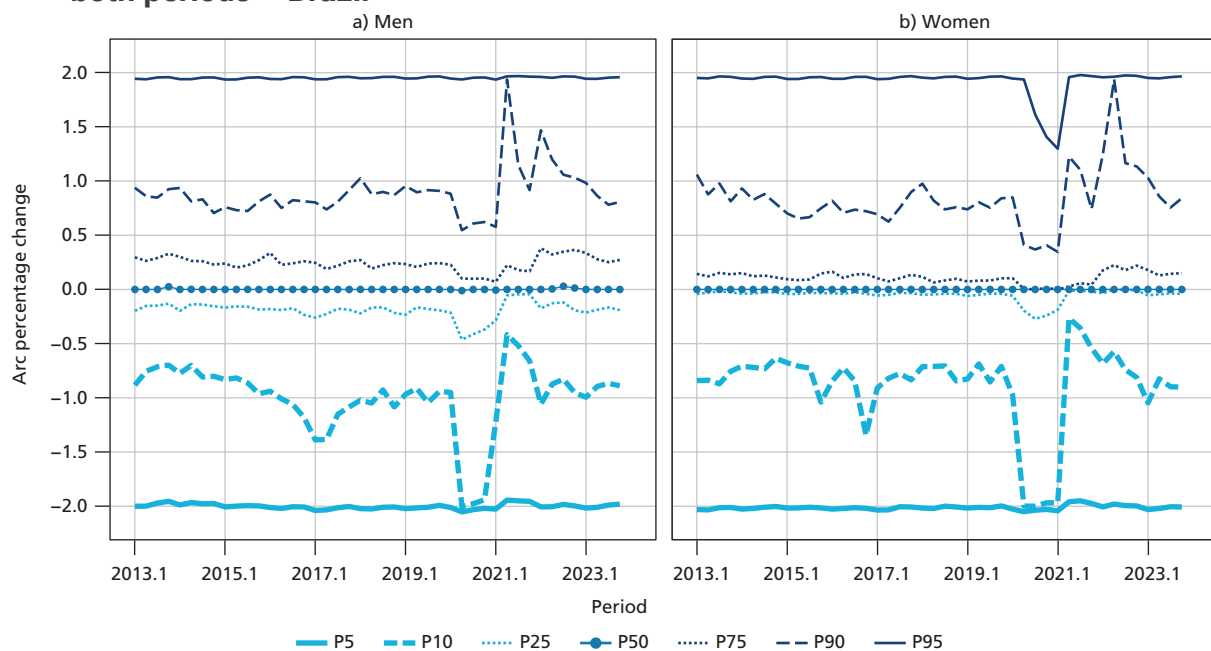
Obs.: These figures plot the 5<sup>th</sup>, 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, 90<sup>th</sup>, and 95<sup>th</sup> percentiles of the arc percent change for positive earnings, for men and women separately between 2013 and 2023, using data from PNADC. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

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Figure 4 displays the distribution of arc percent changes when we also include individuals with zero earnings in both periods. In this case, the distribution of innovations has much heavier tails. For both men and women, the top and bottom 5% of the distribution reached the maximum of  $\pm 2$  throughout almost the entire period. During the pandemic, shocks leading to no earnings (hence, an arc percent change of -2) occurred for at least 10% of men and women. We can also observe that the interquartile range (p25-p75) is more compressed for women than men.

**FIGURE 4**

**Quantiles of the arc percent change including individuals with zero earnings in both periods – Brazil**



Authors' elaboration.

Obs.: These figures plot the 5<sup>th</sup>, 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, 90<sup>th</sup>, and 95<sup>th</sup> percentiles of the arc percent change for all individuals, for men and women separately between 2013 and 2023, using data from PNADC. The sample includes individuals with zero earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

The results shown in figures 3 and 4 are more extreme than the estimates presented by Shin and Solon (2011) and Cappellari and Jenkins (2014). The latter report values around  $\pm 0.5$  for the P5 and P95 quantiles of changes in positive earnings in Britain, both for men and women, representing arc percent changes of 50% in earnings. Similar differences occur when we also include individuals with zero earnings. In Brazil, P10

and P90 were around  $\pm 1.0$  most of the time, meanings that nearly 20% of the population experience arc percent changes larger than 100%, whereas this almost never happens in the United States or the United Kingdom. These contrasts show that the higher earnings volatility in Brazil does not arise only from more likely changes to and from nonemployment but also due to changes in earnings.

## 4 HETEROGENEITY ANALYSES

### 4.1 Volatility by income level

We begin by investigating differences in volatility levels by earnings. We classify workers by ventiles of earnings in the first period, while adding an extra group for all individuals with zero earnings in the first period (percentile 0). We measure volatility in each group as the share of individuals with arc percent changes larger than 50% in either direction.

Figure 5 shows the results for the aggregated samples of 2017 and 2018, for men and women separately.<sup>5</sup> For both groups, we observe higher volatility in the lower tail of the earnings distribution, plateauing around the 30<sup>th</sup> percentile, with a slight upward trend as we move up the distribution. Overall, around 20% of the sample experienced arc percent changes larger than 50%.<sup>6</sup> Results are qualitatively the same if we consider other periods and thresholds.

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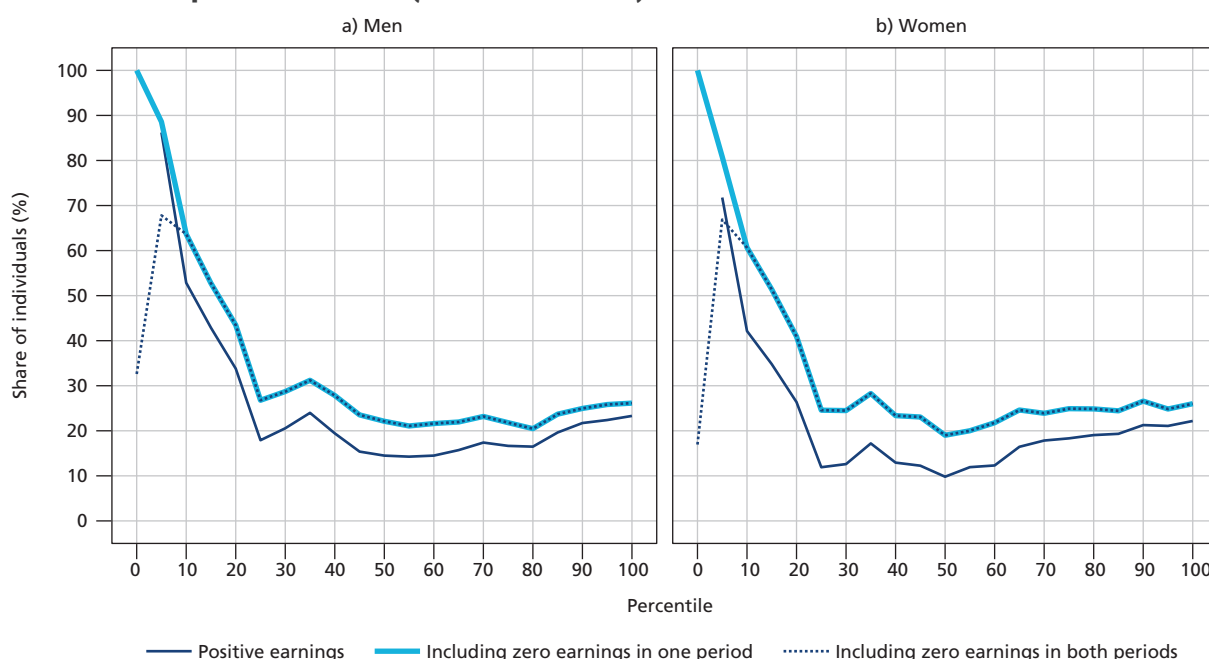
5. We present results for 2017 and 2018 to avoid noise introduced by the covid-19 pandemic, but results are qualitatively similar for other periods, as noted.

