Separations Revisited: Do Layoffs or Quits Drive Lower Separation Rates in High-Quality Firms? *

Cauê Dobbin† Daniel Fernandez‡ Tom Zohar§

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Abstract

We challenge the prevailing view that the negative correlation between firm quality and separation rates is driven by efficient separations, with no distinction between quits and layoffs. Using administrative data from Brazil, we show that this correlation is primarily driven by lower layoff rates at high-quality firms, rather than differences in quits. To explain this pattern, we develop a parsimonious job search model that incorporates wage rigidity and productivity uncertainty, which interact to generate inefficient layoffs that decline with firm quality. We then introduce a novel metric of wage rigidity—based on the ratio of contracted to variable pay—and empirically validate the mechanism proposed by our theoretical framework. Our findings contribute to the growing evidence that inefficient separations play a central role in shaping labor market outcomes.

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†Georgetown University. Email: caue.dobbin@georgetown.edu

‡CEMFI. Email: daniel.fernandez@cemfi.edu.es

§CEMFI. Email: tom.zohar@cemfi.es

Introduction

A well-established fact in labor economics is that high-quality firms tend to have lower separation rates—a pattern we refer to as the negative quality-separation correlation. Theoretical models often attribute this relationship to efficient separations, typically overlooking the distinction between quits and layoffs.[1] This simplification has been partly motivated by McLaughlin (1991), who demonstrated that both quits and layoffs can emerge in settings where all separations are efficient, implying that the distinction may not always be critical. However, recent empirical studies have shown that inefficient separations are widespread,[2] calling for a reassessment of the drivers behind the quality-separation correlation.

In this paper, we address this gap in the literature. First, we present empirical evidence that the negative correlation between firm quality and overall separation rates is primarily driven by a negative relationship between *firm quality and layoffs*, rather than quits. Second, to explain this empirical pattern, we develop a parsimonious job search model that incorporates inefficient separations. Third, we introduce a novel metric of wage rigidity and empirically validate the mechanism proposed by our theoretical framework.

Our empirical analysis draws on the Annual Manufacturing Survey (PIA), conducted by the Brazilian Institute of Geography and Statistics, and administrative records from the Brazilian Ministry of Labor (RAIS). RAIS covers the universe of formal labor contracts in Brazil and provides uniquely detailed information on separations, including precise separation dates and explicit distinctions between quits and layoffs. PIA offers estimates of value-added—our baseline measure of firm quality—and markdowns that are a key part of our model's mechanism. PIA encompasses the entire manufacturing sector.[3]

We begin by highlighting key institutional features of the Brazilian labor market that enhance the accuracy of quit and layoff classifications in the RAIS data. Most importantly, firms are required to provide severance pay for layoffs, creating a financial incentive to classify separations as quits whenever possible. Con-

[1] Burdett and Mortensen (1998); Elsby and Gottfries (2022); Postel-Vinay and Robin (2002); Postel-Vinay and Turon (2010).

[2] Davis and Krolikowski (2025); Jäger et al. (2023); Schmieder and von Wachter (2010).

[3] The PIA survey is representative at the 3-digit industry-state level. Details in Section 1.1.

versely, workers benefit from layoff classification, as it grants access to severance payments and unemployment benefits. These opposing incentives ensure that both parties have strong motivations to report separations accurately. Moreover, we show that post-separation outcomes for laid-off workers are consistently worse than those for workers who quit. This empirical pattern further reinforces the reliability of the quit/layoff classification in the data.

Using this dataset, we document a novel but intuitive pattern: layoff rates decline with firm quality across a variety of quality measures. Additionally, we find that the negative correlation between firm quality and overall separation rates is largely driven by lower layoff rates in high-quality firms. Specifically, the slope of layoff rates with respect to firm quality closely mirrors the slope of overall separation rates. The ratio between these slopes ranges from 0.81 to 0.93, depending on the specific measure of firm quality used.

An alternative explanation for this pattern could be worker heterogeneity, as high-skill workers tend to sort into high-quality firms (Card et al., 2013). Thus, lower layoff rates at better firms might simply reflect the characteristics of their workforce. However, we demonstrate that this is not the primary driver. Even after accounting for worker heterogeneity, the majority of the quality-separation correlation remains explained by lower layoff rates at high-quality firms.

To explain these findings, we develop a partial-equilibrium random-search model, incorporating two key features: worker-level productivity uncertainty and wage rigidity. In the model, firms set wages by balancing the trade-off between average markdowns (the gap between average productivity and wages) and worker retention, which increases with wages.

This stylized model demonstrates that the interaction between worker-level productivity shocks and wage rigidity leads to higher-quality firms having lower layoff rates. The mechanism operates as follows: expected profits per worker are the product of retention and expected markdown, making these two elements complementary inputs for the firm. Consequently, higher-quality firms choose both higher retention and larger markdowns. Because of their larger expected markdowns, higher-quality firms experience a smaller proportion of workers with negative markdowns at any given time. Since firms lay off workers when their

markdowns are negative, this implies that higher-quality firms have fewer layoffs overall.

We then turn to the data to empirically validate the mechanisms proposed by the model. We begin by showing that, consistent with the model's predictions, higher-quality firms exhibit larger markdowns and that these markdowns are associated with lower layoff rates. However, these patterns are also consistent with alternative models that differentiate between quits and layoffs in an efficient separation framework with flexible wages, such as McLaughlin (1991). Therefore, we further validate the mechanisms proposed by our model by focusing on the role of wage rigidity.

We proxy the degree of wage rigidity faced by each firm using the share of their workers total compensation determined by contract wages rather than variable pay. We show that firms with greater wage rigidity exhibit higher layoff rates. To examine the role of wage rigidity in the quality-layoff correlation, we define labor markets based on industry and location, and estimate the quality-layoff correlation separately for each market. We find that the quality-layoff correlation is stronger in markets where firms face greater wage rigidity.

Taken together, our empirical findings support the mechanisms proposed by our theoretical framework, where inefficient layoffs arise due to wage rigidity, and higher-quality firms experience lower layoff rates due to their larger markdowns.

Our work contributes to the literature on models with inefficient separations driven by wage rigidity (Acabbi et al., 2024; Blanco et al., 2024; Carlsson and Westermark, 2022; Hopenhayn, 1992; Hopenhayn and Rogerson, 1993). A key yet often overlooked prediction of this class of models is that high-quality firms experience fewer layoffs. We provide new empirical evidence validating this prediction and identify a novel mechanism driving this pattern: layoff rates decline with wage markdowns, which are systematically higher in high-quality firms due to the complementarity between markdowns and retention.

This paper also relates to the empirical literature documenting wage rigidity and its role in generating inefficient layoffs (Davis and Krolikowski, 2025; Jäger et al., 2023; Schmieder and von Wachter, 2010). Our contributions to this literature are twofold. First, we introduce a novel approach to measuring wage rigidity

based on the ratio of contracted to variable pay. Second, we show that wage rigidity is associated not only with higher layoff rates but also with a stronger quality-layoff correlation.

The remainder of the paper is organized as follows. Section 1 provides an overview of the institutional setting and presents evidence supporting the reliability of the quit-layoff distinction in our data. Section 2 documents our main empirical finding: the negative correlation between firm quality and separation rates is primarily driven by layoffs. Section 3 develops a theoretical framework to explain this pattern. Section 4 empirically validates the mechanisms proposed by our theoretical framework. Finally, Section 5 concludes and discusses implications for future research.

1 Distinguishing quits and layoffs empirically

1.1 Data and sample

Employer-Employee Data from Brazil. We utilize the *Relação Anual de Informações Sociais* (RAIS), an extensive administrative record from Brazil that captures formal employment relationships. Annually, companies submit RAIS filings, documenting all employees from the preceding year, including personal data such as gender, birth date, and education level, alongside contract specifics like earnings, contracted hours, and detailed occupation according to the *Classificação Brasileira de Ocupações* (CBO 2002), which encompasses 2,638 different occupation codes. Crucially, RAIS mandates reporting the dates and reasons for employee separations, distinguishing between quits and layoffs.

Firm Surveys. Our analysis utilizes data from the Annual Manufacturing Survey (Pesquisa Industrial Anual, PIA), run by the Brazilian Institute of Geography and Statistics, which provides detailed information on production, employment, and costs. Value added (VA) is defined as the value of industrial transformation per capita, calculated as the difference between the gross value of industrial production and the costs of industrial operations, divided by the number of workers. The PIA data is representative at the industry-state level.[4]

[4]"Labor Costs" includes salaries, benefits, and mandatory contributions to social security sys-

Sample: Urban, Private Sector Jobs. Our sample spans the period from 2010 to 2017, beginning after the Great Recession and ending prior to the labor market reforms implemented in Brazil in 2018. Our analysis focuses on Brazilian men and women born between 1959 and 1987, who have at least one year of potential labor market experience indicated by their highest educational degree. We restrict our study to individuals employed on December 31 with at least one month of tenure, in open-ended contracts, and earning above the minimum wage in urban areas within Brazil's private sector. For employees holding multiple jobs, we select the position with the highest contracted hours or, in case of a tie, the highest hourly wage. We categorize non-separated workers employed consecutive years by the same firm as *stayers*, and use the reported cause of separation to identify *layoffs* and *quits*.

Given that informal employment is significant in the Brazilian labor force and not captured in our data, we follow Gerard et al. (2021) and restrict our sample to the Southeast region, which includes the states of Espirito Santo, Minas Gerais, Rio de Janeiro, and São Paulo. This region accounts for nearly half of the country's employment and exhibits lower informality rates. Moreover, we include only the largest connected set of firms and workers to estimate firm and worker effects, as proposed by Abowd et al. (1999).

Table I provides descriptive statistics comparing our final sample with the broader national and regional datasets. Workers in our sample have similar profiles in terms of education, age, and tenure with the broader Brazilian workforce. Hourly wages are slightly higher in the Southeast, reflecting its economic status. Our sample includes 74% of the firms in this region but captures 99% of worker-year observations. Notably, layoffs constitute 81% of all separations in our sample. This proportion is even higher across the broader national landscape, suggesting that the predominant role of layoffs in separation dynamics would be even more pronounced in a more expansive sample.

Finally, the PIA survey is restricted to the manufacturing sector and covers 8% of firms and 14% of workers in the RAIS dataset. Within this sample, firms in the Southeast region exhibit higher value-added levels compared to the national

tems. PIA uses 3-digit industry codes, corresponding to 285 industries, and Brazil is divided into 27 states, resulting in 7,695 unique industry-state combinations.

average. Moreover, our sample, being further restricted to larger firms, has value-added that is higher than the regional average.

