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This article investigates gender differences in wage losses in Brazil resulting from job dismissal and periods of non-formal employment. It examines the wage dynamics of men and women to determine the occurrence and magnitude of these losses, as well as the subsequent recovery process upon returning to formal employment. Using administrative employer-employee data from 2003 to 2018, the study employs a matching strategy and event-study estimation to analyze the transitions from formal employment. Estimations are conducted separately for men and women. The findings reveal that both genders experience immediate and persistent wage losses after leaving formal employment. Women generally experience lower losses (7.4%) compared to men (10.5%), but men exhibit a faster recovery within the first three years after reentering formal employment. Additionally, longer periods of non-formal employment are associated with higher wage losses. Workers who voluntarily leave their jobs experience losses 60% lower than those who are dismissed, and they fully recover their wages within the second year after reentering formal employment. This study emphasizes the importance of examining job transitions and their impact on wages throughout individuals' careers, particularly concerning gender differentials.

Keywords: Wage differences, gender differences, job dismissal

JEL Codes: J16, J31, J63

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1 Introduction

Numerous studies address wage losses incurred by workers after a job dismissal. In addition to the immediate loss of job exit (loss of wages), there are persistent losses on associated future wages (FARBER, 2017). According to Jacobson, LaLonde and Sullivan (1993), there are three theoretical reasons to expect a loss of wages after a period of unemployment. The first is linked to the fact that the worker has specific skills from previous job but that may not be valued or even less productive in the new job. The second applies to the scenario in which the worker finds himself in a job that pays above-average wages and, after dismissal, starts working in a firm that offers an average wage. And, finally, the wages of dismissed workers may be lower in the long run if they have accepted a lower wage in their current job given future earnings from tenure. As a result, dismissal has a negative future effect driven by the previous decision.

The search for jobs with fewer hours or flexible hours also implies a loss of wages and potentially affects women disproportionately compared to men (MEEKES; HASSINK, 2020; FARBER, 2017). In addition, there are implications related to the reservation wages of workers. According to Ljungqvist and Sargent (2008), reservation wages can decrease over time, as human capital depreciates and the worker runs out his consumption reserves, such as unemployment insurance, indemnities, and personal savings. This would imply that reemployment wages decrease with the time of reallocation.

The measurement carried out in these studies comprises follow workers before dismissal and after their relocation, but is more commonly focused on men. With the increasing participation of women and awareness of the need for equal conditions in the labor market, the analysis of transitions between jobs and their effects on wages throughout life can support the discussion of gender differentials in a broader context.

This article addresses gender differentials in wage losses for workers facing job dismissal with time outside the formal employment in Brazil. The objective is to assess whether there are wage losses in this movement, the magnitude of it, and consequently, whether such losses are recovered after returning to formal employment and for how long.

To investigate these issues, the Annual Social Information Report (RAIS) will be used, an administrative employer-employee database which allows tracking workers with formal jobs over the period from 2003 to 2018. The empirical strategy consists of an event study around the moment of the worker's leaves formal employment, which combined with the attribution of control workers using propensity score matching, makes it possible to compare similar workers and analyze wage variations after relocation. As the interest is in the trajectories of men and women, the estimation is done separately by gender.

Such an approach still has scarce applications for developing countries. Using an employer-employee database for Mexico, Puggioni *et al.* (2022) show that workers' wages fall in the years before leaving formal employment, with this drop being slightly greater among men. Compared to individuals who have a continuous trajectory in formal employment and who have continuously increased wages, workers who leave formal employment, in addition to already having a lower salary, earn on average 18% less in the replacement and do not recover the previous wage level in the three years following the relocation. Such loss occurs in a similar magnitude between men and women.

The gender differential in wage losses is found in studies for developed countries. By comparing dismiss men and women from similar jobs and with similar earnings in Germany, Illing, Schmieder and Trenkle (2021) estimate that women experience wage losses about 35% greater than men. Furthermore, while there is some recovery in earnings losses for both genders relative to continuous trajectory workers, this recovery is slower for women, so the gender difference in wage losses grows substantially with time after the job loss.

Our estimation showed that in the case of Brazil, both genders suffer immediate and persistent penalties when comparing the wages trajectory before leaving formal employment and after relocation. When the time out of formal employment is only one year the wage loss is slightly less for women than for men, but recovery over time is more accelerated for men than for women. In the first year after returning to formal employment, the loss of women is 7.4%, compared to the wage level before leaving. The loss of men is 10.5% in the same comparison. The losses in the third year after returning to formal employment,

men show a reduction of 4.2pp and women of 3.4pp. Similar results are found when mover workers are analysis together independently of the time out of formal employment. The wage losses are 9.9% and 12.7% respectively for women and men. As expected, the longer the period out of formal employment the higher is the wage losses. Women present a lower loss than men no matter the number of years out of formal employment – except for 10 years when the losses for women are 25.8% and for men 24.0%.

In addition to the main analysis, this article proposes to investigate the wage losses of workers dismissed for different reasons. Thus, two sub-samples are used according to the initiative to end the work contract, either by the employer or the employee. The reason for leaving is relevant as voluntary exits reflect upward movements in the job ladder and wage gains, while involuntary exits may involve time away from formal work that can be costly in terms of wages (MOSCARINI; POSTEL-VINAY, 2018).

The reason for leaving the job is relevant in the magnitude of wage losses and the recovery of them after relocation in the formal sector in Brazil. Although not exempt from salary losses, voluntary exits imply smaller losses and, consequently, a faster recovery than involuntary ones. Losses after a voluntary exit are 60% lower than those recorded in the group dismissed at the employer initiative and are recovered in the third year after returning to formal employment, at least among women.

This study is organized into four sections, in addition to this introduction. Section 2 brings the empirical strategy with details regarding the data used and sample construction. Section 3 presents the results found, with descriptive analyses, econometric results, and heterogeneity and robustness exercises. Finally, section 4, brings the final considerations.

2 Empirical strategy

2.1 Database and sample

The main database is the Annual Social Information Report (RAIS), which is an employer-employee database that covers all firms with tax registration in Brazil, administered by the Ministry of Labor and Social Security. It enables a longitudinal analysis of workers in the formal sector and records personal characteristics (such as age, education, and gender), information regarding the employment contract (occupation, tenure, contracted hours, and nominal salary, in addition to dates of admission and dismissal) and about the employer (sector of activity, firm size, and location, for example).

The analysis covers the period from 2003 to 2018, and it is possible to follow each worker through Individual Taxpayer Registration (CPF). From the original data, observations without clear identification were excluded¹, as well as workers aged under 18 years or over 65 years. The raw dataset has more than 971 million observations over the combined sixteen years, covering approximately 107 million individuals.

Due to the high number of observations and to enable econometric analyzes, a random sample of 10% was selected, totaling 10.7 million workers. A data panel was then constructed for this sample and some filters were implemented to obtain only one observation per worker in each year. First, only workers employed on December 31 of each year and with declared income were kept in the sample. For cases with more than one work contract in the year in the same company, the one with the highest salary and the most recent date of admission were maintained. In the remaining cases with more than one contract in the year, but in different firms, the observations with higher wages and the number of contracted hours were maintained, which constitute, therefore, the worker's principal job. The sample construction process and the loss of observations are shown in Table A1 in the Appendix.

The final base includes just over 62 million observations, 9.5 million workers, with 57.0% being men. By analyzing the trajectories of these workers over time, we separate them into two groups, the non-movers, those who remain in the database all years after their first observation, and the movers, who present one or more gaps between years over his/her personal trajectory. Table 1 shows workers composition by group and

¹Observations with declaration errors or omission of data (i.e., CPF with inconsistent numbering equal to 0, 99, or any sequence of 11 equal digits). In addition, although the CPF is a unique identifier, a code containing the CPF, year of birth, and gender was created to track workers over time.

gender. 54.3% are non-movers and present an average of 5.6 years in the formal jobs, as shown in Figure 1(a). However, almost a third of this group has only one observation, while 10.4% have 16 observations, that is, they have a formal job in all 16 years analyzed².

The mover's group represents 45.7% of workers, with the number of jumps varying from one, covering 27.5% of workers, to a maximum of seven. The time outside the RAIS lasts an average of 3.6 years, as shown in Figure 1(b). It is worth mentioning that during this time outside formal employment, the worker may have gone through three possible situations: unemployment, employment in the informal sector, or acting as a partner in a firm, or even open his own firm (self-employment). As the RAIS only contains information on formal jobs, these possibilities cannot be analyzed using this database. However, as this is a relevant discussion point we deal with them using additional data

Among women, the group of non-movers is larger compared with men - 57.7% versus 51.8% - but apart from this fact, there are no relevant differences in the number of years with formal job or time outside the formal sector³.