6. Nearly 20% of individuals with zero earnings get a job in the following year, hence their arc percent change is 200%. If we restrict the sample to individuals with zero earnings in one period only, then all of those with zero earnings in the first period will necessarily have positive earnings one year later.

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**FIGURE 5**

**Share of individuals with arc percent changes higher than 50% by earnings in the first period – Brazil (2017 and 2018)**

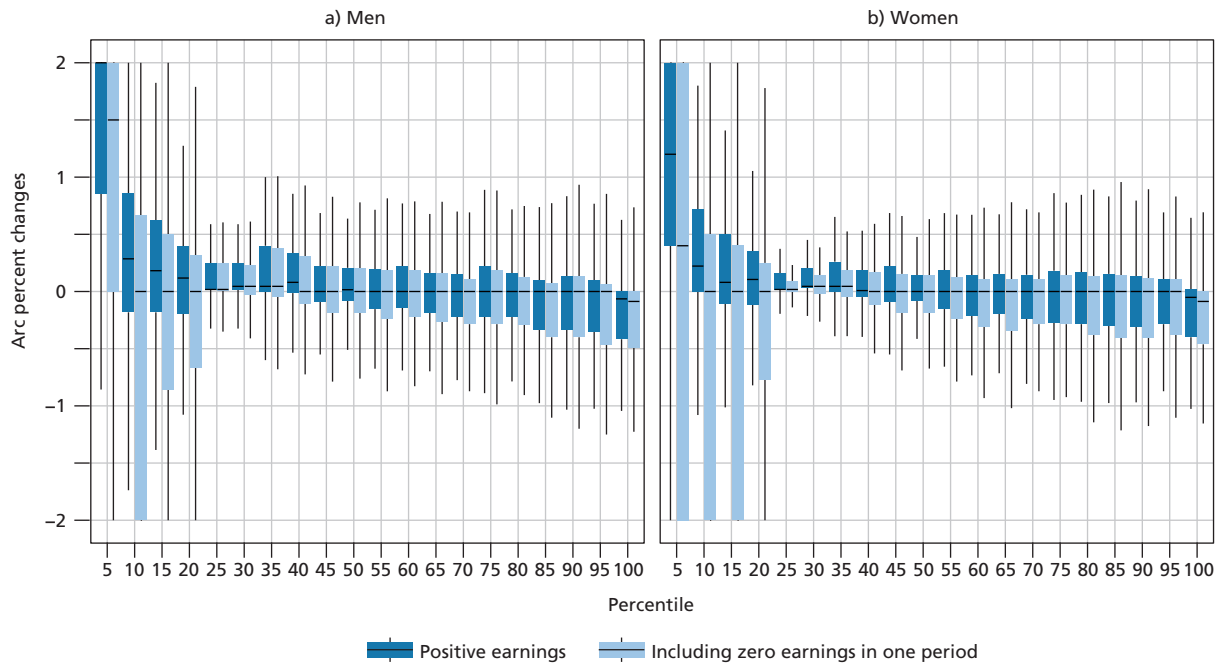


Authors' elaboration.

Obs.: Each line shows the share of individuals with arc percent changes above 50%, negative or positive. We consider three groups: those with positive earnings in both periods; also including those with zero earnings in one period; and also including those with zero earnings in both periods. Individuals with positive in the first are grouped into 20 equally-size bins of approximately 5% of the weighted sample, while those with zero earnings are placed in the "zero" bin.

We also investigate the volatility of earnings by analyzing the dispersion of arc percent changes for the same group of individuals using boxplots (figure 6). In this case, we only plot the results for measures including individuals with positive earnings and also individuals with zero earnings in one period. Again, we observe a much larger dispersion in the arc percent change among low-wage earners, for men and women alike. The minimum level of dispersion is observed between the 30<sup>th</sup> and 40<sup>th</sup> percentile. This is the position in the earnings distribution where the minimum wage becomes binding. After this period, dispersion increases, but to moderate levels when compared to the dispersion observed below the 30<sup>th</sup> percentile. The patterns observed for 2017 and 2018 do not change when compared with 2013 and 2014 (results not shown).



**FIGURE 6****Distribution of arc percent changes – Brazil (2017 and 2018)**

Authors' elaboration.

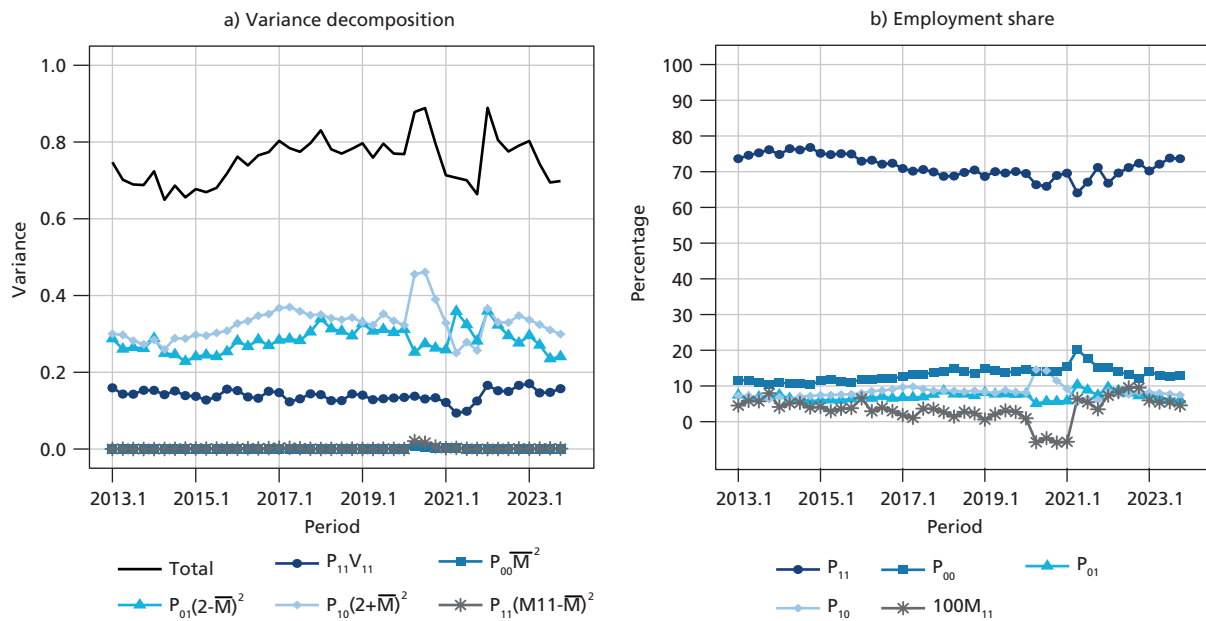
Obs.: Boxes plot the median, interquartile range, and the whiskers correspond to 1.5 times the interquartile range. We consider individuals with positive earnings and zero earnings in one period. Individuals with positive in the first are grouped into 20 equally-size bins of approximately 5% of the weighted sample.