Table I – Descriptive statistics

	Brazil	Southeast region	Sample
Number of firms	4,307,522	2,105,805	1,523,100
Average firm size	7.9	8.5	9.8
Number of worker-year observations	146,878,704	78,877,496	74,910,200
Number of workers	35,403,116	19,023,076	14,868,221
Average age (years)	37.3	37.6	37.4
Average log-hourly wage	2.181	2.282	2.332
Average tenure (months)	46.5	48.0	46.4
Average schooling (years)	10.9	11.0	10.4
Average annual layoff rate (%)	20.17	20.18	17.03
Average annual quit rate (%)	3.34	3.34	4.03
Pesquisa Industrial Anual (PIA)			
Share of firms covered (%)	8.11	9.98	10.68
Share of workers covered (%)	13.85	17.24	17.43
Average log-value added	11.28	11.32	11.70

Notes: The first three panels of this table present summary statistics for the RAIS dataset. The first column covers the period from 2010 to 2017 and includes all urban manufacturing private-sector jobs in the Southeast Region. The second column further restricts the sample to firms located in the Southeast Region of Brazil, while the third column limits the sample to firms belonging to the largest connected component.The last panel provides summary statistics for the PIA dataset, which is restricted to manufacturing firms. "Share of workers covered" and "Share of firms covered" indicate the proportion of workers and firms in RAIS that are in the manufacturing sector and therefore also appear in the PIA dataset.

Measuring Firm Quality. Our baseline measure of firm quality is value added, derived from the PIA survey, as described earlier. We also consider two alternative proxies for firm quality commonly used in the literature: AKM pay premiums and firm size. AKM firm pay premiums are estimated following the methodology of Abowd et al. (1999). To enhance the precision of these estimates, we group firms into 100 clusters using a k-means clustering algorithm, as recommended by Bonhomme et al. (2019). Appendix C details the estimation procedures and validates the assumptions of the AKM model in our sample. Firm size is defined as the total number of employees in each firm.

1.2 Context: Quits and Layoffs in Brazil

The RAIS dataset distinguishes between quits and layoffs, a critical distinction given that the government uses this data for administrative purposes. In the case of a layoff, the firm must pay a fine to the government and provide severance pay to the worker. Additionally, the worker becomes eligible for unemployment benefits and gains access to their public pension fund, which is typically reserved for retirement. Given the low incidence of quits in the data, a natural concern is whether these policies create incentives to misclassify quits as layoffs. Appendix D provides more details on these policies, and below we discuss why such incentives are unlikely to result in systematic misreporting.

If a separation is reported as a quit, it benefits the firm; if reported as a layoff, it benefits the worker. Consequently, both parties have strong incentives to ensure that the separation is accurately reported. However, there is a potential issue: in the case of a layoff, the firm incurs a cost by paying a fine to the government, while the worker benefits from unemployment payments and gains early access to their pension funds. If a worker highly values immediate liquidity—such as accessing their pension funds early—the total benefits received from the government could outweigh the costs to the firm. This scenario might create an incentive for collusion between the worker and the firm, where they agree to misclassify the separation as a layoff in exchange for side payments that leave both parties better off.

Nevertheless, such collusion is unlikely in practice. When a separation is classified as a layoff, the firm must make substantial payments to both the government and the worker. For collusion to succeed, the firm would need to trust that the worker will return a portion of these payments after accessing their pension funds, an arrangement that is difficult to enforce given its illegal nature.

Empirical evidence supports the rarity of such collusion agreements. Since 2018, firms and workers in Brazil have had the option to terminate contracts by mutual agreement. Under this arrangement, the worker receives severance pay and can access 80% of their pension funds, but the firm avoids the government fine. If early access to pension funds were a strong motivator for misreporting quits as layoffs, mutual agreement separations would be more common. How-

ever, they account for only 0.5% of all separations. Another potential motive for misreporting is access to unemployment benefits. Using the same RAIS data, Van Doornik et al. (2023) finds that workers eligible for unemployment insurance are 11% more likely to be laid off. However, their analysis shows that these excess layoffs are not merely misclassified quits, further suggesting that misreporting is uncommon.

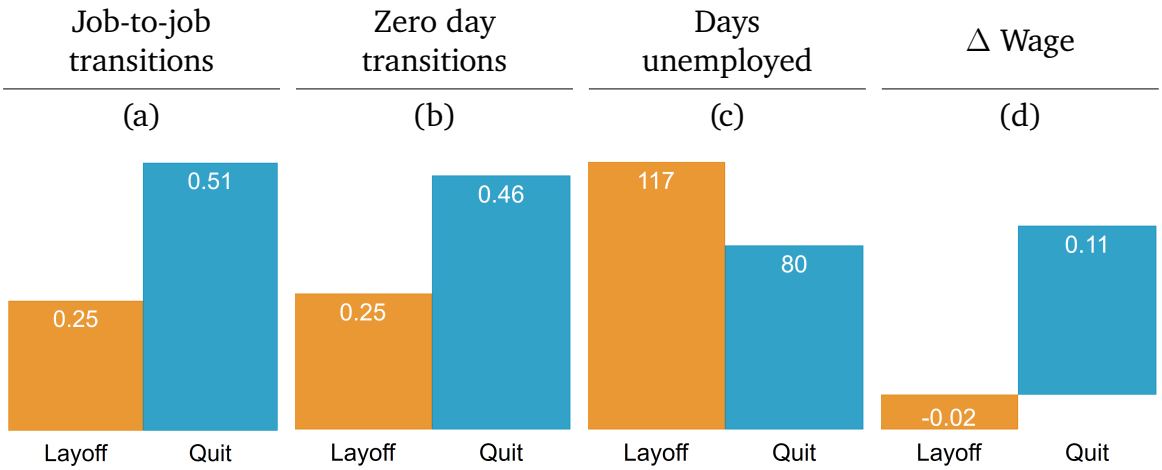
Finally, we conducted further validation by comparing the post-separation outcomes of workers who quit versus those who were laid off. Figure I presents compelling evidence: workers who quit are significantly more likely to secure employment within a year compared to those who were laid off—51% versus 25%, respectively. Moreover, among those who found jobs, quitting workers tended to secure new positions more quickly (46% found immediate employment, compared to 25% of those laid off) and experienced more favorable wage growth, with an average increase of 11% in wages compared to a 2% decrease among those laid off. These patterns align with the hypothesis that separations categorized as quits are indeed voluntary and initiated by the workers, while those labeled as layoffs are not, further substantiating the accuracy of the reporting in our data.

2 The quality-separation correlation: Empirics

In this section, we empirically investigate the determinants of the quality-separation correlation. First, we demonstrate that the negative correlation between firm quality and separation rates is primarily driven by high-quality firms having lower layoff rates, the layoff-separation correlation. Second, we show that this result is not confounded by differential sorting of high-skill workers into high-quality firms.

Figure II presents our main finding: the *layoff*-separation correlation. The y-axis shows firm-level quit and layoff rates, while the x-axis represents different measures of firm quality. Panel (a) uses our preferred quality metric: value-added. However, value-added is available only for the manufacturing sector and is aggregated at the industry-state level, as detailed in Section 1.1. To extend the

Figure I – Quitting workers make better moves than laid-off ones



Notes: This figure compares labor outcomes and mobility patterns between laid-off and quitting workers. Panel (a) reports the share of separated workers who find a job in the same year (job-to-job transitions). Panel (b) reports the share of job-to-job transitions with no gap between the two jobs. Panel (c) reports the average number of days in non-employment for workers in a job-to-job transition. Panel (d) reports the difference in wage growth between workers who change jobs and those who do not. The data is from RAIS. The sample covers the period from 2010 to 2017, includes all urban manufacturing private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1.

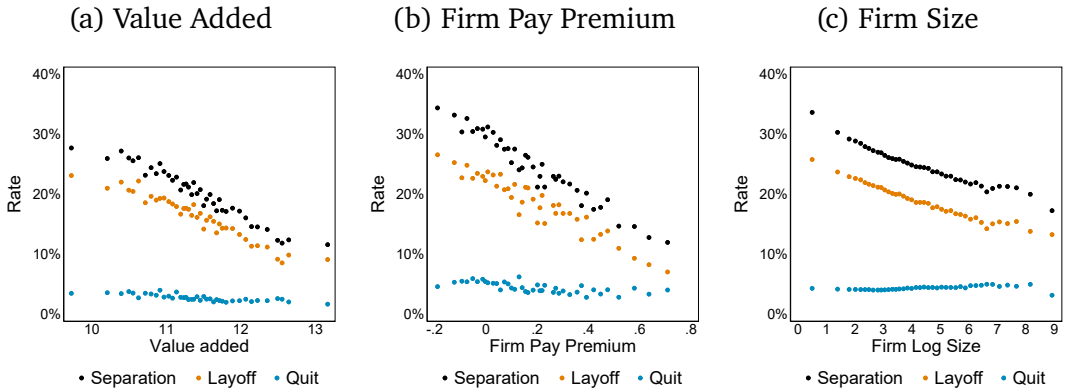
analysis to the full sample and explore firm-level variation, we complement our analysis with two additional proxies for firm quality: pay premiums (b) and firm size (c). Reassuringly, the same patterns emerge regardless of the measure used.

First, layoff rates decline as firm quality increases. Second, the negative relationship between firm quality and overall separation rates is predominantly driven by layoffs, as evidenced by the similarity in the slopes of layoff rates and separation rates with respect to firm quality. Specifically, the ratio of the slopes between layoff rates and separation rates ranges from 0.81 to 0.93, depending on the measure of firm quality used.

A possible explanation for the patterns observed in Figure II is sorting. There is substantial evidence showing that higher-skilled workers tend to sort into higher-quality firms (Abowd et al., 1999; Card et al., 2013). As a result, the lower layoff rates observed in high-quality firms could simply reflect the higher skill levels of their employees rather than firm quality itself.