Table A2 in the Appendix provides the profile of non-mover workers and movers and a comparison of available features. Initially, the comparison between the groups of workers for all observations and then considering only the year before the departure of formal employment for mover workers. In general, among movers, there is a higher incidence of young people, and individuals with a low level of education. In particular, more than 92% of movers do not have higher education when leaving formal employment.

As a result of these characteristics, workers movers are concentrated in occupations that require a lower skill level, such as those related to services and sales, officials, operators and craftsmen from construction industry, plant and machine operators, as well as occupations in agriculture. Even if they show a greater number of contracted hours, the movers consequently have less tenure and lower wages compared to non-moving workers.

Table 1: Workers composition by trajectory and gender

| | Total | Women | Men |
|---|---------|---------|---------|
| Non-movers | 54.3% | 57.7% | 51.8% |
| Movers | 45.7% | 42.3% | 48.2% |
| Movers by number of jumps between years | | | |
| 1 | 27.5% | 27.2% | 27.6% |
| 2 | 12.7% | 11.1% | 13.8% |
| 3 | 4.4% | 3.3% | 5.2% |
| 4 | 1.0% | 0.6% | 1.3% |
| 5 | 0.1% | 0.1% | 0.2% |
| 6 | 0.0095% | 0.0039% | 0.0138% |
| 7 | 0.0003% | 0.0001% | 0.0003% |

Source: Elaborated by the author based on a 10% random sample of RAIS between 2003 and 2018.

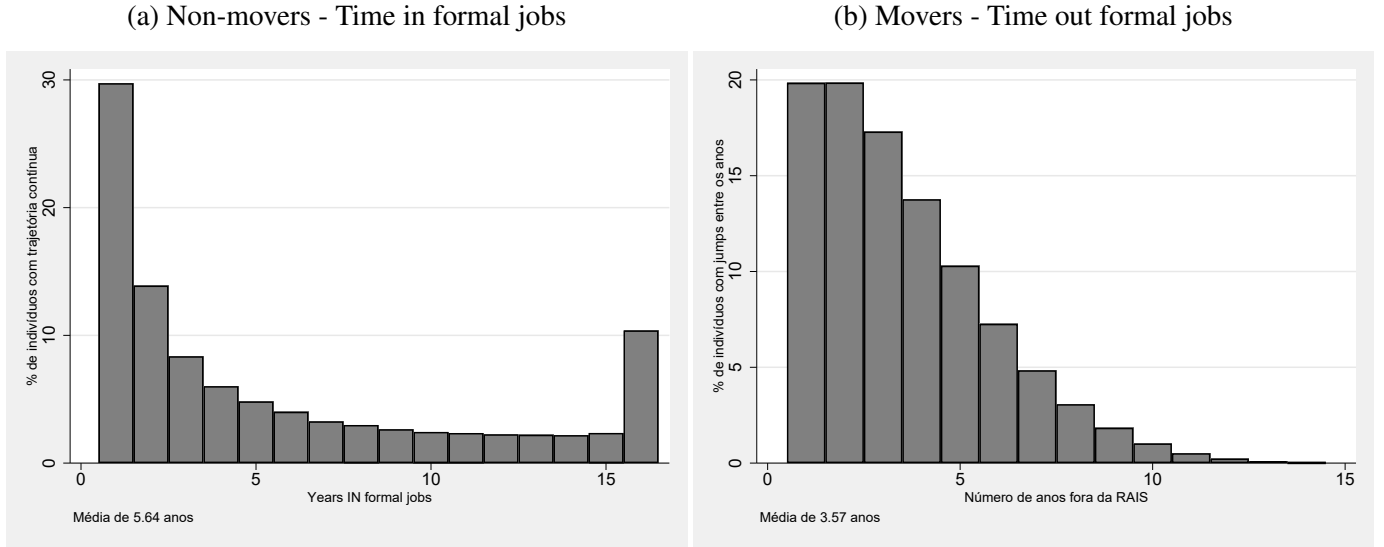
The data variety on workers' employment contracts allows us to identify the reason for leaving employment. We differentiate for each mover worker contract' ending between those done by employer initiative (hereafter, involuntary exits) and those in which the initiative came from the employee (hereafter, voluntary exits)⁴. Contract endings at the employer's initiative have a higher incidence, corresponding to more than 87% of total exits. By gender, they correspond to 89.3% of male workers and 84.3% of female workers.

²It is worth noting that the continuous trajectory identified here concerns being in a formal job and not in the same formal job over time. Thus, although the group of non-movers may have worked for different firms over time, there are no gaps between years as such jobs are formal.

³Figures B6 and B7 in the Appendix show the distribution of these indicators by gender in the sample.

⁴Additionally, it is also possible to differentiate the job endings motivated by the death and retirement of the employee. However, given that the intention is to analyze the periods after relocation, these cases were ignored.

Figure 1: Workers distribution by time in/out of formal jobs



Notes: Elaborated by the author based on a random sample of 10% of the RAIS between 2003 and 2018.

2.2 Econometric model

To analyze whether there are wage losses associated with the worker's transition to/from formal employment, we compared the wages before leaving and after returning to formal employment. The first specification starts from an event-study approach around the time of exit (Equation 1), evaluating the sample of workers with only one gap between years on his employment trajectory, 3 years before leaving and 3 years after returning⁵. Within the movers, 15.3% have this period window, which encompasses 655 million workers, as shown in Table A1 in the Appendix.

$$Y_{it} = \beta_0 + \sum_{\tau=-2}^3 \beta_{\tau} \mathbb{I}_{i,\tau} + \beta_1 \mathbf{X}_{it} + \eta_i + \eta_t + \eta_s + \eta_j + \epsilon_{it} \quad (1)$$

where Y_{it} is the average monthly salary in R\$⁶ (in logarithmic) of worker i in year t . The periods before leaving and after returning are captured by the variable $\mathbb{I}_{\tau} = \mathbb{1}[event = \tau]$, where $\tau = 0$ indicates the year immediately before leaving formal employment and $\tau = 1$ indicates the year of return. Matrix \mathbf{X} includes characteristics of individuals in t , age range and education level, both in 3 categories. The fixed effects for individual, year, macro-region, and industry (CNAE 5-dig) are represented respectively by η_i , η_t , η_s , and η_j . Finally, ϵ_{it} is the error term.

However, this specification may not be sufficient to understand whether the wages trajectory over time is specific to this group of workers. This is because the event of leaving formal employment can be correlated with other determinants of wage changes at the individual level. For this reason, the matching strategy was adopted, where each mover worker in the sample (treated) was assigned a control among workers who have a continuous trajectory in formal employment, and, from there, we compared the wage behavior between those groups.

The controls selection was based on the potential set of individuals with a continuous trajectory and at least the same number of years in formal employment. Thus, if a mover worker has only one year gap we find a control worker with at least 7 years from the set of non-movers; for a mover worker with a 4 years gap, the control worker must have at least 10⁷. This procedure is necessary to compare the wages between

⁵As shown in Table A2 in the Appendix, the average length of employment in the year before leaving employment is 3.1 years, so this window is suitable for this exercise.

⁶Temporarily corrected by the INPC at the January 2023 price level.

⁷Figure B8 in the Appendix illustrate the control workers attribution considering the number of years out of formal jobs for

treated and control workers in the same period of time, being the only difference between them the fact of mover workers lost their formal job, and returned after a period out of formal jobs.