## 4.2 Employment-nonemployment transitions

We follow Ziliak, Hardy and Bollinger (2011) and Cappellari and Jenkins (2014) and decompose the variance of arc percent change based on employment transitions. We classify workers into four groups: employed in both periods (11), nonemployed in both periods (00), employed in the first period but nonemployed in the second (10), and nonemployed in the first but employed in the second (01).

Figure 7 shows the results of the decomposition in equation (2) for men. Panel (a) shows the total variance of arc percent changes, as well as how much each component contributes to it. Transitions into and out of employment ( $P_{01}(2 - \bar{M})^2$  and  $P_{10}(2 + \bar{M})^2$ , respectively) account for the largest share of volatility, as well as for most changes in the period. These changes include the increase in volatility after 2015 and the fluctuations during the pandemics. Variance arising from those who remained employed accounts for less than 25% of total volatility throughout most of the period, even though most men are always employed – panel (b).

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**FIGURE 7****Decomposition of labor market volatility for men – Brazil**

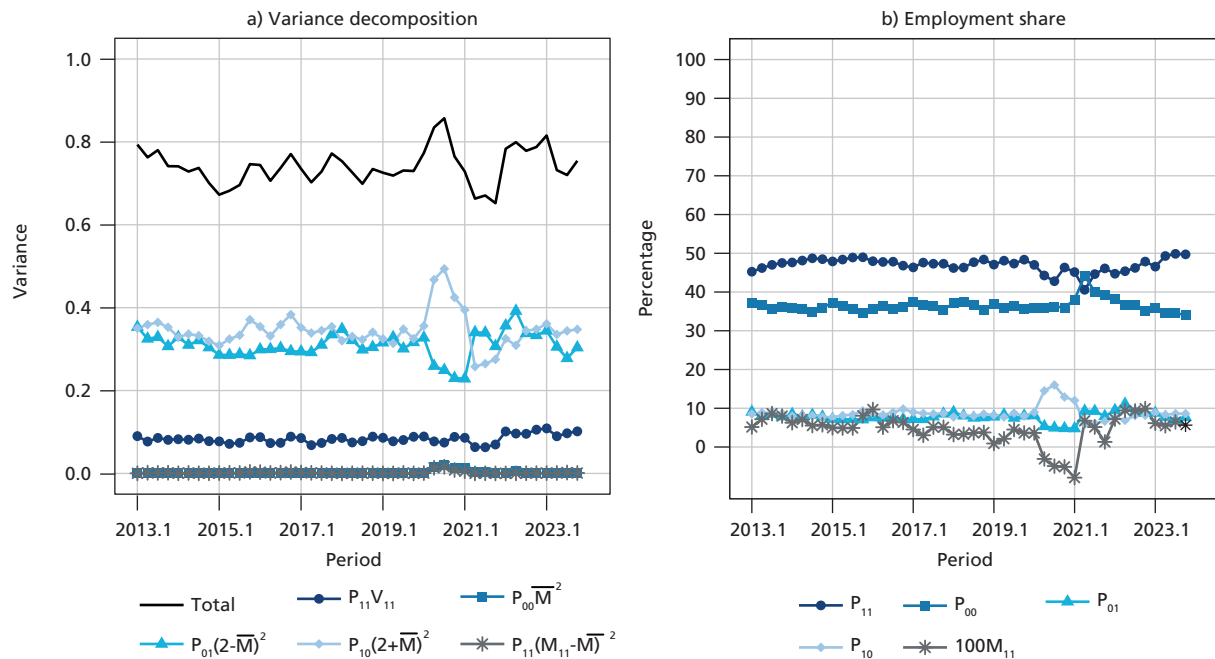
Authors' elaboration.

Obs.: Panel (a) shows the total variance of arc percent changes and the respective components estimated using the decomposition in equation (2). Panel (b) shows the share of each employment transition group in each period. The groups are: employed in both periods (11), nonemployed in both periods (00), or transitioned from employment to non-employment (10) and from nonemployment to employment (01). We restrict the sample to men only. The sample includes individuals with zero earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

These results partially contrast with those found by Ziliak, Hardy and Bollinger (2011) and Cappellari and Jenkins (2014) for the United States and the United Kingdom, respectively. The former shows that volatility among continuously employed workers accounts for the majority of labor market volatility in the United States, especially up to the 1990s. The latter find that transitions out of and into employment account for a larger share of labor market volatility in the United Kingdom, but their importance decreased in more recent periods and converged to levels similar to those of continuous workers.

These differences between Brazil and the United States and the United Kingdom are largely explained by the more common transitions out of and into employment in Brazil (panel b). While in the United States and the United Kingdom, between 80% and 90% of male workers remain employed in both periods, in Brazil these figures range from 60% to 80%. Approximately 10% of men transition to and out of employment in Brazil, while these proportions are around 5% in the United States and the United Kingdom.

Figure 8 shows the same results for women. They are somewhat similar to men if we consider the main contributors to labor market volatility. For women, transitions into and out of employment account for most of the volatility, and their share is larger than that observed for men. The main contrast is for participation in the labor market. The percentage of women employed in both periods is much lower than that of men, ranging between 40% and 50%. Moreover, nearly 40% of women remain nonemployed in both periods, due to their lower workforce participation rates. Women's participation in the labor market is higher in the United States and United Kingdom, approximately 60% to 70%, while nonparticipation ranges from 20% to 25% (Ziliak, Hardy and Bollinger, 2011; Cappellari and Jenkins, 2014). Transitions into and out of employment are also higher for Brazilian women in contrast to the United States or the United Kingdom. In Brazil, it is around 10%, while in these countries it is always below 10%.