To assess the extent to which this sorting behavior influences our findings, we

Figure II – Quality-layoff correlation drives the quality-separation correlation



Notes: This figure illustrates the relationship between yearly separation rates and firm quality, using three measures of firm quality: (1) "Value Added" (Panel a), as described in Section 1.1; (2) "Firm Pay Premium" (Panel b), derived from AKM firm fixed effects (Appendix C); and (3) "Firm Size" (Panel c), defined as the total number of workers in the firm in the first year of the sample. Total separation rates are shown in black, layoffs in orange, and quits in blue. The data is at the firm level, and all estimates are weighted by firm size. Value added is sourced from the PIA dataset, which is aggregated at the industry-state level. Pay premiums, firm size, and separation rates are calculated using the RAIS dataset. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1. Panel (a) is further restricted to manufacturing firms.

estimate the following regression:

$$Y_{it} = \beta_Y Q_{J(i,t)t} + \gamma X_{it} + \epsilon_{it}, \tag{1}$$

where t represents a year, i is an individual worker, and $J(i,t)$ denotes the firm employing worker i at time t. The dependent variable Y represents outcomes of interest, specifically whether a worker separated from or was laid off by their firm on that year. Q is our measure of firm quality, X is a set of worker characteristics, and ϵ captures the residuals. The parameter of interest is β_Y.

In this analysis, we include several covariates to control for worker characteristics. First, since tenure is one of the primary determinants of layoff rates (Jovanovic, 1979; Topel and Ward, 1992; Ureta, 1993), we control for both tenure and tenure squared. Second, given that different genders and skill levels exhibit distinct career trajectories in the labor market, we control for age and age squared, interacted with gender and education fixed effects. Third, to account for potential discrimination, we include race fixed effects. Fourth, to control

for variations across different occupations—such as differences in unionization rates—we introduce occupation fixed effects. Finally, to adjust for unobserved differences in worker skill, we incorporate AKM worker effects.[5]

We focus on how layoffs contribute to the negative separation-quality correlation, estimating this effect as the ratio $\frac{\beta_{\text{Layoff}}}{\beta_{\text{Separation}}}$. The results are presented in Table II.[6] Even after accounting for worker heterogeneity, layoffs account for at least 70% of the negative separation-quality correlation. These findings suggest that worker heterogeneity does not fully explain the observed patterns, reinforcing the idea that layoffs are the predominant driver of the negative relationship between firm quality and separation rates.

3 The quality-separation correlation: Theory

This section introduces a simple labor search model to explain our empirical finding that high-quality firms have lower layoff rates. Previous theoretical work has established that both quits and layoffs can occur even within a framework of fully efficient separations (McLaughlin, 1991). However, recent empirical research has revealed that inefficient layoffs are pervasive (Schmieder and von Wachter, 2010; Davis and Krolikowski, 2025; Jäger et al., 2023).

Building on these empirical findings, we develop a model that generates endogenous inefficient layoffs through the interaction of two key features: wage rigidity and uncertainty about workers' productivity. Specifically, firms commit to a wage rate before the worker's productivity shock is realized. There is a productivity threshold below which it becomes unprofitable for the firm to retain the worker at the predetermined wage, resulting in a layoff. In these cases, the firm would prefer to reduce the wage but cannot do so due to wage rigidity, which is the source of inneficiency in the model. Aside from these key features, we keep the model as simple as possible.

We consider a partial-equilibrium random-search model with homogeneous workers. The assumption of a homogeneous workforce is motivated by the results

[5] Due to measurement error in the estimated AKM effects, the results using this covariate must be interpreted with caution.

[6] Appendix Table B.1 shows estimates of β^{Layoff} and $\beta^{\text{Separation}}$ separately.

Table II – Worker sorting does not drive the quality-layoff correlation

	(1)	(2)	(3)	(4)
Panel A - Firm Size				
$\frac{\beta^{\text{Layoff}}}{\beta^{\text{Separation}}}$	0.927***	0.906***	0.947***	0.899***
	(0.0035)	(0.0047)	(0.0052)	(0.0061)
Observations	49,835,818	49,830,114	49,835,818	49,830,114
Panel B - Firm Pay Premium				
$\frac{\beta^{\text{Layoff}}}{\beta^{\text{Separation}}}$	0.812***	0.773***	0.702***	0.702***
	(0.0018)	(0.0025)	(0.0034)	(0.0033)
Observations	49,835,818	49,830,114	49,835,818	49,830,114
Panel C - Value Added				
$\frac{\beta^{\text{Layoff}}}{\beta^{\text{Separation}}}$	0.851***	0.828***	0.748***	0.776***
	(0.0055)	(0.0095)	(0.0091)	(0.0120)
Observations	9,289,254	9,288,612	9,289,254	9,288,612
Worker covariates			✓	✓
Worker AKM Effect		✓		✓

Notes: This table reports OLS estimates of Equation (1), which describe the relationship between separation rates and firm quality. Firm quality is measured using three metrics: (1) "Value Added" (Panel A), as described in Section 1.1; (2) "Firm Pay Premium" (Panel B), derived from AKM firm fixed effects (Appendix C); and (3) "Firm Size" (Panel C), defined as the total number of workers in the firm during the first year of the sample. The table reports the ratio of the estimates from two separate regressions where the outcome changes from layoff rates total separations. Controls include worker-specific wage components from an AKM estimation (detailed in Appendix C) and the following covariates: race and occupation fixed effects, tenure and tenure squared, and interactions between age, age squared, gender, and education fixed effects. Estimates of β^{Layoff} and $\beta^{\text{Separation}}$ are presented separately in Table B.1 in the Appendix. The data is at the worker level. Value added is sourced from the PIA dataset, which is aggregated at the industry-state level. Pay premiums, firm size, and separation rates are calculated using the RAIS dataset. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1. Panel A is further restricted to manufacturing firms.

in Section 2, which demonstrate that worker heterogeneity does not explain the negative relationship between layoff rates and firm quality. This framework can be interpreted as representing the labor market for a specific worker type—for instance, defined by education level or occupation. In our model, random search implies that firms are matched with an exogenously determined type and number of workers. Furthermore, the partial-equilibrium framework assumes that the distribution of workers' outside options is exogenous. In other words, the firm is atomistic, and its decisions do not affect the factors determining workers' outside

options, such as offers from other firms, government policies, or market-level conditions.

The rest of this section proceeds as follows. First, we present the economy in which our model operates and the timing of agents' decisions. Second, we delve into the quality-separation correlation and present our key theoretical result: more productive firms have both fewer quits and fewer layoffs.

3.1 Set up

There is a single firm, characterized by quality ψ. In each period t, it chooses the wage rate w_t, common to all its workers, and whether to layoff each worker to maximize the present value of expected profits. The firm discounts the future at rate β. There is a continuum of ex-ante homogeneous workers, with expected productivity α. In each period t, each worker i receives a productivity shock η_{it}. Hence, the total revenue the firm receives from worker i in period t is $\psi + \alpha + \eta_{it}$. The value of the outside option to worker i in year t is b_{it}. For simplicity, we assume workers discount the future infinitely and hence accept an offer if $w_t \geq b_{it}$. Both shocks, η_{it} and b_{it}, are idiosyncratic and follow known distributions, F_η and F_b, respectively. We normalize α so that $\mathbb{E}_\eta[\eta_{it}] = 0$.

In each period t, the timing is as follows:

1. Firm starts the period with s_t workers.
2. Firm meets an additional unit mass of potential hires.
3. Firm chooses a wage w_t to offer both to current workers and potential hires.
4. Workers and the firm observe productivity (η_{it}) and outside option (b_{it}) shocks.
5. Simultaneously, workers decide whether to quit, and firm decides whether to layoff each worker.
    - The share of workers who stay (retention rate) is $\rho(w_t)$.
    - The layoff rate if $\delta_\psi(w_t)$.
6. Payoffs realize:
    - Firm's profit per worker: $\psi + \alpha + \eta_{it} - w_t$.
    - Employed workers payoff: w_t.
    - Non-employed workers payoff: b_{it}.
7. Firm starts next period with $s_{t+1} = \rho(w_t) \cdot [1 - \delta_\psi(w_t)](1 + s_t)$.

The key feature of this timing is that firms must commit to a wage rate before observing the productivity shock (η), but decide whether to layoff each worker after observing it. This structure creates endogenous layoffs in our model.

Note that workers can quit the same period they meet with the firm. In this formulation, the retention rate represents both the share of current workers that stays in the firm and the share of new matches that accepts the offer. Since all shocks are independent across periods and workers are ex-ante homogeneous, these two shares are identical.

An equilibrium is defined by the optimality of three decisions: layoffs, quits, and wages. First, the firm lays off a worker if their realized productivity plus the continuation value of keeping the worker is lower than wages, which defines the layoff rate as a function of wages. Second, workers quit if the outside option is higher than wages, which defines the quit rate as a function of wages. Third, the firm chooses wages to maximize profits. Appendix A.1 defines an equilibrium formally.

3.2 Drivers of the quality-separation correlation

In Section 2, we empirically demonstrated that the primary driver of the quality-separation correlation is the lower layoff rates observed in high-quality firms. We now use our theoretical model to explore why higher-quality firms lay off workers less frequently. To build intuition, we present a simplified version of the relevant theorem below. The full technical statement is available in Appendix A.

Key Insights *Under mild assumptions about the distribution of productivity and outside option shocks—which hold for a wide range of common distributions such as uniform, normal, and Gumbel—we establish the following:*

(I) Firm size is increasing in firm quality;
(II) Wages are increasing in firm quality;
(III) Separation rate is decreasing in firm quality;
(IV) Quit rate is decreasing in firm quality;
(V) Layoff rate is decreasing in firm quality;
(VI) Markdown is increasing in firm quality.

Formal statement: *Theorem 1 in Appedix A.1.*

Proof: *Appendix A.2.*

Consistent with prior theoretical work (Postel-Vinay and Robin, 2002; Elsby and Gottfries, 2022), our model shows that wages and firm size increase with firm quality. These findings validate our use of these variables as proxies for firm quality in the empirical analysis in Section 2. Additionally, we confirm that separation rates decrease with firm quality, in line with previous literature.

We extend this literature by decomposing separations into quits and layoffs to investigate how each margin relates to firm quality. We find that *both* quits and layoffs decline as firm quality increases. The intuition behind the negative quality-quit relationship is straightforward: workers are less likely to quit higher-quality firms because these firms pay higher wages.

The key contribution of our theoretical framework is to explain why better firms lay off workers less frequently. The intuition is as follows: a worker is laid off only if their productivity shock is sufficiently negative to outweigh the firm's average markdown. Therefore, layoff rates decline as markdowns increase. The crucial question, then, is whether higher-quality firms have larger markdowns.