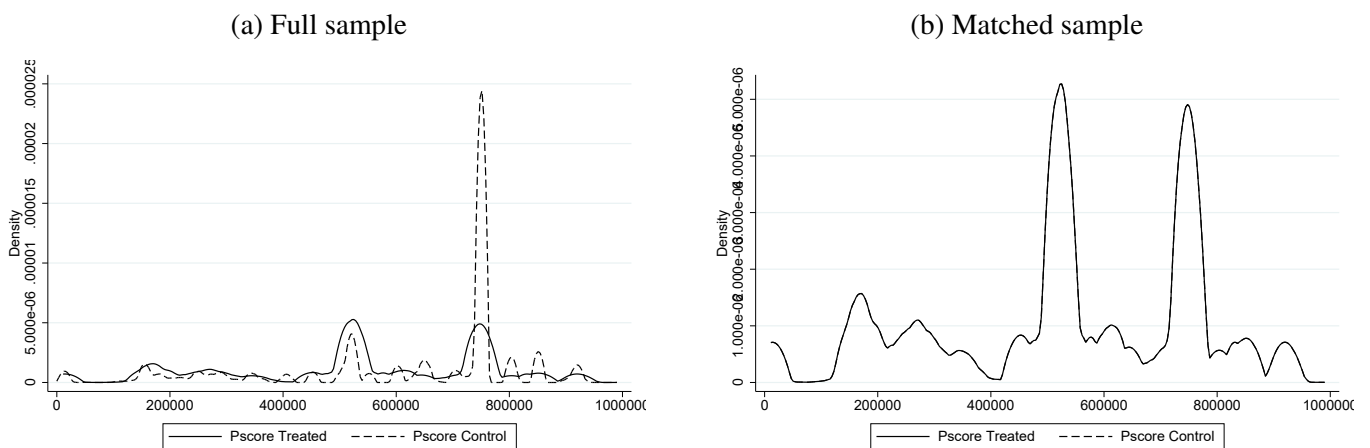
Subsequently, the propensity score was estimated using a logistic probability model, following the specification in Equation 2, given the set of selected covariates composed of age, school level, gender, industry (CNAE 5-dig), firm size, tenure (years), State and year. Treated workers were considered at $\tau = -2$, that is, the matching takes into account the characteristics 3 years before leaving and, for control workers, the year that begins a series of with the respective number of years of the treated.

$$p_i = Prob(mover = 1) = \Phi(Year_i, Age_i, Scho_i, Gender_i, Industry_i, Firmsize_i, Tenure_i, State_i) \quad (2)$$

Given the estimated propensity score, only workers in the common support were kept in the dataset, discarding control units (treated units) with an estimated propensity score lower than the minimum score (or greater than the maximum) estimated for the treated units (control units). Finally, the dataset was randomly ordered, and identified for the first worker treated the nearest neighbor in terms of propensity score. We started this procedure (pscore estimation and matching) with treated workers with 1 year gap (which corresponds to 67% of all group) using the whole set of potential controls with at least 7 years continuous trajectory. Once identified as control, the worker is exclude from the set of potential controls. This process was repeated for all group of treated workers, from 2 to 10 years out of formal job. Thus, the matching step is done with no replacement and each pair have the exactly same years in their trajectory⁸.

The final dataset encompasses 659,204 workers in both control and treated groups. Figure 2 presents propensity score estimates for when the group of treated workers have 1 year gap, first for the entire sample (panel a) and the matched sample (panel b), evidencing the overlap in the estimation. Also for this group, Table A3 in the Appendix shows worker's characteristics before and after matching. This table also show the after match comparison for the whole group of treated workers. Although there are still some differences in the profile of the two groups after matching, the chosen controls have characteristics closer to those presented by the treated ones. It is noted, however, that treated workers earn wages on average 17% lower.

Figure 2: Propensity Score Estimates: Treated workers with 1 year out of formal job



Notes: Elaborated by the author based on a random sample of 10% of the RAIS between 2003 and 2016. Estimation of Equation 2 considering workers with only one gap in their formal employment trajectory, with at least 3 years before leaving and 3 years after leaving return (treated), and workers with a continuous trajectory of 6 years (controls).

We want to compare wage behavior between treated and control workers. After matching process, we expect moving and non-movers workers to behave similarly in the absence of treatment. The estimation will

mover wokers.

⁸Note that Non-mover workers can have more than one series of years, for example, a non-mover with 16 observations can have up to 10 different series of 7 observations and so can potentially be attributed to up to 7 treated workers with 1 year gap).

proceed in a differences-in-differences approach with fixed effects, following the specification of Equation 3:

$$Y_{it} = \beta_0 + \delta_\tau \mathbb{R}_{i,\tau} + \gamma_\tau^{treated} (\mathbb{R}_\tau * \mathbb{I}_{i,treated}) + \beta_1 \mathbf{X}_{it} + \eta_i + \eta_t + \eta_s + \eta_j + \epsilon_{it} \quad (3)$$

where the variable $\mathbb{I}_{i,treated}$ indicates the treatment of each individual i , and \mathbb{R}_τ indicates the periods after the worker's relocation. Interest is precisely in the interaction between these two variables ($\gamma_\tau^{treated}$) which will indicate the wage loss in the treated group after returning to formal employment. The other variables are the same as in Equation 1. To capture wage differentials over time, the event-study strategy is applied, adapting the first specification to include the treatment identification:

$$Y_{it} = \sum_{\tau=-2}^3 \beta_\tau \mathbb{I}_\tau + \sum_{\tau=-2}^3 \beta_\tau^{treated} (\mathbb{I}_\tau * \mathbb{I}_{i,treated}) + \beta_1 \mathbf{X}_{it} + \eta_i + \eta_t + \eta_s + \eta_j + \epsilon_{it} \quad (4)$$

where $\mathbb{I}_{treated}$ is added interacting with period identification. This specification 4 allows us to verify the pre-trends in wages and the effects after returning to formal employment, captured by the coefficients $\beta_\tau^{treated}$. Standard deviations were clustered at the individual and sector-year levels. Estimation is done separately for men and women. Furthermore, additional estimations are carried out after dividing the sample according to the reason for leaving formal employment.

3 Results

3.1 Wage differences in the formal employment trajectory

Our interest is to identify the effects caused by leaving formal employment on workers' wages, and for that, Equation 3 was estimated after matching and the results are shown in Table 2. We first show the results for the group of treated workers with one year out of formal employment (Panel a) and then for all treated workers (Panel b). The wage loss of mover workers is approximately 8.9% compared to the level before leaving formal employment when the time out of formal employment is only one year. For the whole group the losses reach 10.9%, being a little higher for men than for women – 11.8% versus 9.5%.

To verify the pre-trends in wages and the effects after returning to formal employment, we turn our attention to the estimation of Equation 4 and plot the coefficients $\beta_\tau^{treated}$. Figure 3 shows the wage differences for workers with only one gap between years in their employment trajectory, and at least 3 years before leaving and 3 years after returning, compared to their respective control workers. Here, the moment $t = 0$ refers to the year immediately before leaving formal employment and, therefore, $t = 1$ the year of return. Panel (a) shows the results for the group of treated workers with one year out of formal employment and Panel (b) for all treated workers.

In the period before leaving formal employment, wages show a decreasing behavior, both for men and women, that is, wages behave similarly in the periods that precede the exit from formal employment. The wage loss in the first year after returning to formal employment (Figure 3-a), compared to the year before the leaving, reaches 9.3% and although it reduces in subsequent years, it is not enough to return to the level before leaving formal employment, at least in the first 3 years. The wages losses for movers is still 5.5% in the third year after return. The behavior is similar between genders, with smaller losses for women from the first year - loss of 7.4% versus 10.5% respectively for women and men. Still, men show a slightly faster recovery. Comparing the losses in the first and third years after returning to formal employment, men show a reduction of 4.2pp and women of 3.4pp.

A similar scenario are shown when all mover workers are taking together (Figure 3-b), but as expected, the higher time out of formal employment causes higher wage losses. It reaches 12.7% for men and 9.87% for women. To explore how relevant is the period a worker stay out of formal employment, we estimate the Equation 4 separately for each group of workers from 1 to 10 years out of formal employment. Figure 4 shows the results by gender and, as expected, the longer the period out of formal employment the higher

is the wage losses. Women present a lower loss than men no matter the number of years out of formal employment – except for 10 years when the losses for women are 25.8% and for men 24.0%.

Table 2: Effects on wages - DID

| | Total | Women | Men |
|---|--------------------------|--------------------------|-------------------------|
| Dep. Var.: ln(Average monthly wage) | (1) | (2) | (3) |
| Panel (a): treated workers with 1 year gap | | | |
| Re-enter | -0.00926*** (0.00116) | -0.00786*** (0.00144) | -0.0105*** (0.00132) |
| Re-enter*Treated | -0.0896*** (0.00269) | -0.0725*** (0.00364) | -0.100*** (0.00213) |
| Observations | 5,296,836 | 2,049,139 | 3,247,692 |
| R-squared | 0.912 | 0.910 | 0.911 |
| Panel (b): all treated workers | | | |
| Re-enter | 0.0313*** (0.00119) | 0.0302*** (0.00159) | 0.0314*** (0.00138) |
| Re-enter*Treated | -0.109*** (0.00269) | -0.0948*** (0.00376) | -0.118*** (0.00204) |
| Observations | 7,910,448 | 3,193,400 | 4,717,044 |
| R-squared | 0.905 | 0.902 | 0.904 |
| Individual FE | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| State FE | Yes | Yes | Yes |
| Controls | Yes | Yes | Yes |

Notes: Prepared by the author based on a random sample of 10% of the RAIS between 2003 and 2018. Estimation of Equation 3 for the complete sample and separately by gender, after matching procedure. Standard errors are grouped at the worker and sector-year levels.