**FIGURE 8****Decomposition of labor market volatility for women – Brazil**

Authors' elaboration.

Obs.: Panel (a) shows the total variance of arc percent changes and the respective components estimated using the decomposition in equation (2). Panel (b) shows the share of each employment transition group in each period. The groups are: employed in both periods (11), nonemployed in both periods (00), or transitioned from employment to non-employment (10) and from nonemployment to employment (01). We restrict the sample to men only. The sample includes individuals with zero earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

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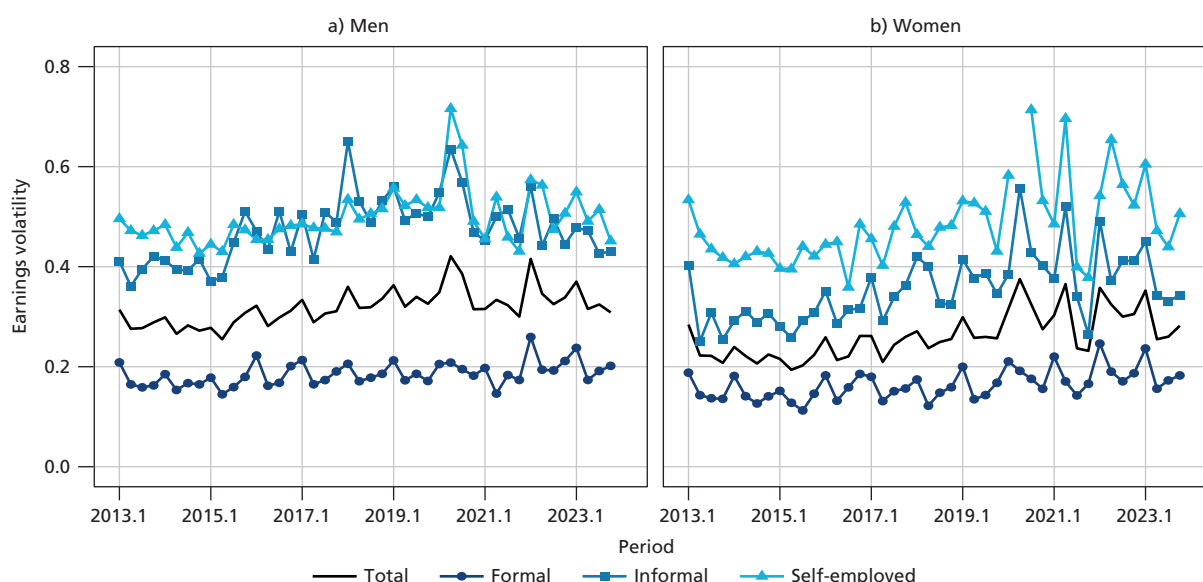
### 4.3 Type of employment

Informal labor markets are widespread in developing countries (La Porta and Shleifer, 2014; Ulyssea, 2020). Gomes, Iachan and Santos (2020) show that changes in log earnings across periods in Brazil are more dispersed and more negatively skewed among informal workers and those who transition to informality. Here, we investigate how earnings and labor market volatility also vary with the type of labor contract.

Figure 9 presents estimates of earnings volatility among workers grouped by type of employment in the first period. The solid black lines reproduce the results for all workers. Formal workers experience the lowest volatility levels, around 0.2 for men and women, with only small fluctuations throughout the period. There was little change during the 2014-2016 recession and even during the covid-19 pandemic. These values are much closer to those found in the United States, especially when researchers include imputed earnings information in their analysis (Ziliak, Hokayem and Bollinger, 2023).

**FIGURE 9**

**Earnings volatility by employment category in the first period – Brazil**



Authors' elaboration.

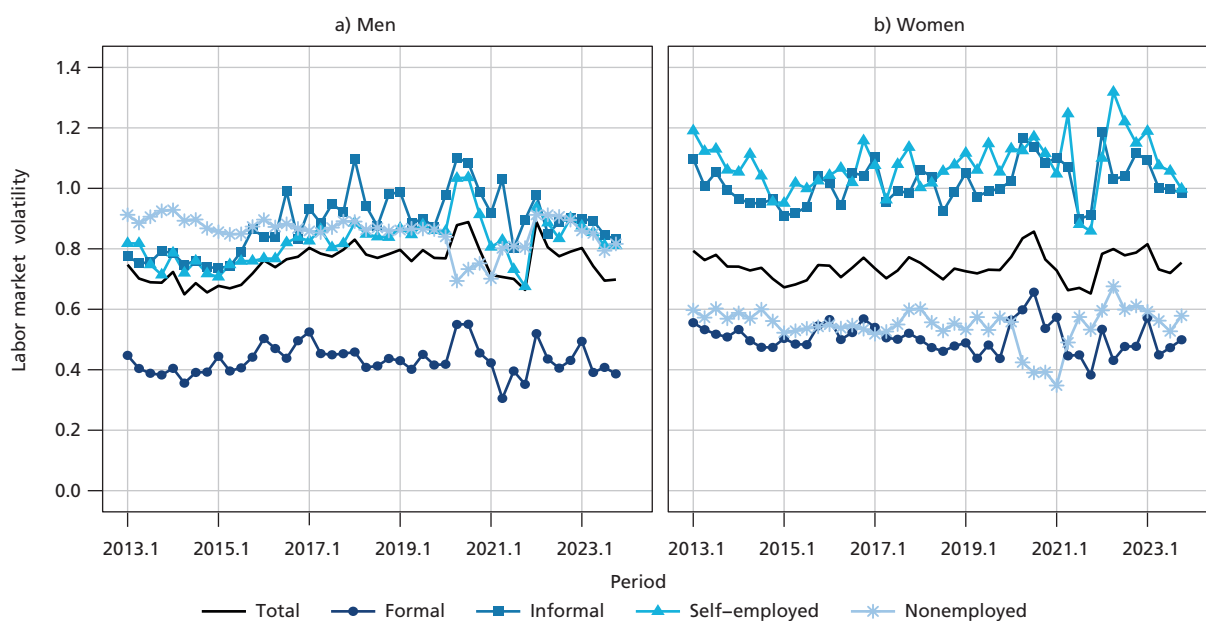
Obs.: Each panel presents the estimated volatility for the whole population; among workers employed in the formal sector; workers employed in the informal sector; and workers self-employed. We use employment status in the first period to classify workers. Panel (a) restricts the sample to men and panel (b) to women. The sample includes only individuals with positive earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter and trim the bottom and top 1% positive earnings each quarter. The years and quarters on the horizontal axis correspond to the last period when estimating volatility. Labels on the horizontal axes correspond to the final year of each panel cohort.