While it is intuitive that higher-quality firms would have larger markdowns, this result is not straightforward. Higher-quality firms pay higher wages to increase worker retention. If the incentives to retain workers were sufficiently strong, higher-quality firms could end up with *lower* markdowns. Indeed, the framework in Burdett and Mortensen (1998) predicts a negative relationship between wages and markdowns. However, this is not the case in our model, as established in the *Key Insights* above. To provide intuition for this result, consider a uniform calibration of our model.[7] Under this calibration, the firm's problem simplifies to:

$$\begin{aligned} &\max_{\rho,\mu} \rho^{\frac{1}{3}} \cdot (\mu+1)^{\frac{2}{3}} \\ &\text{subject to: } \mu + \sigma_b \rho = \psi + \alpha, \end{aligned} \tag{2}$$

where σ_b is the range of the outside option shock (b).

[7]The calibration assumes $\eta \sim U[-\sigma_\eta, \sigma_\eta]$, $b \sim U[0, \sigma_b]$, and $\beta = 0$. Additionally, we normalize $\sigma_\eta = 1$ because layoff and quit rates depend only on the ratio $\frac{\sigma_b}{\sigma_\eta}$, not on σ_b and σ_η separately.

Equation (2) highlights the main tradeoff of the model: The firm chooses wages to maximize profits by trading-off retention (ρ) and markdown (μ). Markdowns are twice as important because they affect both profits per worker and the layoff rate, as we can see in Equation (7). Figure III presents this trade-off graphically. The solid lines represent the production possibility frontier (PPF), while dashed lines represent isoprofit curves.

The level of the PPF depends on firm quality (ψ):[8] a higher-quality firm (orange line) can have a higher μ for any given ρ. Finally, note that the objective function is convex and, hence, ρ and μ are complementary inputs. Therefore, if the PPF expands (higher ψ), the firm increases *both* its ρ and μ. That is, higher quality firms have higher markdowns, even though they pay higher wages. Hence, they have lower layoff rates. Moreover, note that the quit rate is simply $1-\rho$, so more produtive firms also have fewer quits.

This simple framework is also informative about the relative rates of quits to layoffs. This ratio depends on how the firm trades-off retention and markdowns, which is determined by the slope of the PPF. This slope is given by σ_b since it determines the labor-supply elasticity. The more elastic labor supply is (low σ_b), the "cheaper" it is for the firm to retain a worker and, hence, the firm will choose relatively higher retention and lower markdown, which results in fewer quits and more layoffs.

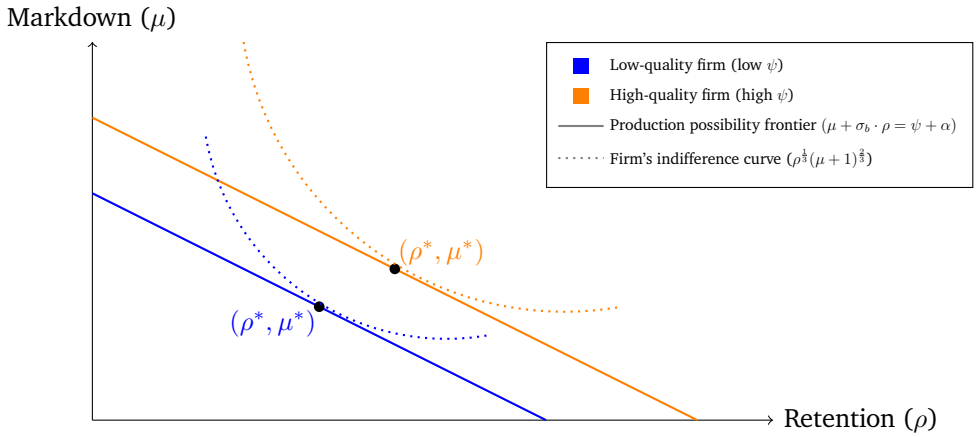
Why do our theoretical predictions diverge from Burdett and Mortensen (1998) and others, who predict a negative relationship between retention and markdowns? The key distinction lies in allowing for exogenous variation in firm quality (ψ). If all firms have identical firm quality, they share the same PPF. This scenario leads to two possibilities: either all firms would have exactly the same markdown, as would occur under the parameterization we consider here, or firms would locate at different points along the PPF. In the latter case, this would induce a mechanical negative relationship between markdown and retention.

In summary, this section proposes an explanation for the negative quality-layoff correlation: higher-quality firms exhibit larger markdowns, and larger markdowns result in lower layoff rates. In the next section, we present empir-

[8]The PPF also depends on average workers' productivity (α), but this is fixed across firms.

ical evidence to support this explanation.

Figure III – High-quality firm has *both* higher markdown and retention



Notes: This figure illustrates the model presented in Equation (2). Markdown and retention are defined in Definition (1). Solid lines represent the production possibility frontier and dashed lines represent firms' indifference curves. Stars denote equilibrium outcomes. Two firms are represented in the figure: high-quality (orange) and low-quality blue.

4 Empirical validation of the proposed mechanism

In this section, we empirically validate the mechanism proposed by the theoretical model in Section 3. First, in Section 4.1, we establish that higher-quality firms exhibit larger markdowns and that these markdowns are associated with lower layoff rates. Second, in Section 4.2, we show that the quality-layoff correlation is stronger among firms with tighter constraints on wage adjustments, providing evidence that this correlation is driven by wage rigidity. Together, these patterns align closely with the model's predictions.

4.1 Higher-quality firms have larger markdowns

In this subsection, we describe the empirical relationship between markdowns, firm quality, and layoffs, and show that it aligns with the predictions of our model. Markdowns are measured using the PIA dataset.[9] Markdowns are defined as the

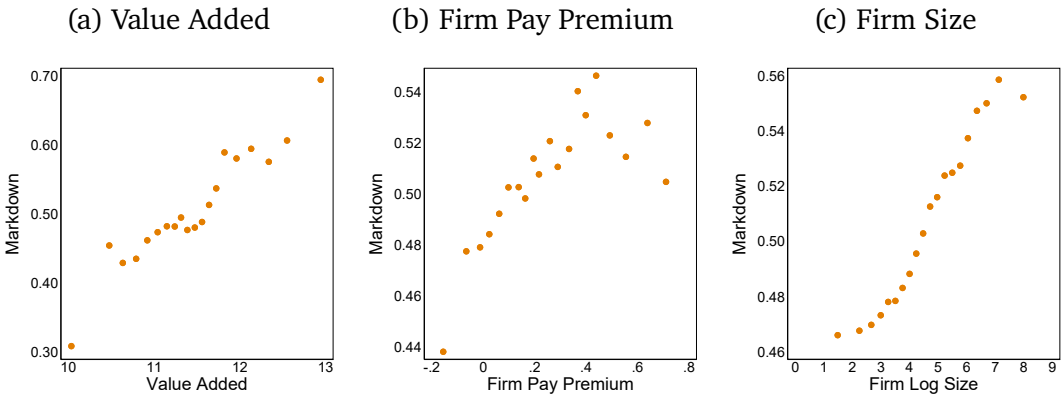
[9]As described in Section 1, the PIA dataset is aggregated at the state-industry level and is available only for the manufacturing sector. Hence, all results in Section 4.1 are restricted to this sample.

proportion of value added (VA) retained by firms after accounting for direct labor expenses: Markdown $= \frac{\text{VA}-\text{Labor Costs}}{\text{VA}}$.[10]

Figure IV illustrates the relationship between markdowns and firm quality, using different measures of quality—value added, pay premium, and firm size. The results are consistent across all quality measures, showing that higher-quality firms exhibit higher markdowns, as predicted by our model. The magnitudes are substantial. Using our preferred quality measure, value added, Panel (a) of Figure IV shows that firms in the bottom 5% of quality have an average markdown of 31%, while those in the top 5% have 69%—more than double.

These results underscore the importance of allowing for heterogeneous firms in our theoretical framework. In models with ex-ante homogeneous firms, such as Burdett and Mortensen (1998), markdowns *decrease* with wages and firm size, in contrast to the empirical patterns observed in Panels (b) and (c) of Figure IV.

Figure IV – Higher-quality firms have larger markdowns



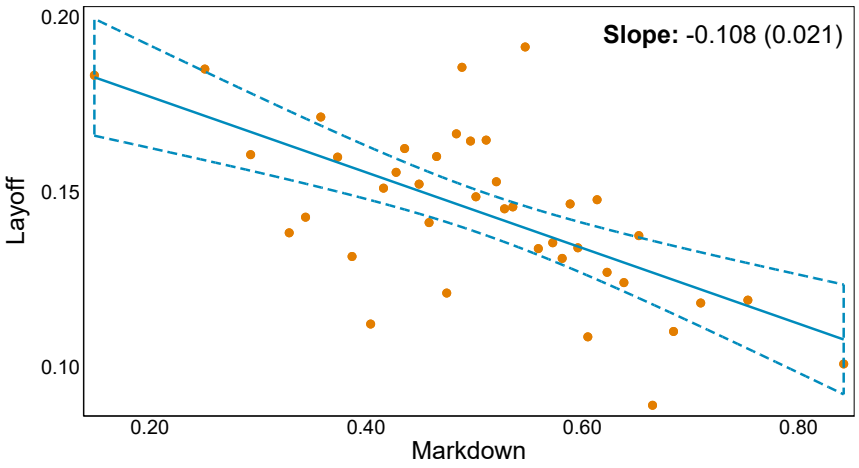
Notes: This figure illustrates the relationship between markdowns and firm quality, using three measures of firm quality: (1) "Value Added" (Panel a), as detailed in Section 1.1; (2) "Firm Pay Premium" (Panel b), derived from AKM firm fixed effects, with details in Appendix C; and (3) "Firm Size" (Panel c), defined as the total number of workers in the firm in the first year of the sample. Markdowns are calculated as the proportion of value added retained by firms after accounting for labor expenses. Value added and markdowns are obtained from the PIA dataset, which is aggregated at the industry-state level. Pay premiums and firm size are computed using the RAIS dataset and are at the firm level. The sample covers the period from 2010 to 2017, includes all urban manufacturing private-sector jobs in the Southeast Region, and it is restricted to firms within the largest connected set, as detailed in Section 1. Estimates are weighted by firm size.