3.2 Reasons for leaving the job

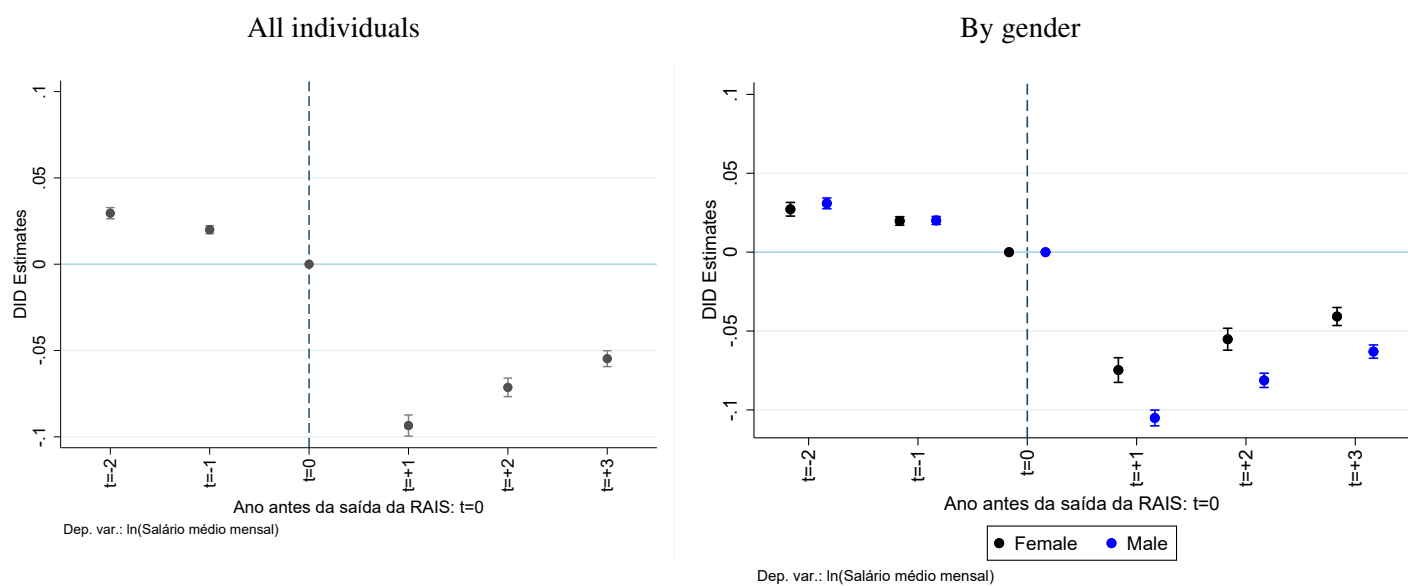
To test whether wages can have different trajectories according to the reason for leaving the job, we divided the movers two groups: workers dismissed on the employer initiative and those by the initiative of the employee. Control workers were assigned to the respective reason for leaving of their treated pair and, based on this identification, the model proposed by Equation 4 was again estimated separately by gender⁹ and considering all treated workers together.

The effects differences are relevant, as shown in Figure 5. In the group of workers in which the dismissal initiative was the employer's, we see behavior like that observed previously. Wage losses reach 12.8% for women and 15.3% for men and, at the end of the three years, still reach 8.6% and 10.0% respectively. In the group of workers who opted to voluntary end their employment, the estimated loss in the year of replacement is 4.9% for women and 6.2% for men. Such losses are more than 60% lower than those recorded in the group dismissed on the initiative of the employer. Furthermore, in the second year after returning to formal employment, both women and men fully recover the loss and their wages reach the same level as in the previous job when the exit is voluntary. this recovering did not occur in the involuntary exits case, at least in the first three years.

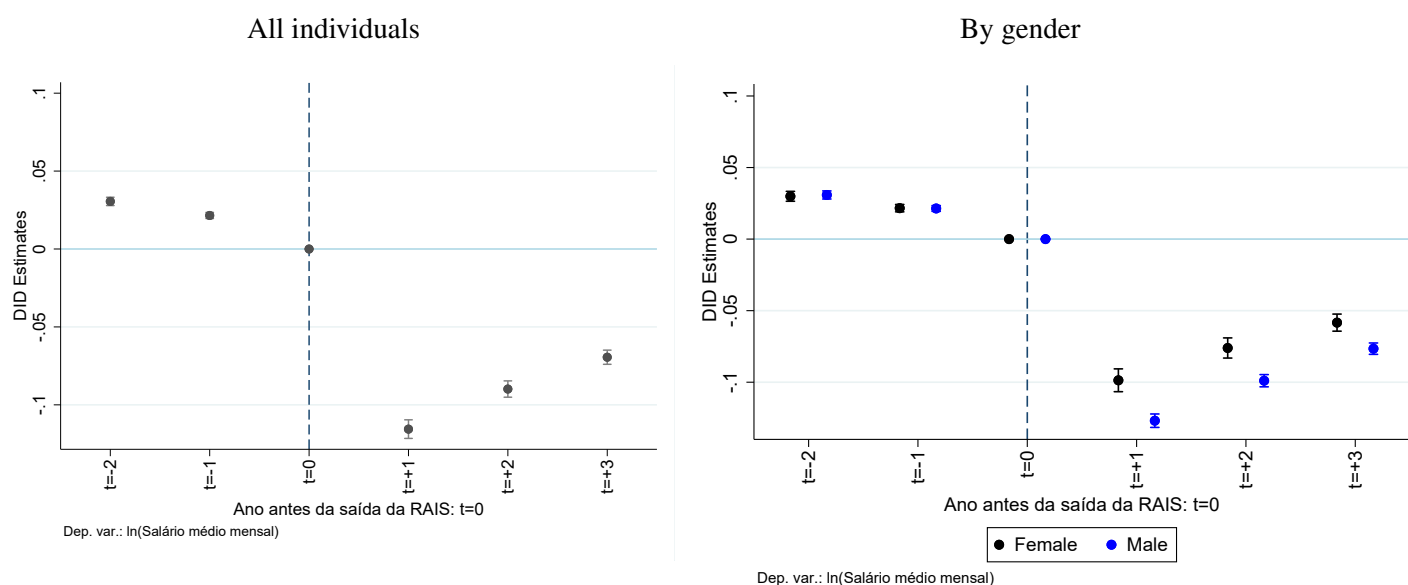
⁹As described above, most layoffs are initiated by the employer. In the matched sample, the number of cases with this reason reaches 86.1% of women and 90.1% of men

Figure 3: Effects on wages - Event study

(a) Treated workers with 1 year gap



(b) All treated workers



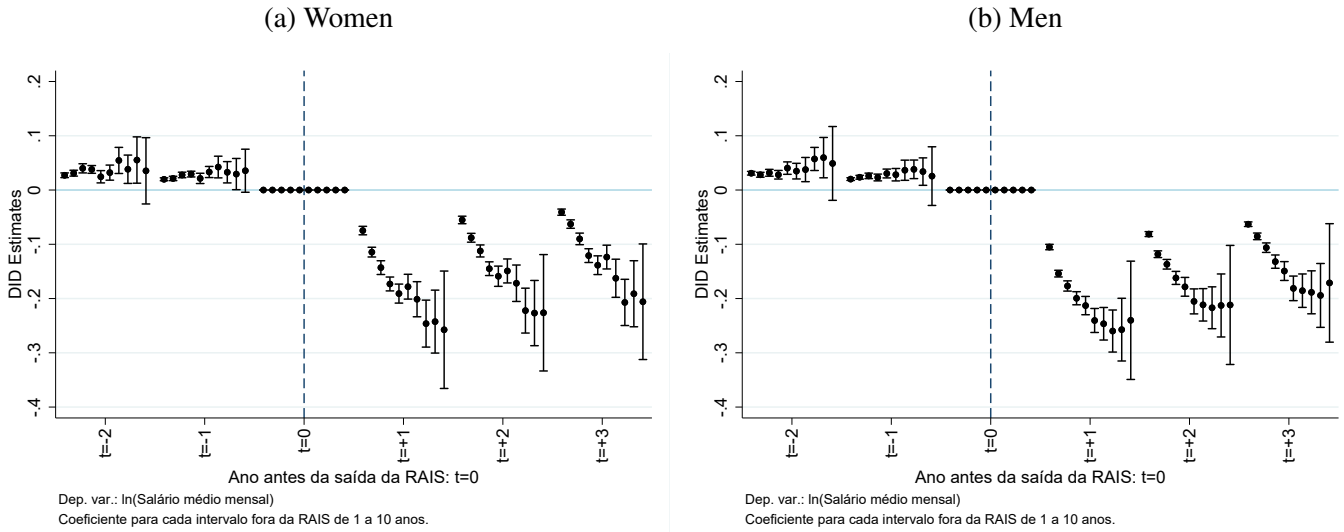
Notes: Elaborated by the author based on a random sample of 10% of the RAIS between 2003 and 2018. Coefficients $\beta_T^{treated}$ of Equation 4 estimated for the complete sample and separately by gender, after matching procedure. Table A4 brings the complete result of the estimation. Standard errors are grouped at the worker and sector-year levels. 95% confidence intervals.