For men, earnings volatility for informal and self-employed workers are similar in level and tendency, and much higher than for formal workers. Furthermore, volatility for these groups varies more through the economic cycle, increasing after the recession in 2015 and during the pandemic, while declining considerably by 2021. For women, self-employment is more volatile than informal employment. During the pandemic, the rise in volatility was more pronounced for self-employed women, whereas for women in the informal sector, the increase during the recession was more sustained and lasting.

Figure 10 shows estimates for the broader concept of labor market volatility, including individuals with zero earnings in either or both periods. Correspondingly, we adapt the figure to add a group for nonemployment in the first period. For men, labor market volatility among nonemployed individuals in the first period is similar to that of informal and self-employed workers and above the level observed for formal workers. Volatility levels among all groups are higher than those observed when we restrict the analysis to those with positive earnings in both periods. For instance, labor market volatility for formal employees in the first period is twice as high when we allow for zero earnings than otherwise. Interestingly, when volatility increases during the pandemic, it increases for all groups, except the nonemployed. This is likely the result of a reduction in transitions into employment for this group, which reduces volatility for them.

Unlike men, female labor market volatility for the nonemployed is similar in magnitude to formal employees. This pattern results from lower participation in the workforce. There is a large share of women who are never employed and thus do not experience any volatility in pay. Hence, gender differences in the share of persistent nonemployment explain why we see similar overall levels of volatility for men and women, even though women experience higher volatility than men among all subgroups.

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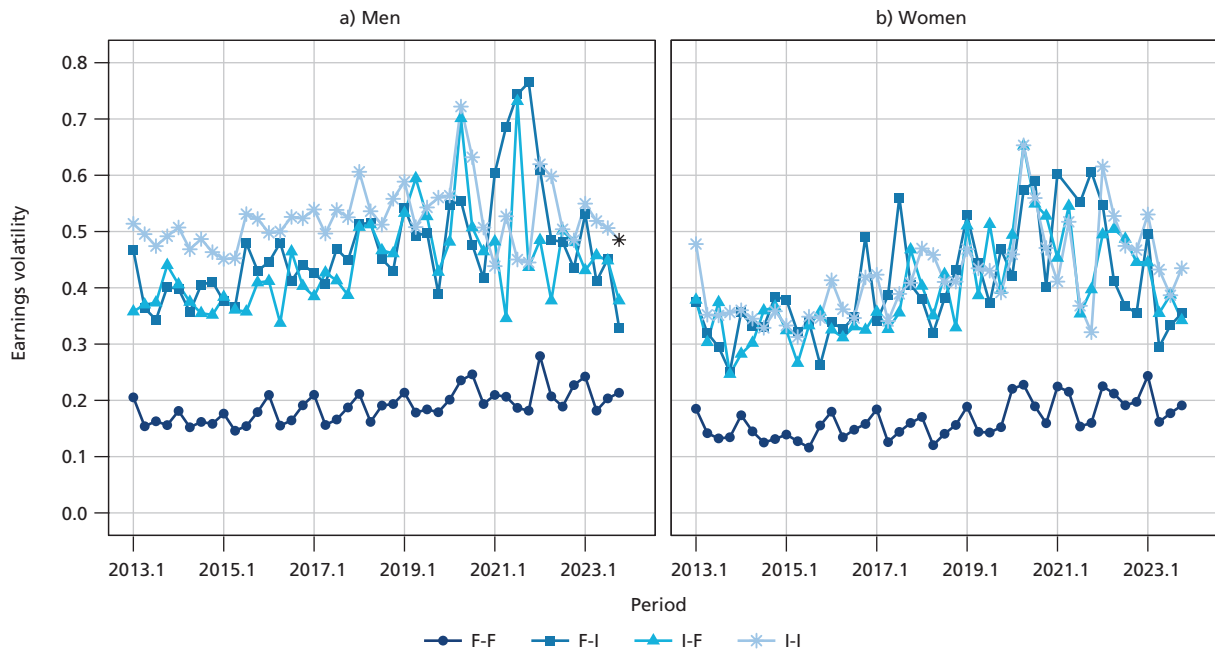
**FIGURE 10****Labor market volatility by employment category in the first period – Brazil**

Authors' elaboration.

Obs.: Each panel presents the estimated volatility for the whole population; among workers employed in the formal sector; workers employed in the informal sector; workers self-employed; nonemployed individuals. We use employment status in the first period to classify workers. Panel (a) restricts the sample to men and panel (b) to women. The sample also includes individuals with zero earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

Figure 11 reports earnings volatility taking into account the transitions between the first and second period across formality and informality, broadly defined.<sup>7</sup> For both men and women, we see that earnings volatility is larger for workers who transition across sectors or who remain in the informal sector. Workers who remain in the formal sector throughout both periods have lower levels of volatility, around 0.2 for men and ranging from 0.1 to 0.2 for women.

7. In this case, formal workers include those with formal labor contracts and self-employed workers who contribute to social security. Informal workers are those without labor contracts or self-employed who do not contribute to social security. We proceed this way to restrict the number of comparison groups.

**FIGURE 11****Earnings volatility by transitions between formal and informal employment – Brazil**

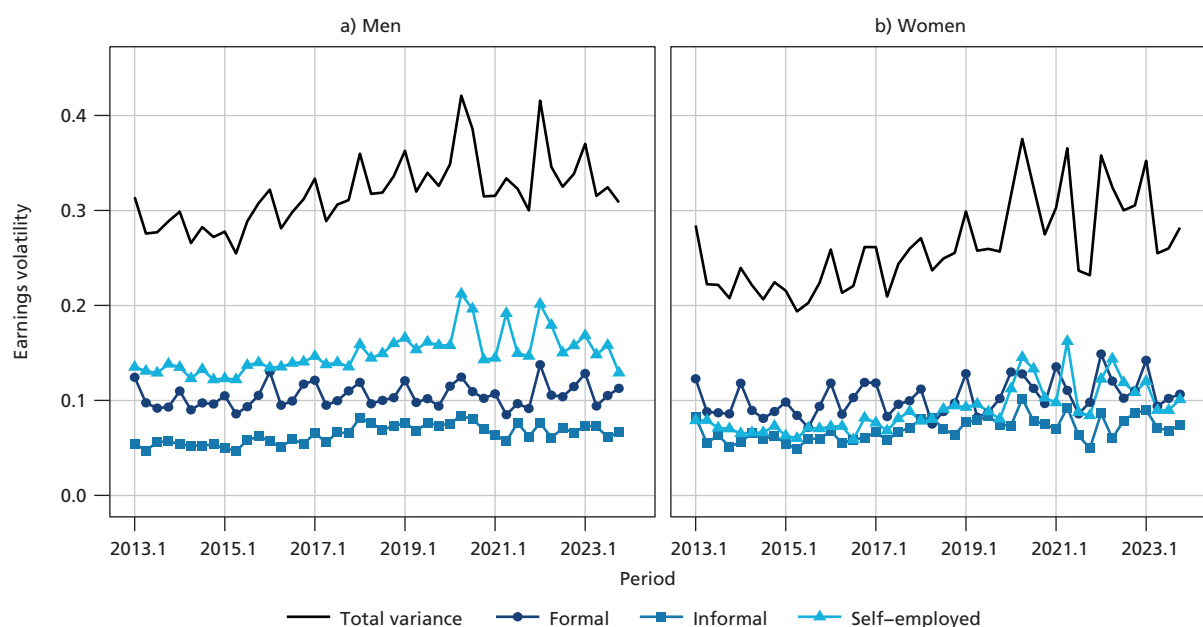
Authors' elaboration.