Next, we test the model's prediction that markdowns and layoff rates are

[10] Markdowns are often defined as the ratio of marginal product to wages (Estefan et al., 2024). However, marginal product estimates are not available in our setting.

negatively correlated. The results, presented in Figure V, indicate that higher-markdown firms exhibit lower layoff rates: each 10 percentage-point increase in markdown is associated with a 1 percentage-point reduction in layoffs. This effect is economically meaningful, as firms in the bottom 5% of markdowns have an average layoff rate of 18%, compared to just 11% for firms in the top 5%.

Figure V – Firms with larger markdown have lower layoff rates



Notes: This figure illustrates the relationship between markdowns and layoff rates. Markdowns are calculated as the proportion of value added retained by firms after accounting for labor expenses and are derived from the PIA dataset, which is aggregated at the industry-state level. Layoff rates are computed at the firm level using the RAIS dataset. The blue line represents the best linear fit, with OLS estimates displayed in the upper-right corner, with robust standard errors in parentheses. The sample covers the period from 2010 to 2017, includes all urban manufacturing private-sector jobs in the Southeast Region, and it is restricted to firms within the largest connected set, as detailed in Section 1. Estimates are weighted by firm size.

The findings in this section confirm key predictions of our model: higher-quality firms have higher markdowns (Figure IV), and these higher markdowns are associated with lower layoff rates (Figure V). However, these patterns are also consistent with alternative models that differentiate between quits and layoffs in an efficient separation framework with flexible wages, such as McLaughlin (1991). In the next section, we provide further validation of the mechanisms proposed by our model—the role of wage rigidity.

4.2 Wage rigidity amplifies the quality-layoff correlation

In the model presented in Section 3, wage rigidity plays a central role in generating inefficient layoffs. When a worker experiences a negative productivity shock that reduces their markdown below zero—and the firm is unable to adjust wages downward due to wage rigidity—the worker is laid off. As a result, layoffs can occur even when a wage level exists that would make it mutually beneficial for both the firm and the worker to remain matched, rendering the layoff inefficient.

In this subsection, we empirically investigate the relationship between wage rigidity and layoffs. First, we document substantial wage rigidity in our context. Then, we construct a proxy for wage rigidity at the firm level, which we use to show that higher wage rigidity is associated with higher layoff rates and a stronger quality-layoff correlation.

Documenting wage rigidity

To study wage rigidity, we leverage the fact that the RAIS dataset reports contract wages separately from a variable wage component.[11] The variable component encompasses bonuses, performance pay, and overtime. Firms face substantial rigidity in adjusting contract wages, as the Brazilian Constitution prohibits wage reductions unless authorized by a collective bargaining agreement.[12] In contrast, the variable component is not constrained by these regulations. Figure VI presents the distribution of yearly wage changes for workers who remain in the same firm across two consecutive years. Consistent with these regulations, Panel (a) shows that only 1.34% of workers experience a reduction in their contract wage, whereas Panel (b) reveals that 9.28% see a reduction in their total wage. Additionally, contract wage changes cluster around zero, whereas total wages exhibit no such bunching. These patterns underscore the strong rigidity of contract wages compared to the flexibility of the variable component.

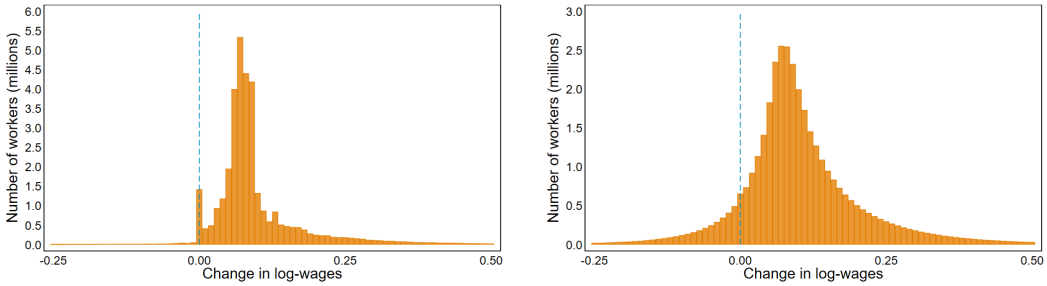
To build a firm-level measure of wage rigidity, we construct a proxy based on

[11] Throughout this paper, "wage" has referred to "total wage," which is the sum of the contract and variable components.

[12] Title II, Chapter I, Article 7, Paragraph VI of the 1988 Constitution.

Figure VI – Distribution of wage changes for stayers

(a) Contract Wages (b) Total Wages



Notes: This figure depicts the distribution of wage changes between two consecutive years for workers who remain with the same firm. Panel (a) shows the distribution of changes in contractual wages, while Panel (b) illustrates the distribution of changes in total wages (the sum of contractual and variable wage components). Wages are not adjusted for inflation in either panel. The data is from the administrative records of the Brazilian Ministry of Labor (RAIS) and is at the worker level. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and it is restricted to firms within the largest connected set, as detailed in Section 1.

the average share of contract wages in total wages:

$$\text{ContractShare}_j = \frac{1}{N_j} \sum_{i|J(i,t_{j0})=j} \frac{\text{ContractShare}_i}{\text{VariableWage}_i + \text{ContractWage}_i}, \tag{3}$$

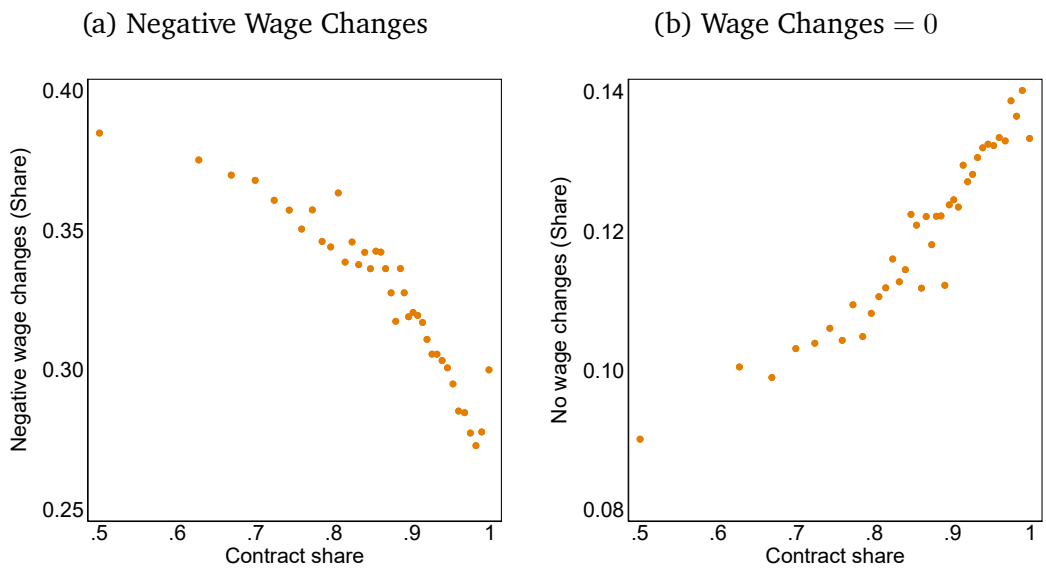
where $J(i, t_{j0})$ denotes the firm employing worker i in year t_{j0}, N_j is the size of firm j, and t_{j0} is the first year the firm appears in the sample. Since variable wages can be adjusted while contract wages cannot, higher ContractShare indicates stronger wage rigidity. To address concerns about endogeneity, such as ContractShare responding to productivity shocks, we compute ContractShare using the first year each firm appears in the sample and hold it fixed throughout the analysis. Furthermore, we exclude the year used to define ContractShare from subsequent analysis. Appendix Figure B.1, Panel (a), presents the distribution of ContractShare across firms and reveals substation variation: the median share is 88%, the 5th percentile is 65%, and the 95th percentile is 99%.

To validate ContractShare as a proxy for wage rigidity, we examine its correlation with wage changes for workers who remain in the same firm for two consecutive years. The results are presented in Figure VII. Consistent with the interpretation of higher ContractShare being associated with more rigid wages,

we find that ContractShare is negatively correlated with the share of wage reductions in a firm and positively correlated with the share of wage changes equal to zero. The differences are economically significant. Firms in the top 5% of ContractShare have a share of unchanged wages that is 40% larger than that of firms in the bottom 5%.

The patterns observed in Figure VII are not driven by worker sorting. Appendix Figure B.2 shows that these patterns remain robust after controlling for race, occupation, tenure, AKM worker effects, and flexible interactions of gender, age, and education.

Figure VII – Higher ContractShare is associated with more wage rigidity



Notes: This figure illustrates the relationship between wage rigidity and ContractShare. ContractShare represents the average share of salaries disbursed as contract pay in each firm, as defined in Equation (3). The two panels depict correlations between ContractShare and different measures of wage changes for workers who remain in the same firm for two consecutive years: Panel (a) presents the share of workers experiencing negative wage changes; and Panel (b) presents the share of workers experiencing no wage changes. The data is from the RAIS dataset and is at the firm level. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1. Estimates are weighted by firm size.

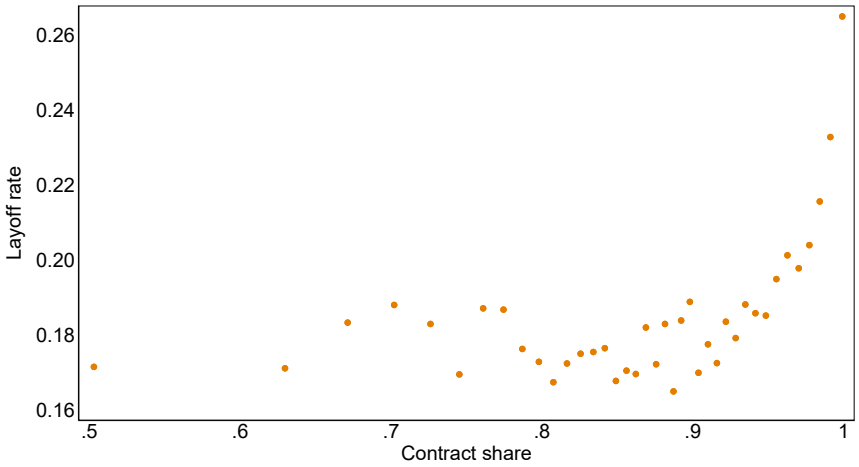
Greater wage rigidity is associated with higher layoff rates

After establishing that higher ContractShare is associated with more wage rigidity, we examine its relationship with layoff rates. Figure VIII shows that firms with

higher ContractShare exhibit higher layoff rates. Firms with a ContractShare of 100% have an average layoff rate of 28%, whereas those with a ContractShare around 90% have a rate of 17%. Notably, the relationship flattens for ContractShare below 90%, with layoff rates stabilizing at approximately 17% even for firms with ContractShare below 60%.