Thus, as the majority of movers are involuntary exits they impact the overall results we saw in last section. These results are consistent with evidence from the literature. Although not exempt from salary losses, it is observed that voluntary exits imply smaller losses and, consequently, a faster recovery than involuntary ones.

4 Final remarks

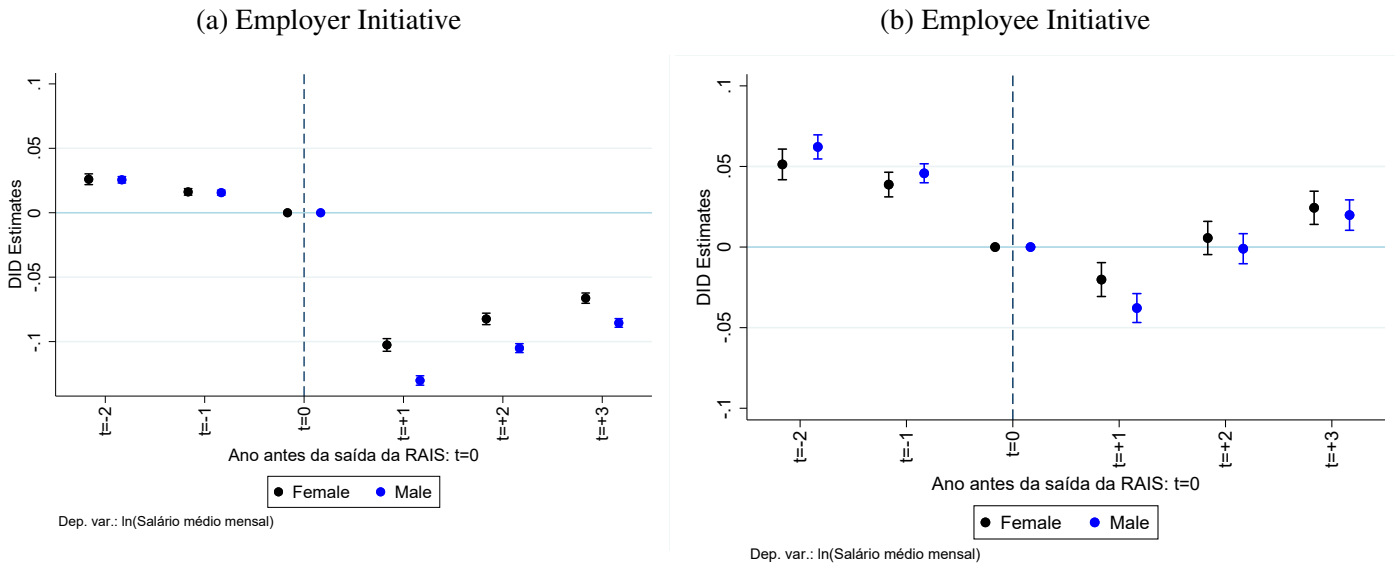
In this article, wage losses after dismissal from formal employment are analyzed by comparing the wage dynamics of workers with exits and time out of formal employment and those who have a continuous trajectory. From a sample of workers with only one exit from formal employment and at least three years

Figure 4: Effects on wages - Event study: by the number of years out of formal employment



Notes: Elaborated by the author based on a random sample of 10% of the RAIS between 2003 and 2018. Coefficients $\beta_{\tau}^{treated}$ of Equation 4 estimated separately by gender and time out of formal employment, after matching procedure. Standard errors are grouped at the worker and sector-year levels. 95% confidence intervals.

Figure 5: Effects on wages, by reason for leaving the job - Event study



Notes: Prepared by the author based on a random sample of 10% of the RAIS between 2003 and 2018. The coefficients $\beta_{\tau}^{treated}$ of Equation 4 are estimated separately by gender and reason for leaving the job, after matching procedure. Standard errors are grouped at the worker and sector-year levels. 95% confidence intervals.

before leaving and three years after returning, control workers were assigned to each of them and the effects on wages were estimated.

By separately estimating men and women, we observed that both suffer immediate and persistent penalties when comparing the wages trajectory before leaving formal employment and after relocation. For women, the loss is slightly less than for men, but recovery over time is more accelerated for men than for women.

The reason for leaving the job is relevant in the magnitude of wage losses and the wages recovering after the replacement, a result consistent with the evidence in the literature. Although not exempt from salary losses, it is observed that voluntary exits imply smaller losses and, consequently, a faster recovery than

involuntary ones. Losses after a voluntary exits are 60% lower than those recorded in the group dismissed by employer initiative and are recovered in the third year after returning to formal employment, at least among women.

The measurement carried out in this article takes into account transitions between formal jobs, and it is not possible to identify the situation of the worker in periods outside of formal employment. To complement this analysis, additional exercises will be carried out with different databases that allow (i) to understand if the worker chose to be partner of a firm or a self-employed and (ii) to understand the transitions involving the replacement in a formal job, the time unemployed or opting for inactivity.

Furthermore, considering that it is possible that leaving formal employment is not completely exogenous in terms of gender, we intend to re-estimate the effects for specific sub-samples of workers in which the exit occurred due to firms mass-layoff events.

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Appendices

A Additional tables

Table A1: Construction of the database - RAIS

| | | Observations | | Loss | | Individuals | |
|-----------------------------|---|--------------|--------|-------------|-------|-------------|--------|
| | | Absolute | % | Absolute | % | Absolute | % |
| | | (1) | (2) | (5) | (6) | (3) | (4) |
| Sample cutting steps | | | | | | | |
| | Total Observations of RAIS | 994,236,771 | 100.0% | | | | |
| Step 1 | Fill Errors | 987,176,433 | 99.3% | 7,060,338 | 0.7% | | |
| Step 2 | Below 18 or above 65 years old | 971,034,378 | 97.7% | 16,142,055 | 1.6% | 107,561,365 | 100.0% |
| Step 3 | 10% Random Sample of Individuals | 97,133,652 | 9.8% | 873,900,726 | 87.9% | 10,756,137 | 10.0% |
| Pannel construction | | | | | | | |
| Step 4 | Non-employed in December 31st | 65,573,366 | 6.6% | 31,560,286 | 3.2% | | |
| Step 5 | Without wages | 64,717,507 | 6.5% | 855,859 | 0.1% | | |
| Step 6 | Same firm, different wages only | 64,618,075 | 6.5% | 99,432 | 0.0% | | |
| Step 7 | Same firm, more recente contract | 64,274,366 | 6.5% | 343,709 | 0.0% | | |
| Step 8 | Principal job | 62,167,368 | 6.3% | 2,106,998 | 0.2% | 9,516,108 | 8.8% |
| Final Sample | | | | | | | |
| | Total | | | | | 9,516,108 | |
| | Women | | | | | 4,089,131 | 43.0% |
| | Men | | | | | 5,426,977 | 57.0% |
| <hr/> | | | | | | | |
| | Non-Movers | 29,163,305 | 2.9% | | | 5,169,019 | 54.3% |
| | With at least 7 years trajectory | 21,151,888 | 2.1% | 8,011,417 | 27.5% | 1,712,024 | 18.0% |
| <hr/> | | | | | | | |
| | Movers | 33,004,063 | 3.3% | | | 4,347,089 | 45.7% |
| | With at least 3 years before and after formal employment exit | 3,991,056 | 0.4% | 29,013,007 | 87.9% | 665,176 | 15.3% |
| | By number of years out of formal job before returning | | | | | | |
| | 1 year | 2,671,902 | 66.9% | | | 445,317 | 66.9% |
| | 2 years | 673,614 | 16.9% | | | 112,269 | 16.9% |
| | 3 years | 290,802 | 7.3% | | | 48,467 | 7.3% |
| | 4 years | 153,600 | 3.8% | | | 25,600 | 3.8% |
| | 5 years | 88,272 | 2.2% | | | 14,712 | 2.2% |
| | 6 years | 53,070 | 1.3% | | | 8,845 | 1.3% |
| | 7 years | 31,422 | 0.8% | | | 5,237 | 0.8% |
| | 8 years | 17,166 | 0.4% | | | 2,861 | 0.4% |
| | 9 years | 8,280 | 0.2% | | | 1,380 | 0.2% |
| | 10 years | 2,928 | 0.1% | | | 488 | 0.1% |

Source:: Elaborated by the author based on RAIS data.