Obs.: We classify workers into four transitions: formal to formal (F-F); formal to formal (F-F); formal to formal (F-F); and formal to formal (F-F). Panel (a) restricts the sample to men and panel (b) to women. The sample includes individuals with positive earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort. We exclude the F-I point for women in 2021.2 because it was a clear outlier during the pandemic, with a volatility of 1.4.

Figure 12 shows decomposition results for earnings volatility, splitting the sample based on the form of labor market attachment in the first period and restricting the sample to those with positive earnings only. Among men, self-employment accounts for most of the earnings volatility throughout the period. Moreover, the large swings observed during the pandemic are mainly influenced by volatility for this group. Formal workers account for a relatively constant level of volatility for the entire period. Informal workers contribute the least, but their share increases disproportionately after 2016. These results are partially explained by the share of employment for each of these groups. More than half of male workers were formal, and self-employment is much more common than informal employment.



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**FIGURE 12****Decomposition of earnings volatility by employment status in the first period – Brazil**

Authors' elaboration.

Obs.: We classify workers based on their employment status in the first period. Panel (a) restricts the sample to men and panel (b) to women. The sample includes individuals with positive earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

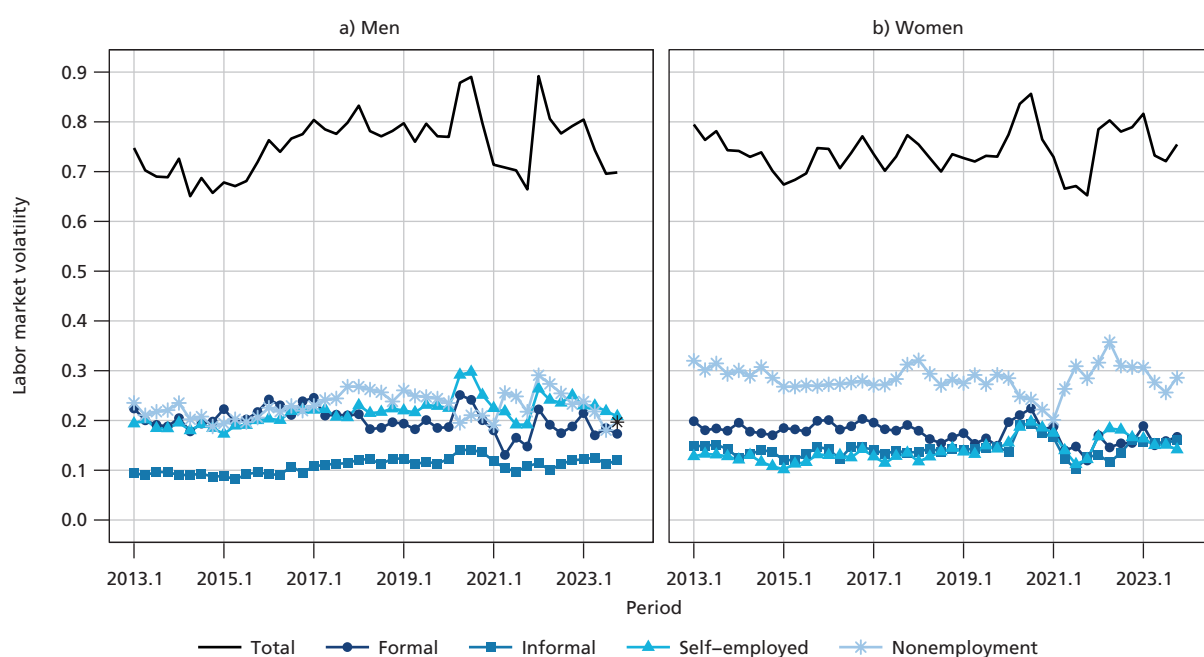
For women, the contribution of each group to earnings volatility was similar, with volatility associated with self-employment rising after the mid-2010s. Consequently, self-employment was the primary driver of changes in overall volatility in recent years, as we observed among men. Self-employment and informal jobs have similar employment shares among women, in contrast to men, for whom self-employment is more prevalent. The share of formal employment is similar for women and men.

Figure 13 shows analogous decomposition results for labor market volatility. For men, the share of volatility arising from formal employment, self-employment and non-employment is similar until 2017, when the contribution of formal jobs becomes smaller and nonemployment increases. The share of labor market volatility associated with informal employment rose gradually after 2017 as well. During the pandemic, the large swings in volatility are driven mostly by self-employed and formal workers, while non-employment reduced volatility in the first two years because of the large increase in long unemployment spells. The declining importance of formal jobs in explaining total volatility results partially from a decline in the share of men in this category, with corresponding increases in self-employment and nonemployment. The share of informal workers remained the same.

For women, the largest contribution to volatility arises from nonemployment. Many women not employed in the first period of each panel wave had paid jobs one year later, contributing to sizeable arc percent changes in earnings. The other three categories – formal employment, informal jobs, and self-employment – recorded comparable contributions to overall labor market volatility. This pattern became clearer towards the end of the 2010s as the contribution of formal employment diminished. Again, relatively low levels of participation coupled with the high prevalence of short-term spells in the labor market explain the outsized contribution of nonemployment among women. Notably, the share of women in each employment group remained more or less constant throughout the period. The only exception was a large increase in nonemployment in 2021, as a result of the pandemic.

**FIGURE 13**

**Decomposition of labor market volatility by employment status in the first period – Brazil**



Authors' elaboration.