These patterns suggest two key conclusions. First, the strong positive correlation between ContractShare and layoff rates underscores the important role wage rigidity plays in contributing to layoffs. Second, the persistence of layoffs at low levels of ContractShare indicates that some observed layoffs are not driven by wage rigidity. Through the lens of our model, these layoffs correspond to productivity shocks so severe that no feasible wage adjustment could make retaining the match desirable for both the firm and the worker. Alternatively, such layoffs could be interpreted as the result of an exogenous job destruction shock (Sorkin, 2018; Jarosch, 2023).

Figure VIII – Firms with higher ContractShare have more layoffs



Notes: This figure illustrates the relationship between layoff rates and ContractShare. The layoff rate is defined as the proportion of a firm's workers laid off per year, while ContractShare represents the average share of salaries disbursed as contract pay in each firm, as defined in Equation (3). The data is from the RAIS dataset and is at the firm level. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and it is restricted to firms within the largest connected set, as detailed in Section 1. Estimates are weighted by firm size.

A potential concern with the results in Figure VIII is the role of worker heterogeneity. High-skill workers are less likely to be laid off. If these workers

tend to receive more bonuses, this could create a positive relationship between ContractShare and layoffs. To address this concern, Appendix Figure B.3 presents the relationship between ContractShare and layoff rates while controlling for a rich set of worker characteristics, and the results remain largely unchanged.

Greater wage rigidity is associated with stronger quality-layoff correlation

Next, we investigate whether wage rigidity contributes to the quality-layoff correlation. This presents a challenge, as this correlation is an equilibrium object observed at the market level rather than at the firm level. Ideally, we would observe a set of disconnected labor markets where firms exhibit varying degrees of wage rigidity, allowing for direct comparisons of the quality-layoff correlation across these markets.

As an approximation, we define markets based on the combination of industry and location. We use the firm's state as our definition of location and, since value-added (our preferred firm quality measure) is aggregated at the 3-digit industry level, we define industries using 2-digit CNAE codes to ensure variation in value-added within a market. This results in 341 distinct markets. We measure wage rigidity in each market by the average ContractShare of its firms, denoted as $\overline{\text{ContractShare}}$. Appendix Figure B.1, Panel (b), presents the distribution of $\overline{\text{ContractShare}}$, revealing substantial variation in wage rigidity at the market level: the 5th percentile of $\overline{\text{ContractShare}}$ is 72%, while the 95th percentile is 94%.

To assess whether $\overline{\text{ContractShare}}$ is a relevant proxy for wage rigidity, we replicate the analyses from Figures VII and VIII at the market level. Specifically, we estimate the following regression:

$$Y_m = \chi_Y \cdot \overline{\text{ContractShare}}_m + \epsilon^Y_m, \tag{4}$$

where $\overline{\text{ContractShare}}m$ is the average ContractShare of firms in market m, ϵm^Y represents residuals, and χ^Y is our parameter of interest. The outcome Y_m corresponds to either the share of negative wage changes in each market, the share of wage changes equal to zero, or the average layoff rate. Figure VIII suggests

a highly nonlinear relationship between ContractShare and layoffs. To account for this, we also estimate Equation (4) using the average log layoff rate in each market as an outcome.[13]

OLS estimates of Equation (4) are reported in Columns (1) to (4) of Table III and confirm the patterns observed at the firm level. Specifically, in markets with higher $\overline{\text{ContractShare}}$, fewer workers experience wage reductions, more workers experience no wage changes, and layoff rates are higher. These results indicate that $\overline{\text{ContractShare}}$ serves as a reliable proxy for the wage rigidity faced by firms in different markets.

To quantify the strength of the quality-layoff correlation within each market, we estimate the following regression separately for each market:

$$Layoff Rate_{jt} = \beta_{M(j)} \cdot Q_{jt} + \epsilon^{M}_{jt}, \tag{5}$$

where t denotes a year, j represents a firm, and $M(j)$ identifies firm j's market. The dependent variable, $Layoff Rate_{jt}$, captures the firm's yearly layoff rate, while Q_{jt} measures firm quality. The term ϵ^{M}_{jt} represents residuals. Following our approach in Equation (4), we estimate the model using both layoff rates and log layoff rates as the outcome variable to account for the nonlinearity observed in Figure VIII. The parameter of interest, β_m, captures the market-specific relationship between firm quality and layoffs.

Appendix Figure B.4 presents the distribution of estimated $\hat{\beta}_m$ across markets. Since $\hat{\beta}_m$ is an estimated parameter and thus subject to measurement error, its distribution should be interpreted with caution. Nevertheless, some clear patterns emerge. The quality-layoff correlation is negative in 95% of markets when using our preferred measure of firm quality, value-added, indicating that the negative relationship between firm quality and layoffs is a widespread labor market phenomenon. Moreover, there is substantial variation in the strength of this relationship: in 5% of markets, the correlation is more than twice as strong as the median, while in another 5%, it is close to zero. The patterns are similar when using alternative firm quality measures, such as pay premiums and firm size.

[13] As in Figure VII, the shares of negative and zero wage changes are calculated among workers who remain in the same firm for two consecutive periods.

We then examine whether the quality-layoff correlation is stronger in markets with greater wage rigidity by estimating the following regression:

$$\hat{\beta}_m = \chi_\beta \cdot \overline{CS}_m + \epsilon_m^\beta, \tag{6}$$

where χ_β is the parameter of interest and ϵ_m^β represents residuals.

OLS estimates of Equation (6), presented in Columns (5) to (10) of Table III, indicate that the quality-layoff correlation is stronger in markets with greater wage rigidity. Columns (5), (7), and (9) report results using $\hat{\beta}_m$ estimated with linear layoff rates, while Columns (6), (8), and (10) use $\hat{\beta}_m$ estimated with log layoff rates. The findings are consistent across these two specifications. Similarly, the results hold when using either value-added or firm size as the measure of firm quality. However, we do not find a significant relationship between $\hat{\beta}_m$ and $\overline{\text{ContractShare}}$ when using pay premiums as the quality metric. This may be due to pay premiums being estimated objects, and accumulated measurement error across multiple estimation steps reduces the reliability of the estimates of Equation (6) in this specification.

The magnitudes in Table III are substantial. Estimates in Column (5)—which use value-added as the firm quality measure and a linear specification for layoff rates—indicate that $\hat{\beta}_m$ is 26% larger (in absolute terms) than the median in markets in the top 5% of $\overline{\text{ContractShare}}$ and 73% smaller in markets in the bottom 5%. Similar patterns emerge when using firm size as the firm quality measure or when adopting the log specification for layoff rates.

In summary, this section links wage rigidity to differential layoff patterns across firms and markets. We show that firms facing stronger wage rigidity exhibit both higher layoff rates and a more pronounced quality-layoff correlation. These findings suggest that layoffs partly stem from firms' inability to adjust wages, empirically validating the mechanisms proposed in our theoretical framework.

Table III Quality-layoff correlation is stronger in markets with more wage rigidity

	$\Delta W = 0$	$\Delta W < 0$	Layoff		$\hat{\beta}_m$					
					VA		ψ		Size	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Contract Share	0.106***	-0.437***	0.178**	0.148**	-0.249***	-0.207***	0.050	0.039	-0.039**	-0.032**
	(0.0208)	(0.0393)	(0.0774)	(0.0634)	(0.0802)	(0.0659)	(0.1000)	(0.0852)	(0.0177)	(0.0149)
Observations	341	341	341	341	71	71	338	338	340	340
Avg. Outcome	0.092	0.276	0.191	0.191	-0.031	-0.031	-0.113	-0.113	-0.012	-0.012
Specification			Linear	Log	Linear	Log	Linear	Log	Linear	Log

Notes: This table examines the relationship between wage rigidity and the quality-layoff correlation. Columns (1)–(4) present estimates from regression (4). To assess whether ContractShare is a relevant proxy for wage rigidity, we present its relationship with the share of negative wage changes in each market (Column (1)), while Column (2) considers the share of wage changes equal to zero. Column (3) and (4) examines the relationship between ContractShare and the average- and log-average-layoff rate, correspondingly. Columns (5)–(10) test whether the quality-layoff correlation (estimated using average- and log-average-layoff rate, and different measures of firm quality) is stronger in markets with greater wage rigidity using regression (6). Each column uses a different measure of firm quality: (5) and (6) Value Added, as described in Section 1.1; (7) and (8) Firm Pay Premium, derived from AKM firm fixed effects (Appendix C); and (9) and (10) Firm Size, defined as the total number of workers in the firm in the first year of the sample. The data is from the administrative records of the Brazilian Ministry of Labor (RAIS) and is at the firm level. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1.

5 Final Remarks

In this paper, we investigate the determinants of the negative quality-separation correlation. We show empirically that high-quality firms have lower layoff rates and propose a parsimonious theoretical framework that explains this pattern.

Our findings indicate promissing directions for future research on the literature that estimates job-search models from job flows. We have shown that layoffs are the majority of separations and that layoff rates depend on firm quality. While several previous papers allow for firm-specific involuntary separation rates, they do not directly observe layoffs. Some papers assume that involuntary separation are exogenous and treat them as residuals (Sorkin, 2018; Jarosch, 2023), others infer layoff rates indirectly from other moments (Acabbi et al., 2024; Blanco et al., 2024). Revisiting these models taking advantage of the Brazilian data, which explicitly flags layoffs, could bring valuable new insights.

Additionally, our novel empirical approach to measuring wage rigidity—based on the ratio of contracted wages to variable pay—offers a practical method for documenting variation in wage rigidity across firms and markets. Leveraging this variation can help address key questions about the causes and implications of wage rigidity. For instance, it can shed light on the optimal level of wage rigidity that balances the benefits of insuring workers against wage shocks with the costs of misallocation and inefficient layoffs.