Table A2: Workers profile by type of trajectory

| Variable | Non-movers | Movers (all years) | Diff. | Movers (year before dismissal) | Diff. |
|------------------------------------|-------------------|--------------------|--------------|--------------------------------|--------------|
| | Mean / share | Mean / share | | Mean / share | |
| Men | 55% | 61% | 0.06781*** | 61% | 0.06861*** |
| Age | 37.9 | 34.3 | -3.60324*** | 31.1 | -6.78192*** |
| Age 18-24 | 16.0% | 17.9% | 0.01888*** | 31.5% | 0.15443*** |
| Age 25-44 | 52.7% | 64.8% | 0.12090*** | 56.8% | 0.04159*** |
| Age 45-65 | 31.3% | 17.3% | -0.13978*** | 11.7% | -0.19602*** |
| Incomplete Secondary | 33.6% | 37.7% | 0.04099*** | 45.4% | 0.11786*** |
| Complete Secondary | 44.2% | 50.4% | 0.06172*** | 47.4% | 0.03244*** |
| Complete Tertiary | 22.2% | 11.9% | -0.10271*** | 7.2% | -0.15030*** |
| Years OUT of formal jobs | 0.0 | 3.1 | 3.07003*** | 3.6 | 3.60733*** |
| Years IN formal jobs | 5.6 | 7.6 | 1.95028*** | 5.8 | 0.17787*** |
| Tenure (years) | 6.5 | 4.5 | -2.06014*** | 3.1 | -3.37441*** |
| Contracted hours (week) | 40.4 | 42.2 | 1.82545*** | 42.5 | 2.12842*** |
| Average monthly wage | 2,307.6 | 1,541.5 | -7.66e+02*** | 1,086.9 | -1.22e+03*** |
| Wages in December | 2,432.7 | 1,602.4 | -8.30e+02*** | 1,102.3 | -1.33e+03*** |
| Directors and managers | 5.3% | 4.1% | -0.01208*** | 3.4% | -0.01913*** |
| Scientific and intellectual | 12.8% | 6.5% | -0.06346*** | 4.4% | -0.08420*** |
| Mid-level technicians | 12.8% | 8.8% | -0.04004*** | 7.1% | -0.05724*** |
| Administrative support staff | 20.1% | 19.2% | -0.00929*** | 19.7% | -0.00351*** |
| Service workers, market vendors | 22.5% | 25.4% | 0.02913*** | 26.3% | 0.03876*** |
| Farmers and skilled agricultural | 2.8% | 4.3% | 0.01497*** | 5.2% | 0.02421*** |
| Officials, operators and craftsmen | 15.2% | 24.0% | 0.08858*** | 26.1% | 0.10932*** |
| Plant and machine operators | 3.2% | 3.9% | 0.00717*** | 4.1% | 0.00895*** |
| Elementary occupations | 2.7% | 2.9% | 0.00182*** | 3.0% | 0.00245*** |
| Not specified | 2.6% | 0.9% | -0.01679*** | 0.6% | -0.01962*** |
| Obs | 29,163,305 | 33,004,063 | | 5,641,375 | |

Notes: Elaborated by the author based on a random sample of 10% of the RAIS between 2003 and 2018. Salary values in R\$ are temporally corrected by the INPC at the January 2023 price level.

Table A3: Control x Treated Units

| Variable | Treated workers with 1 year out of formal job | | | | | | All treated workers | | |
|------------------------------|---|-----------|--------------|----------------|-----------|--------------|---------------------|-----------|--------------|
| | Before matching | | | After matching | | | After matching | | |
| | Potential controls | Treatment | | Treat = 0 | Treat = 1 | | Treat = 0 | Treat = 1 | |
| | Share | Share | Diff. | Share | Share | Diff. | Share | Share | Diff. |
| Male | 0.56 | 0.61 | 0.05710*** | 0.61 | 0.61 | 0.00 | 0.60 | 0.60 | 0.00 |
| | [0.0002] | [0.0007] | | [0.0007] | [0.0007] | | [0.0006] | [0.0006] | |
| Age | 37.3 | 32.0 | -5.30750*** | 32.6 | 32.0 | -0.56343*** | 33.4 | 31.8 | -1.54407*** |
| | [0.0030] | [0.0147] | | [0.0160] | [0.0148] | | [0.0135] | [0.0120] | |
| Age 18-24 | 0.11 | 0.28 | 0.16971*** | 0.29 | 0.28 | -0.00591*** | 0.28 | 0.29 | 0.00978*** |
| | [0.0001] | [0.0007] | | [0.0007] | [0.0007] | | [0.0006] | [0.0006] | |
| Age 25-44 | 0.63 | 0.58 | -0.04169*** | 0.54 | 0.58 | 0.04414*** | 0.52 | 0.59 | 0.06225*** |
| | [0.0001] | [0.0007] | | [0.0008] | [0.0007] | | [0.0006] | [0.0006] | |
| Age 45-65 | 0.26 | 0.13 | -0.12802*** | 0.17 | 0.13 | -0.03823*** | 0.20 | 0.13 | -0.07203*** |
| | [0.0001] | [0.0005] | | [0.0006] | [0.0005] | | [0.0005] | [0.0004] | |
| Incomplete Secondary | 0.33 | 0.43 | 0.09160*** | 0.40 | 0.42 | 0.02534*** | 0.40 | 0.43 | 0.02703*** |
| | [0.0001] | [0.0007] | | [0.0007] | [0.0007] | | [0.0006] | [0.0006] | |
| Incomplete Tertiary | 0.42 | 0.47 | 0.05261*** | 0.47 | 0.48 | 0.00951*** | 0.46 | 0.47 | 0.01670*** |
| | [0.0001] | [0.0007] | | [0.0008] | [0.0008] | | [0.0006] | [0.0006] | |
| Complete Tertiary | 0.24 | 0.10 | -0.14421*** | 0.13 | 0.10 | -0.03485*** | 0.14 | 0.10 | -0.04373*** |
| | [0.0001] | [0.0004] | | [0.0005] | [0.0005] | | [0.0004] | [0.0004] | |
| Years OUT of formal jobs | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.68 | 1.68479*** |
| | [0.0000] | [0.0000] | | [0.0000] | [0.0000] | | [0.0000] | [0.0016] | |
| Years IN formal jobs | 14.06 | 6.00 | -8.06417*** | 12.39 | 6.00 | -6.38585*** | 12.60 | 6.00 | -6.60231*** |
| | [0.0008] | [0.0000] | | [0.0049] | [0.0000] | | [0.0038] | [0.0000] | |
| Tenure (years) | 16.06 | 8.05 | -8.01634*** | 11.34 | 8.06 | -3.28257*** | 12.05 | 7.65 | -4.40203*** |
| | [0.0026] | [0.0095] | | [0.0112] | [0.0095] | | [0.0096] | [0.0075] | |
| Contracted hours (week) | 39.80 | 42.08 | 2.27527*** | 41.93 | 42.07 | 0.13850*** | 41.86 | 42.07 | 0.21185*** |
| | [0.0020] | [0.0075] | | [0.0078] | [0.0076] | | [0.0065] | [0.0062] | |
| Wages (monthly, mean) | 1,903.99 | 1,178.38 | -7.26e+02*** | 1,371.25 | 1,182.16 | -1.89e+02*** | 1,366.81 | 1,133.61 | -2.33e+02*** |
| | [0.7712] | [2.3931] | | [2.8996] | [2.4104] | | [2.3645] | [1.9267] | |
| Wages in Dec (monthly, mean) | 2,053.46 | 1,253.03 | -8.00e+02*** | 1,460.53 | 1,257.18 | -2.03e+02*** | 1,459.91 | 1,203.76 | -2.56e+02*** |
| | [0.8759] | [2.6875] | | [3.2187] | [2.7069] | | [2.6459] | [2.1553] | |
| Region | | | | | | | | | |
| North | 0.05 | 0.05 | 0.00218*** | 0.03 | 0.05 | 0.02063*** | 0.03 | 0.05 | 0.01739*** |
| | [0.0001] | [0.0003] | | [0.0003] | [0.0003] | | [0.0002] | [0.0003] | |
| North East | 0.19 | 0.17 | -0.02254*** | 0.14 | 0.17 | 0.02519*** | 0.15 | 0.17 | 0.01768*** |
| | [0.0001] | [0.0006] | | [0.0005] | [0.0006] | | [0.0004] | [0.0005] | |
| Mid West | 0.08 | 0.08 | -0.00536*** | 0.06 | 0.08 | 0.01386*** | 0.06 | 0.08 | 0.01404*** |
| | [0.0001] | [0.0004] | | [0.0004] | [0.0004] | | [0.0003] | [0.0003] | |
| South East | 0.51 | 0.53 | 0.02019*** | 0.63 | 0.53 | -0.10869*** | 0.60 | 0.53 | -0.07156*** |