Obs.: We classify workers based on their employment status in the first period. Panel (a) restricts the sample to men and panel (b) to women. The sample includes individuals with zero earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

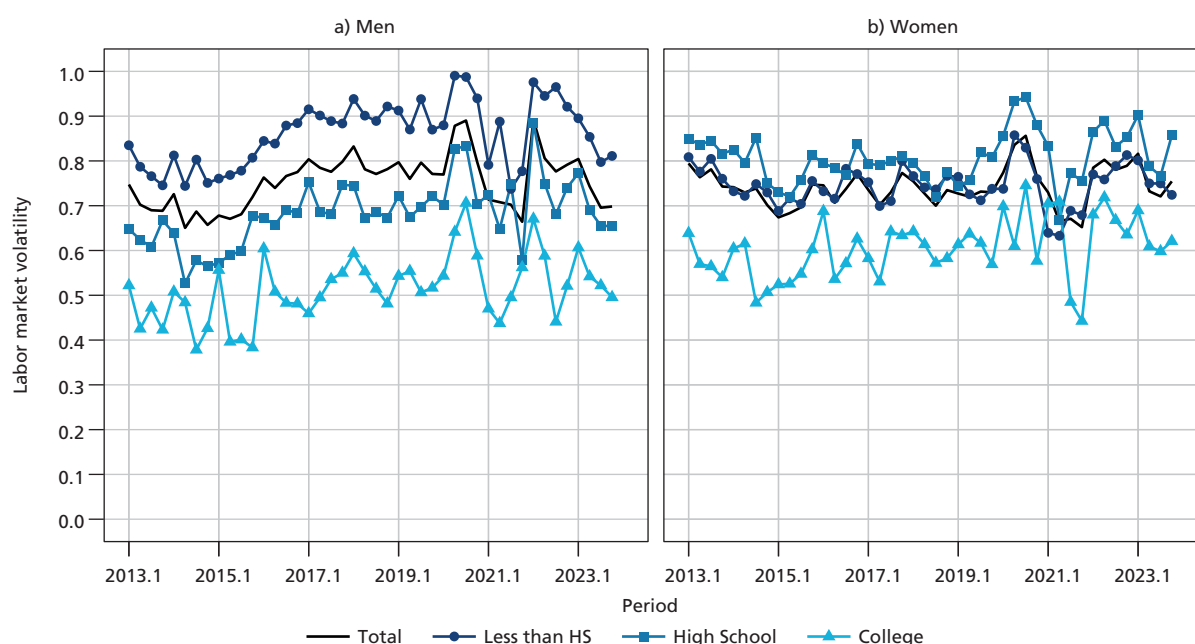
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#### 4.4 Demographic sub-groups

Figure 14 displays the labor market volatility among all workers and by three educational groups: individuals with less than high school, high school graduates, and college graduates. More educated individuals face smaller volatility in their earnings. The variance of the arc percent changes for male college-educated workers is around 0.5 throughout the period, although it became more volatile during the pandemic. Among workers who only completed high school, the corresponding figure was around 0.6 in the early 2010s, then increased over the decade, peaking at around 0.8 during the pandemic. Workers with less than high school started at a higher level (around 0.8), but followed a similar trend. In other words, college-educated workers fare better in income levels (as they typically earn more than less-educated workers in the cross-section) and income stability, especially during economic downturns.

**FIGURE 14**

**Labor market volatility by education level – Brazil**



Authors' elaboration.

Obs.: We classify individuals based on their educational attainment. The black solid line presents results for all individuals. Labels on the horizontal axes correspond to the final year of each panel cohort.

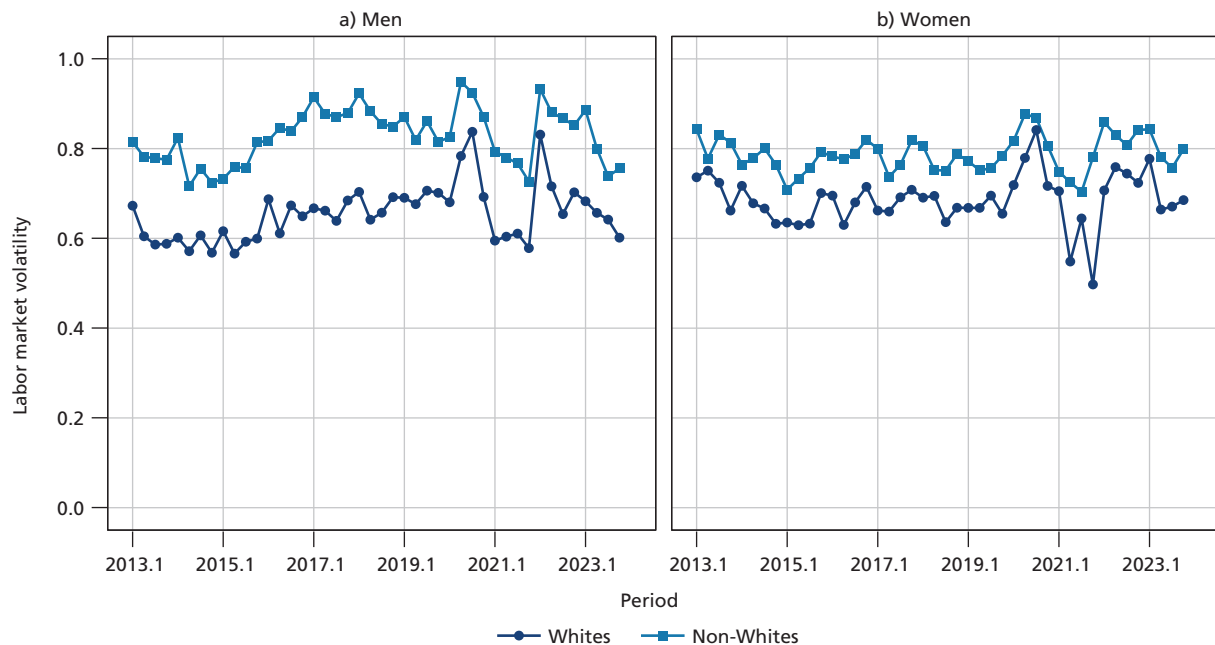
For women, labor market volatility is also lower among more educated workers (figure 14), but differences between high school dropouts and high school graduates are small, although they widened a bit in more recent years. In this case, lower volatility among high school dropouts likely reflects decreasing labor market participation among the least educated women, as there is no labor market volatility for individuals who are never employed. College-educated women experienced labor market volatility around 0.6 for most of the period, while volatility fluctuated between 0.7 and 0.8 for the other educational groups.

The relative stability of female labor market volatility is driven by an increase in the component explained by college and high school graduates and a decline in the share accounted by high school dropouts. This is to a large extent the result of a larger share of high school and college graduates in the population.

Ziliak, Hardy and Bollinger (2011) also report differences in labor market volatility in the United States between educational groups. Their estimates indicate similar levels of volatility for high school and college graduates, while high school dropouts display larger volatility. This holds for both men and women. Hence, while a high school diploma seems to provide similar protection against earnings risk to a college degree in the United States, in Brazil the labor market volatility of high school graduates is larger compared to college graduates.