A Model details

A.1 Definitions

An equilibrium is defined by the optimality of three decisions: layoffs, quits, and wages. The firm lays off a worker if their realized productivity plus the continuation value of keeping the worker is lower than wages, which defines the layoff rate as a function of wages. Workers quit if the outside option is higher than wages, which defines the quit rate as a function of wages. The firm does not control workers' quit decisions and cannot commit to a layoff policy, hence it takes both the layoff and quit rate functions as given when it chooses wages to maximize profits. Below we define an equilibrium formally.

Definition 1 *An equilibrium is defined by wages w^*_ψ, retention function $\rho(w)$, and layof function $\delta_\psi(w)$, such that conditions (I), (II), and (III) below hold:*
(I) Workers quit if $w < b$. Hence, retention function is:

$$\rho(w) = P_b\big(b \leq w\big) = F_b(w).$$

(II) Firm lays off worker if realized markdown is negative. Hence, layoff function is:

$$\delta_\psi(w) = P_\eta\big(\mu_\psi(w) + \eta \leq 0\big) = F_\eta\big[-\mu_\psi(w)\big].$$

(III) Firm chooses wages to maximize the expected present value of profits:

$$w^*_\psi = \arg\max_w V_\psi(w). \tag{7}$$

Where $\mu_\psi(w)$ and V_ψ are defined as follows.
Since $\mathbb{E}_\eta\big[\eta\big] = 0$, ex-ante expected markdown is:

$$\mu_\psi(w) \equiv \psi + \alpha - w + \beta V^*_\psi + \mathbb{E}_\eta\big[\eta\big] = \overbrace{\psi + \alpha - w}^{\text{instant markdown}} + \underbrace{\beta V^*_\psi}_{\text{continuation value}}.$$

The expected present value of profits is:

$$V_\psi(w) \equiv \overbrace{\rho(w)}^{\text{retention rate}} \cdot \big[1 - \overbrace{\delta_\psi(w)}^{\text{layoff rate}}\big] \cdot \Big\{ \overbrace{\psi + \alpha - w}^{\text{instant markdown}} + \underbrace{\mathbb{E}_\eta\big[\eta \big| \mu_\psi(w) + \eta \geq 0\big]}_{\text{expected productivity shock for non-laid off workers}} + \overbrace{\beta V^*_\psi}^{\text{continuation value}} \Big\}.$$

And $\mu^*_\psi \equiv \mu_\psi(w^*)$, $V^*_\psi \equiv V_\psi(w^*)$, $\rho^*_\psi \equiv \rho_\psi(w^*)$, $\delta^*_\psi \equiv \delta_\psi(w^*)$.

A few clarifications regarding Definition 1. The term $V_\psi(w)$ represents the value of each individual worker that the firm meets, rather than the total firm

value. Nonetheless, optimizing these two objects is equivalent because the number of meetings is exogenously determined. Additionally, note that the continuation value in $\mu_\psi(w)$ and $V_\psi(w)$ is βV_ψ^*, not $\beta V_\psi(w)$, since the firm does not commit to offering the same wage in subsequent periods.

We now delve into the determinants of the quality-separation correlation. First, we present a theorem that establishes our main theoretical result: high-quality firms have *both* lower quit and lower layoff rates. The theorem's assumptions impose only weak restrictions on the distributions of productivity and outside options shocks, which are necessary to guarantee a unique equilibrium. Second, we discuss the intuition behind this result.

Theorem 1 *Assume F_b is a log-concave distribution and F_η is such that $\frac{\partial \mathbb{E}_\eta\left[\eta\middle|\eta>x\right]}{\delta x} \leq 1$. Then, there is an unique equilibrium and:*

(I) Wages are increasing in firm quality $\left(\frac{dw_\psi^*}{d\psi} \geq 0\right)$;

(II) Markdown is increasing in firm quality $\left(\frac{d\mu_\psi^*}{d\psi} \geq 0\right)$;

(III) Quit rate is decreasing in firm quality $\left(\frac{d(1-\rho(w_\psi^*))}{d\psi} \leq 0\right)$;

(IV) Layoff rate is decreasing in firm quality $\left(\frac{d\delta_\psi(w_\psi^*)}{d\psi} \leq 0\right)$;

(V) Steady-state firm size is increasing in firm quality.

Proof: *Appendix A.2.*

The assumptions in Theorem 1 mean that F_b and F_η do not have heavy tails. These assumptions hold for a wide range of common distributions, as formalized in the following remark.

Remark 1 *The assumptions of Theorem 1 hold if F_b and F_η are any of the following distributions, under any set of parameters: uniform, Normal, and Gumbell.*

A.2 Proofs

Theorem 1: Define the following functions: $H_\eta(x) \equiv \mathbb{E}_\eta\left[\eta\middle|\eta \geq x\right] - x$ and $H_b(x) \equiv \frac{1}{\frac{\partial ln F_b(x)}{\partial x}}$. Taking first order conditions of Equation (7) with respect to w, we have that:

$$H_\eta(-\mu_\psi^*(w)) = H_b(w^*). \tag{8}$$

(I) Wages are increasing in firm quality: Replacing $\mu^*_\psi(w)$ from Definition (1) in Equation (8), taking total derivative with respect to ψ , and isolating $\frac{dw^*}{d\psi}$, we have:

$$\frac{dw^*}{d\psi} = \frac{H'_\eta \cdot (1 + \beta V'^*)}{H'_\eta - H'_b}. \tag{9}$$

Under the assumptions of Theorem (1), $H'_b > 0$ [14], and $H'_\eta < 0$ [15]. Additionally, $V'^* > 0$ since the value of a match is always increasing in firm quality. Therefore, from Equation (9), $\frac{dw^*}{d\psi} > 0$.

(II) Expected markdown is increasing in firm quality: Replacing w from Definition (1) in Equation (8), taking derivatives with respect to ψ, and isolating $\frac{d\mu^*(w)}{d\psi}$, we have:

$$\frac{d\mu^*(w)}{d\psi} = \frac{\partial \mu}{\partial \psi} + \frac{\partial \mu}{\partial w} \cdot \frac{dw}{d\psi} = \frac{H'_b(1 + \beta V'^*)}{H'_b - H'_\eta}. \tag{10}$$

Since $H'_b > 0$ and $H'_\eta < 0$ under the assumptions of Theorem (1), and $V'^* > 0$, from Equation (10), $\frac{d\mu^*(w)}{d\psi} > 0$.

(III) Quit rate is decreasing in firm quality: Since wages are increasing in firm quality, and quit rate is decreasing in wages, it is also decreasing in firm quality.

(IV) Layoff rate is decreasing in firm quality: Since expected markdown is increasing in firm quality, and layoff rate is decreasing in expected markdown, it is also decreasing in firm quality.

(V) Steady-state firm size is increasing in firm quality: Firm size dynamics can be described as $s_{t+1} = \rho(w_t) \cdot [1 - \delta_\psi(w_t)](1 + s_t)$. In steady-state, $s_t = s_{t+1} = s$. Isolating s, steady-state firm size is:

$$s = \frac{\rho(w) \cdot [1 - \delta_\psi(w)]}{1 - \big[\rho(w) \cdot [1 - \delta_\psi(w)]\big]}.$$

Therefore, since retention ($\rho(w)$) is increasing in firm quality and layoffs ($\delta_\psi(w)$) are decreasing, firm size is increasing in firm quality.

[14] Since $F_b(w)$ is log concave, $\frac{\partial \log F_b(w)}{\partial w}$ is decreasing, hence $\frac{1}{\frac{\partial \log F_b(w)}{\partial w}}$ is increasing. That is, $H'_b(x) > 0$.

[15] $H'_\eta = \frac{\partial \mathbb{E}_\eta\left[\eta \middle| \eta \geq x\right]}{\partial x} - 1$, so $H'_\eta < 0$ since $\frac{\partial \mathbb{E}_\eta\left[\eta \middle| \eta \geq x\right]}{\partial x} < 1$.

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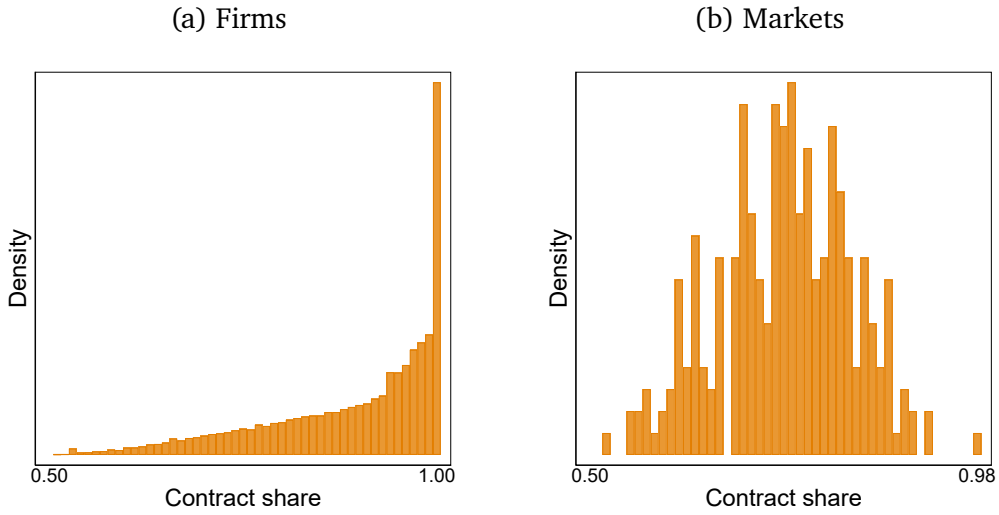
Supplemental Appendices