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Table A3 – continued from previous page

| Variable | Treated workers with 1 year out of formal job | | | | | | All treated workers | | |
|--------------------|---|-----------|-------------|----------------|-----------|-------------|---------------------|-----------|-------------|
| | Before matching | | | After matching | | | After matching | | |
| | Potential controls | Treatment | | Treat = 0 | Treat = 1 | | Treat = 0 | Treat = 1 | |
| | Share | Share | Diff. | Share | Share | Diff. | Share | Share | Diff. |
| South | [0.0002] | [0.0007] | | [0.0007] | [0.0008] | | [0.0006] | [0.0006] | |
| | 0.17 | 0.18 | 0.00552*** | 0.13 | 0.18 | 0.04901*** | 0.15 | 0.17 | 0.02245*** |
| | [0.0001] | [0.0006] | | [0.0005] | [0.0006] | | [0.0004] | [0.0005] | |
| Industry | | | | | | | | | |
| Agriculture | 0.03 | 0.04 | 0.01632*** | 0.04 | 0.04 | 0.00 | 0.04 | 0.04 | 0.00 |
| | [0.0000] | [0.0003] | | [0.0003] | [0.0003] | | [0.0002] | [0.0002] | |
| Manufacturing | 0.16 | 0.22 | 0.05308*** | 0.22 | 0.22 | 0.00 | 0.22 | 0.22 | 0.00 |
| | [0.0001] | [0.0006] | | [0.0006] | [0.0006] | | [0.0005] | [0.0005] | |
| Construction | 0.02 | 0.04 | 0.02002*** | 0.04 | 0.04 | 0.00 | 0.04 | 0.04 | 0.00 |
| | [0.0000] | [0.0003] | | [0.0003] | [0.0003] | | [0.0002] | [0.0002] | |
| Trade | 0.13 | 0.28 | 0.15407*** | 0.29 | 0.29 | 0.00 | 0.29 | 0.29 | 0.00 |
| | [0.0001] | [0.0007] | | [0.0007] | [0.0007] | | [0.0006] | [0.0006] | |
| Transportation | 0.05 | 0.06 | 0.01009*** | 0.06 | 0.06 | 0.00 | 0.06 | 0.06 | 0.00 |
| | [0.0001] | [0.0004] | | [0.0004] | [0.0004] | | [0.0003] | [0.0003] | |
| Financial Services | 0.03 | 0.01 | -0.01742*** | 0.01 | 0.01 | 0.00 | 0.02 | 0.02 | 0.00 |
| | [0.0001] | [0.0002] | | [0.0002] | [0.0002] | | [0.0002] | [0.0002] | |
| Personal Services | 0.18 | 0.19 | 0.01471*** | 0.19 | 0.19 | 0.00 | 0.20 | 0.20 | 0.00 |
| | [0.0001] | [0.0006] | | [0.0006] | [0.0006] | | [0.0005] | [0.0005] | |
| Public Sector | 0.37 | 0.12 | -0.25021*** | 0.12 | 0.12 | 0.00 | 0.11 | 0.11 | 0.00 |
| | [0.0001] | [0.0005] | | [0.0005] | [0.0005] | | [0.0004] | [0.0004] | |
| Domestic services | 0.00 | 0.00 | 0.00007*** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | [0.0000] | [0.0000] | | [0.0000] | [0.0000] | | [0.0000] | [0.0000] | |
| Other Sectors | 0.04 | 0.03 | -0.00073*** | 0.03 | 0.03 | 0.00 | 0.04 | 0.04 | 0.00 |
| | [0.0001] | [0.0003] | | [0.0003] | [0.0003] | | [0.0002] | [0.0002] | |
| Firm size | | | | | | | | | |
| Zero | 0.03 | 0.08 | 0.04172*** | 0.07 | 0.07 | 0.00378*** | 0.08 | 0.08 | 0.00768*** |
| | [0.0001] | [0.0004] | | [0.0004] | [0.0004] | | [0.0003] | [0.0003] | |
| Up to 4 | 0.05 | 0.09 | 0.04689*** | 0.09 | 0.09 | 0.00602*** | 0.09 | 0.10 | 0.00827*** |
| | [0.0001] | [0.0004] | | [0.0004] | [0.0004] | | [0.0003] | [0.0004] | |
| From 5 to 9 | 0.06 | 0.11 | 0.04862*** | 0.10 | 0.10 | 0.00686*** | 0.10 | 0.11 | 0.00829*** |
| | [0.0001] | [0.0005] | | [0.0004] | [0.0005] | | [0.0004] | [0.0004] | |
| From 10 to 19 | 0.08 | 0.13 | 0.04921*** | 0.12 | 0.13 | 0.00471*** | 0.12 | 0.13 | 0.00524*** |
| | [0.0001] | [0.0005] | | [0.0005] | [0.0005] | | [0.0004] | [0.0004] | |
| From 20 to 49 | 0.07 | 0.10 | 0.03263*** | 0.10 | 0.10 | -0.00 | 0.10 | 0.10 | 0.00 |
| | [0.0001] | [0.0005] | | [0.0005] | [0.0005] | | [0.0004] | [0.0004] | |
| From 50 to 99 | 0.09 | 0.11 | 0.01578*** | 0.11 | 0.11 | -0.00413*** | 0.11 | 0.11 | -0.00310*** |
| | [0.0001] | [0.0005] | | [0.0005] | [0.0005] | | [0.0004] | [0.0004] | |
| From 100 to 249 | 0.10 | 0.10 | -0.00368*** | 0.10 | 0.10 | -0.00179*** | 0.10 | 0.10 | -0.00149*** |
| | [0.0001] | [0.0005] | | [0.0005] | [0.0005] | | [0.0004] | [0.0004] | |

Continued on next page

Table A3 – continued from previous page

| Variable | Treated workers with 1 year out of formal job | | | | | | All treated workers | | |
|----------------------|---|---------------------|-------------|---------------------|---------------------|-------------|---------------------|---------------------|-------------|
| | Before matching | | | After matching | | | After matching | | |
| | Potential controls | Treatment | | Treat = 0 | Treat = 1 | | Treat = 0 | Treat = 1 | |
| | Share | Share | Diff. | Share | Share | Diff. | Share | Share | Diff. |
| From 250 to 499 | [0.0001] 0.11 | [0.0004] 0.08 | -0.02280*** | [0.0004] 0.08 | [0.0004] 0.08 | -0.00 | [0.0004] 0.08 | [0.0004] 0.08 | -0.00115** |
| From 500 to 999 | [0.0001] 0.33 | [0.0004] 0.17 | -0.16841*** | [0.0004] 0.18 | [0.0004] 0.17 | -0.00920*** | [0.0003] 0.19 | [0.0003] 0.17 | -0.01937*** |
| 1000 or more | [0.0001] 0.08 | [0.0006] 0.04 | -0.03996*** | [0.0006] 0.05 | [0.0006] 0.04 | -0.00550*** | [0.0005] 0.04 | [0.0005] 0.03 | -0.00456*** |
| N Individuals | [0.0001] 10,879,744 | [0.0003] 445,317 | | [0.0003] 441,403 | [0.0003] 441,403 | | [0.0002] 659,204 | [0.0002] 659,204 | |

Notes: Prepared by the author based on a random sample of 10% of the RAIS between 2003 and 2018, a sub-sample of workers with only one gap in their formal employment trajectory, with at least 3 years before leaving and 3 years after returning (treated) and workers with a continuous trajectory (controls). Salary values in R\$ are temporally corrected by the INPC at the January 2023 price level.