Brazil is also marked by huge inequalities between White and non-White individuals, and the worse outcomes of non-White workers in the labor market are likely to manifest also in terms of higher earnings volatility. Ziliak, Hardy and Bollinger (2011) find that volatility levels for Black men and women in the United States are larger than their White counterparts, especially before the 2000s. Figure 15 presents estimates for labor market volatility by racial groups. Non-White workers experience more volatility than Whites, for men and women alike. For men, non-White volatility was around 0.7 and 0.8 in the early period, while it was around 0.6 for Whites. After the recession in 2015, volatility increases for both groups, but faster for non-Whites, reaching around 0.9 among them. For Whites, volatility remained below 0.7 before the pandemic. During the pandemic, both racial groups experiment similar swings, with non-White men always displaying higher volatility.

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**FIGURE 15****Labor market volatility by racial groups – Brazil**

Authors' elaboration.

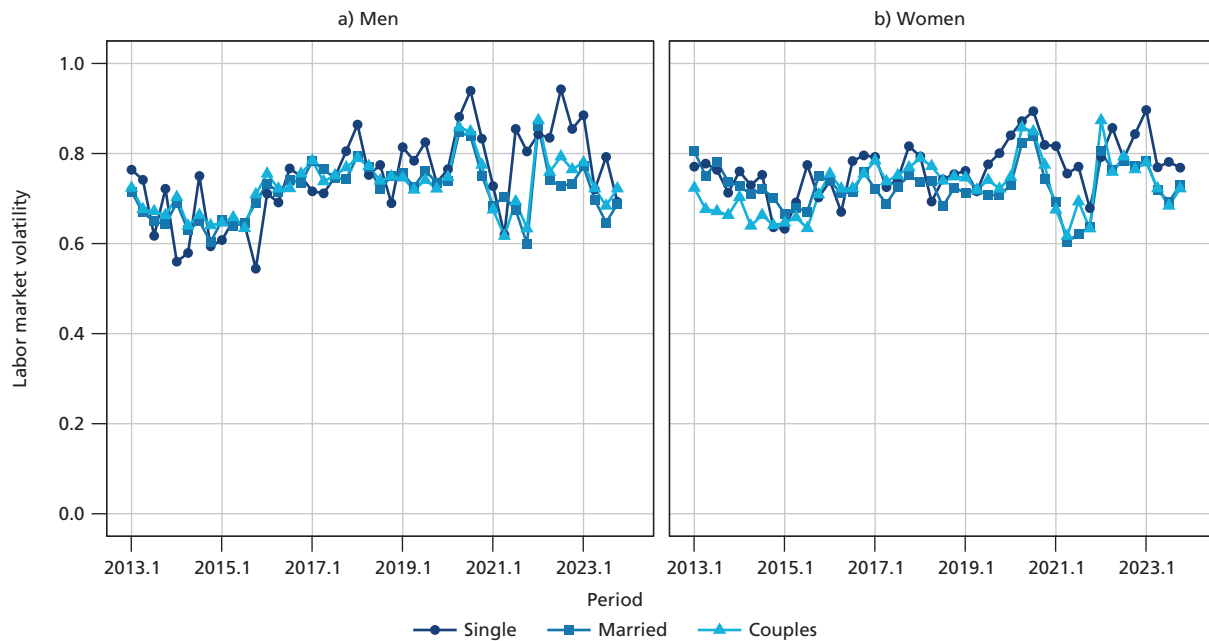
Obs.: Panel (a) restricts the sample to men and panel (b) to women. The sample includes individuals with zero earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

Panel (b) in figure 15 shows that labor market volatility is also higher for non-White than White women, although the racial gap is smaller than for men. Both groups display roughly constant volatility levels prior to the pandemic, with small changes during the 2015 recession. The racial gap in volatility levels narrowed briefly during the pandemic but widened afterward.

Finally, we investigate labor market volatility by marital status, as families are risk-pooling organizations that help buffer adverse earnings shocks. Marriage or cohabitation status<sup>8</sup> matters because couples may make interdependent decisions to stabilize welfare, as illustrated by the “added worker effect” when spouses either enter the labor force or work longer hours to offset earnings losses resulting from the involuntary unemployment of the primary earner (Western et al., 2012).

8. In this section, we refer to marriage and cohabitation interchangeably, that is, we define couples regardless of the relationship's legal status.

Figure 16 compares levels and trends in labor market volatility between groups defined by relationship status. We present volatility measures for individual earnings for singles and married individuals separately and add a series for couples based on the sum of earnings of both partners.<sup>9</sup> Results are similar for single and married men, as well as couples. Estimates are noisier for single men – possibly due to smaller sample sizes – but the trend is the same as for married men and couples, with rising volatility between 2015 and the pandemic. Single and married women also have very similar volatility levels and trends.

**FIGURE 16****Labor market volatility by marital status – Brazil**

Authors' elaboration.

Obs.: Panel (a) restricts the sample to men and panel (b) to women. The sample includes individuals with zero earnings in both periods. We adjust arc percent changes by age (quadratic) and quarter fixed effects and trim the bottom and top 1% positive earnings each quarter. Labels on the horizontal axes correspond to the final year of each panel cohort.

There are some contrasts between our results and analyses for the United States in Ziliak, Hardy and Bollinger (2011). They show that labor market volatility is higher for unmarried men throughout the period they investigated. Unmarried women also display larger earnings fluctuations, but less so. In Brazil, we see that the earnings volatility of married and single men and women are generally similar.

9. By definition, the volatility of couples is the same for both men and women.

## 5 CONCLUSION

In this study, we have provided a comprehensive analysis of earnings volatility in Brazil, a highly unequal developing country. Our findings indicate that earnings volatility in Brazil is significantly higher than in the United States and other advanced economies, a pattern that is exacerbated by the large informal labor market and high labor turnover. In particular, the volatility of male earnings exceeds that of female earnings, diverging from the typical pattern observed in high-income countries, although this result reverses when we incorporate periods of zero earnings in the analysis. In addition, our results corroborate previous findings on the countercyclical nature of earnings volatility, with larger income fluctuations during recessions and the covid-19 pandemic.

Our data allowed us not only to document the gross measures of earnings volatility for the whole population but also to explore the nuances introduced by different labor market attachments that are more common in emerging economies. We observed that informal and self-employed workers experience the most significant fluctuations in earnings, suggesting that the nature of informal work contributes substantially to the observed volatility. Moreover, we show how low-wage earners are significantly more exposed to labor market volatility. This is relevant information for the design of public safety nets in developing countries. Furthermore, our heterogeneity analysis shows how earnings volatility varies across educational, racial, and marital lines, revealing less volatility among individuals with higher educational attainment and White individuals, while marital status showed more nuanced effects.

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