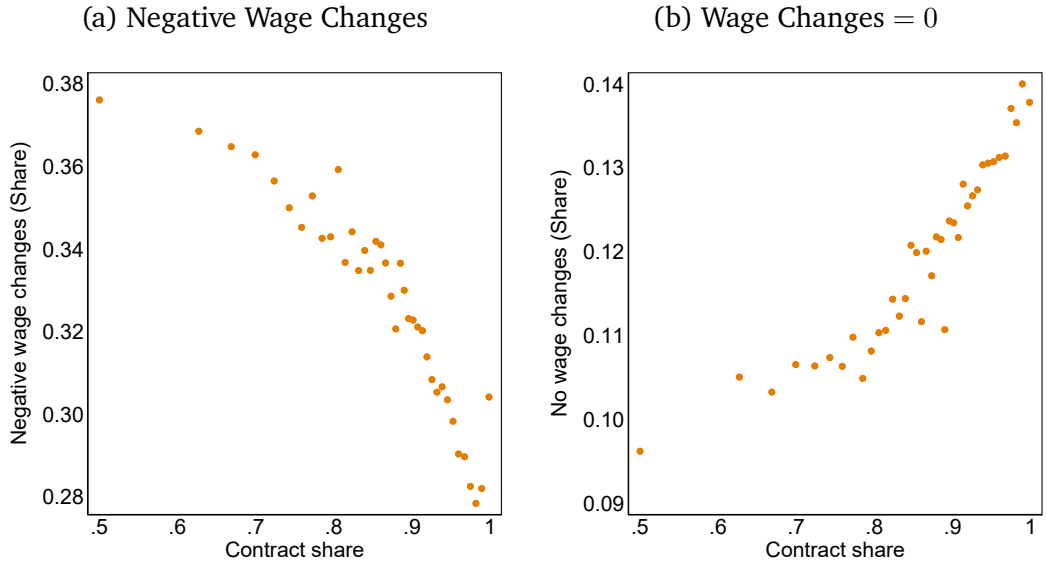
B Appendix figures and tables

Figure B.1 – Distribution of wage rigidity proxy (ContractShare) across firms and markets



Notes: This figure depicts the distribution of our firm-level measure of wage rigidity, ContractShare (see Equation 3). Higher ContractShare indicates stronger wage rigidity. To mitigate endogeneity concerns, we compute ContractShare using the first year each firm appears in the sample and hold it fixed throughout the analysis. Additionally, we exclude the year used to define ContractShare from subsequent analysis. Panel (a) shows the distribution of ContractShare across firms, while Panel (b) presents its distribution across markets. The data is from the administrative records of the Brazilian Ministry of Labor (RAIS) and is at the firm level. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1.

Figure B.2 – Higher ContractShare is associated with more rigidity wages (robustness)



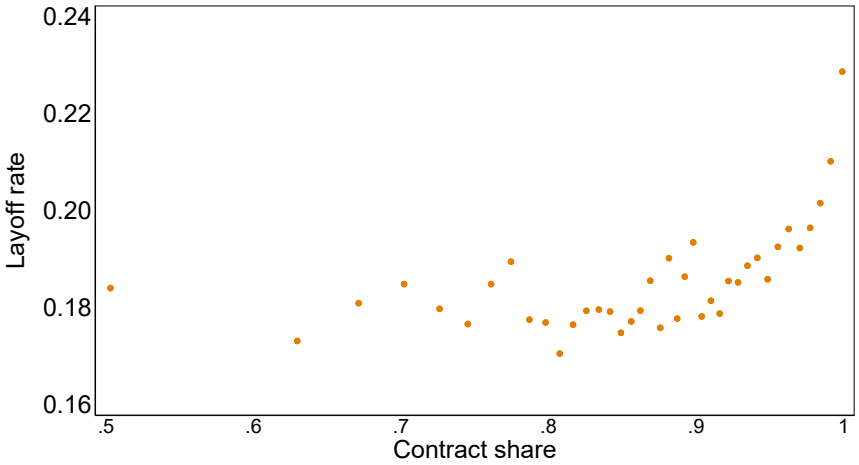
Notes: This figure illustrates the relationship between wage rigidity and ContractShare is not driven by workers' sorting. ContractShare represents the average share of salaries disbursed as contract pay in each firm, as defined in Equation (3). The two panels depict correlations between ContractShare and different measures of wage changes for workers who remain in the same firm for two consecutive years: Panel (a) presents the share of workers experiencing negative wage changes; and Panel (b) presents the share of workers experiencing no wage changes. Both panels show the relationship after controling for race, occupation, tenure, AKM worker effects, and flexible interactions of gender, age, and education. The data is from the RAIS dataset and is at the firm level. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1. Estimates are weighted by firm size.

Table B.1 – Quality-layoff corr. drives quality-separation corr.: Robustness

	(1)	(2)	(3)	(4)
Panel A - Firm Size				
β^{Layoff}	-0.015***	-0.011***	-0.010***	-0.009***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$\beta^{\text{Separation}}$	-0.016***	-0.012***	-0.011***	-0.010***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$\frac{\beta^{\text{Layoff}}}{\beta^{\text{Separation}}}$	0.927***	0.906***	0.947***	0.899***
	(0.0035)	(0.0047)	(0.0052)	(0.0061)
Observations	49,835,818	49,830,114	49,835,818	49,830,114
Panel B - Firm Pay Premium				
β^{Layoff}	-0.214***	-0.183***	-0.116***	-0.131***
	(0.0002)	(0.0003)	(0.0003)	(0.0003)
$\beta^{\text{Separation}}$	-0.264***	-0.236***	-0.165***	-0.187***
	(0.0003)	(0.0003)	(0.0004)	(0.0004)
$\frac{\beta^{\text{Layoff}}}{\beta^{\text{Separation}}}$	0.812***	0.773***	0.702***	0.702***
	(0.0018)	(0.0025)	(0.0034)	(0.0033)
Observations	49,835,818	49,830,114	49,835,818	49,830,114
Panel C - Value Added				
β^{Layoff}	-0.049***	-0.032***	-0.026***	-0.023***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$\beta^{\text{Separation}}$	-0.058***	-0.038***	-0.035***	-0.030***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$\frac{\beta^{\text{Layoff}}}{\beta^{\text{Separation}}}$	0.851***	0.828***	0.748***	0.776***
	(0.0055)	(0.0095)	(0.0091)	(0.0120)
Observations	9,289,254	9,288,612	9,289,254	9,288,612
Worker covariates			✓	✓
Worker AKM Effect		✓		✓

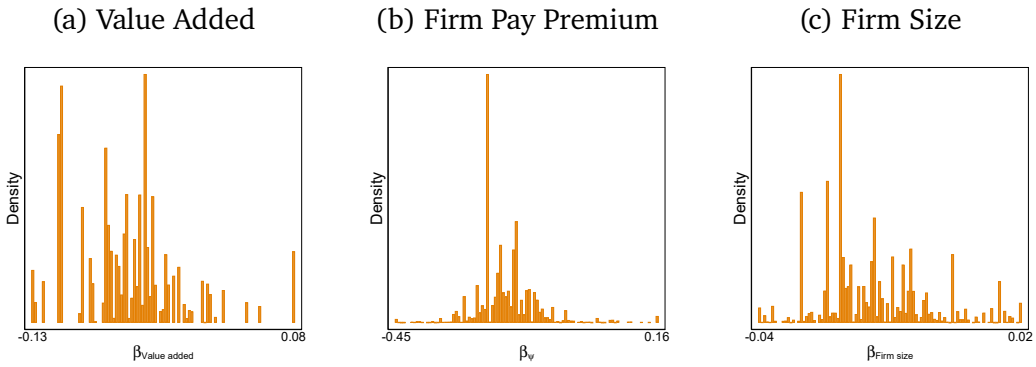
Notes: This table reports OLS estimates of Equation (1), which describe the relationship between separation rates and firm quality. Firm quality is measured using three metrics: (1) "Value Added" (Panel A), as described in Section 1.1; (2) "Firm Pay Premium" (Panel B), derived from AKM firm fixed effects (Appendix C); and (3) "Firm Size" (Panel C), defined as the total number of workers in the firm during the first year of the sample. Estimates for layoff rates and total separation rates are labeled β^{Layoff} and $\beta^{\text{Separation}}$, respectively. Controls include worker-specific wage components from an AKM estimation (detailed in Appendix C) and the following covariates: race and occupation fixed effects, tenure and tenure squared, and interactions between age, age squared, gender, and education fixed effects. The data is at the worker level. Value added is sourced from the PIA dataset, which is aggregated at the industry-state level. Pay premiums, firm size, and separation rates are calculated using the RAIS dataset. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1. Panel A is further restricted to manufacturing firms.

Figure B.3 – Firms with higher ContractShare have more layoffs (robustness)



Notes: This figure illustrates the robustness of the relationship between layoff rates and ContractShare, after controling for different measures of worker heterogeneity. The layoff rate is defined as the proportion of a firm's workers laid off per year, while ContractShare represents the average share of salaries disbursed as contract pay in each firm, as defined in Equation (3). We controls for a wide range of worker heterogeneity: race, occupation, tenure, AKM worker effects, and flexible interactions of gender, age, and education. The data is from the RAIS dataset and is at the firm level. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and it is restricted to firms within the largest connected set, as detailed in Section 1. Estimates are weighted by firm size.

Figure B.4 – Distribution of Market-Level Quality-Separation Correlation ($\hat{\beta}_m$) Using Different Firm Quality Measures



Notes: This figure depicts the distribution of the market-level quality-separation correlation ($\hat{\beta}_m$), estimated from regression (5). Each panel presents the distribution using a different measure of firm quality: Panel (a) Value Added, as described in Section 1.1; Panel (b) Firm Pay Premium, derived from AKM firm fixed effects (Appendix C); and Panel (c) Firm Size, defined as the total number of workers in the firm in the first year of the sample. The data is from the administrative records of the Brazilian Ministry of Labor (RAIS) and is at the firm level. The sample covers the period from 2010 to 2017, includes all urban private-sector jobs in the Southeast Region, and is restricted to firms within the largest connected set, as detailed in Section 1.

C AKM estimation

to-do

D Setting: Details

The Public Pension Fund: FGTS. All formally employed workers in the private sector are required to have an account at *Caixa*, a public bank. This account is known as FGTS (Fundo de Garantia do Tempo de Serviço). Employers must deposit 8% of each worker's gross monthly salary into this account. Furthermore, if a worker is laid off, they receive a severance payment amounting to 40% of the total balance accrued in their FGTS account. Workers can access these funds if they are laid off or upon reaching retirement age.

Layoff Fine. In the event of a layoff, firms are required to pay a government fine equivalent to 10% of the worker's total FGTS balance. This is in addition to the 40% severance payment made directly to the worker.

Unemployment Benefits. Workers who are laid off are eligible for unemployment benefits, which are contingent upon the length of their formal employment. The benefits are structured as follows:

- Workers employed for 6 to 11 months within the last 36 months receive three months of benefits.
- Workers employed for 12 to 23 months within the last 36 months receive four months of benefits.
- Workers employed for 24 months or more within the last 36 months receive five months of benefits.

→ In 2015, the monthly unemployment payment ranged from one to 1.76 times the minimum wage, dependent on the worker's average salary prior to being laid off.