Table A4: Effects on wages - Event study

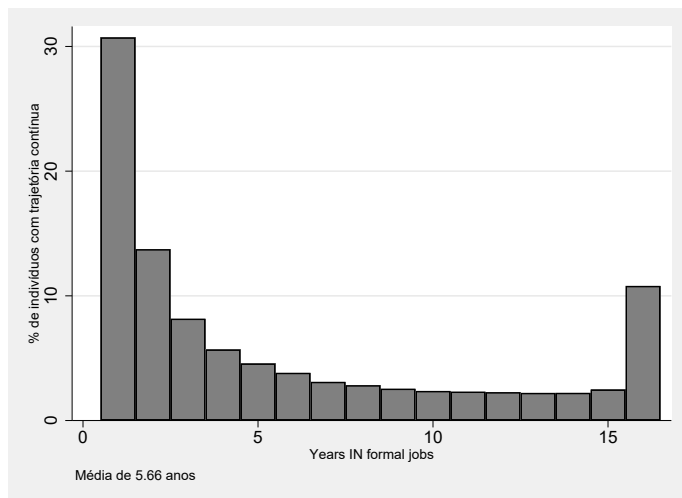
| Dep. Var.: ln(Average monthly wage) | Total (1) | Women (2) | Men (3) |
|---|-------------------------|-------------------------|-------------------------|
| Panel (a): treated workers with 1 year gap | | | |
| t = -2 *Treated | 0.0296*** (0.00165) | 0.0272*** (0.00221) | 0.0309*** (0.00174) |
| t = -1 *Treated | 0.0200*** (0.00119) | 0.0198*** (0.00138) | 0.0201*** (0.00129) |
| t = 1 *Treated | -0.0935*** (0.00312) | -0.0747*** (0.00399) | -0.105*** (0.00255) |
| t = 2 *Treated | -0.0713*** (0.00273) | -0.0552*** (0.00354) | -0.0813*** (0.00230) |
| t = 3 *Treated | -0.0547*** (0.00235) | -0.0408*** (0.00291) | -0.0630*** (0.00215) |
| Observations | 5,296,836 | 2,049,139 | 3,247,692 |
| R-squared | 0.912 | 0.910 | 0.911 |
| Panel (b): all treated workers | | | |
| t = -2 *Treated | 0.0305*** (0.00136) | 0.0299*** (0.00176) | 0.0308*** (0.00144) |
| t = -1 *Treated | 0.0215*** (0.00100) | 0.0216*** (0.00132) | 0.0214*** (0.00104) |
| t = 1 *Treated | -0.116*** (0.00304) | -0.0987*** (0.00407) | -0.127*** (0.00240) |
| t = 2 *Treated | -0.0899*** (0.00267) | -0.0761*** (0.00359) | -0.0990*** (0.00218) |
| t = 3 *Treated | -0.0694*** (0.00232) | -0.0584*** (0.00305) | -0.0766*** (0.00203) |
| Observations | 7,910,448 | 3,193,400 | 4,717,044 |
| R-squared | 0.906 | 0.903 | 0.905 |
| Individual FE | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| State FE | Yes | Yes | Yes |
| Controls | Yes | Yes | Yes |

Notes: Elaborated by the author based on a random sample of 10% of the RAIS between 2003 and 2018. Estimation of Equation 4 for the complete sample and separately by gender, after the matching procedure. Standard errors are grouped at the worker and sector-year levels.

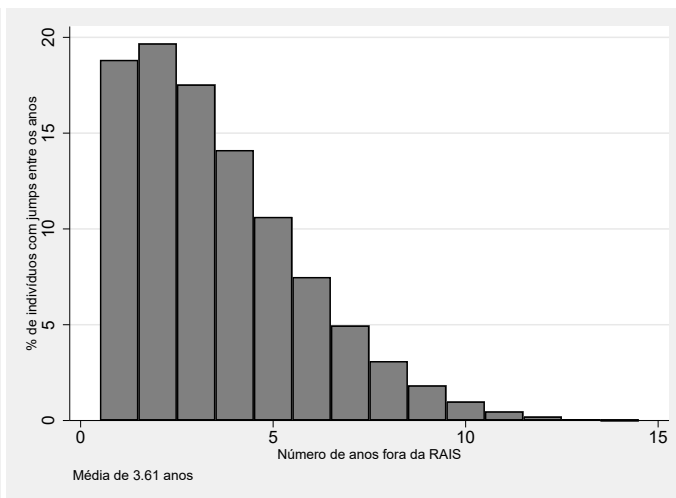
B Additional figures

Figure B6: Workers distribution by trajectory - Men

(a) Non-movers - Time in formal employment



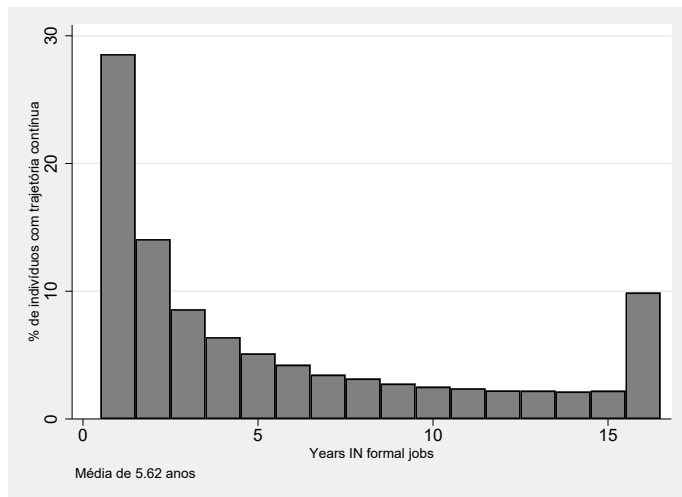
(b) Movers - Time out of formal employment



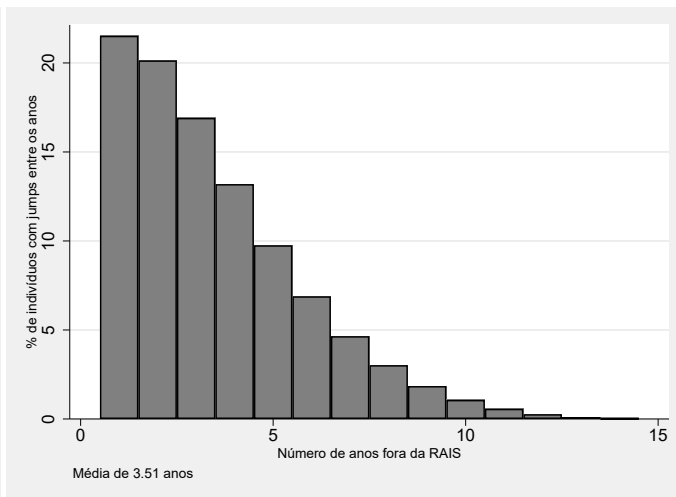
Notes: Elaborated by the author based on a random sample of 10% of the RAIS between 2003 and 2018.

Figure B7: Workers distribution by trajectory - Women

(a) Non-movers - Time in formal employment

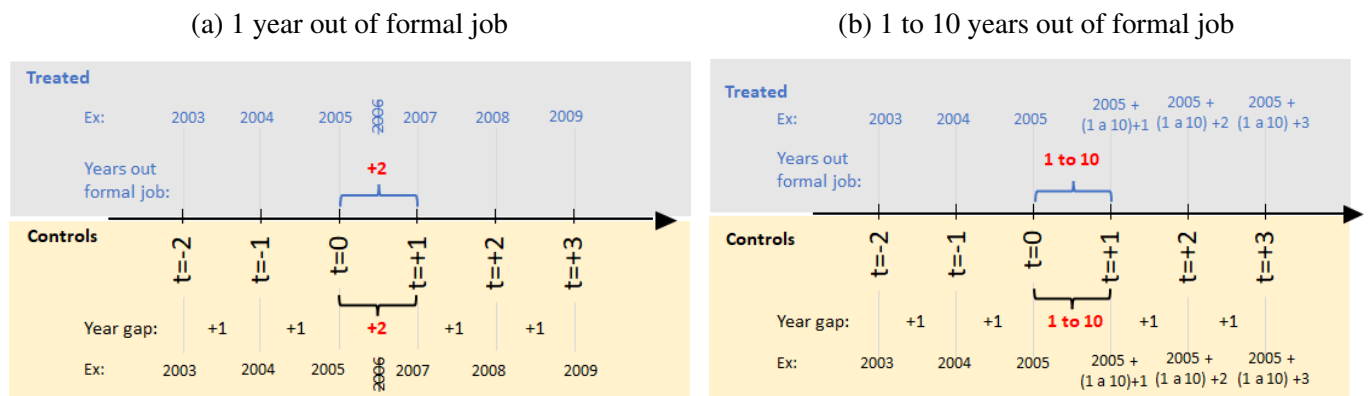


(b) Movers - Time out of formal employment



Notes: Elaborated by the author based on a random sample of 10% of the RAIS between 2003 and 2018.

Figure B8: Example of control worker attribution considering number of years out of formal work of mover workers



Notes: Elaborated by the author.