

Worker churning and wage rigidity over the business cycle: the role of firm quality*

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Abstract

This paper studies the quality of employment and wage adjustments over the business cycle. We do this evaluating the two possible mechanisms that firms have to adjust their labor costs: worker flows and wage changes. The most distinctive feature of the impact of the current crisis on the labor market is the reduction in hirings and churning and the increase in wage cuts for continuing workers. We show that churning, the replacement of departing workers with new ones, has decreased substantially during the crisis and that hirings have a larger contribution to the Portuguese business cycle than separations.

Low-quality firms dominate the reaction of the labor market to the economic conditions. The effect of increased unemployment is a reduction in hirings and separations, inducing a substantial reduction in churning. These adjustments are all concentrated in firms that pay lower wages. The observed halt in labor market flows was compensated by wage flexibility. There is a great deal of wage flexibility in Portuguese firms and there is no evidence that wage rigidity indicators increase with the business cycle. On the contrary, we show that high-paying firms reduce the share of minimum wage workers in recessions, while low-quality firms increase it. Our results show that in recessions jobs become stickier in low-quality firms, they reduce churning, and simultaneously there is a shift in employment towards high-paying firms. Thus, Portuguese recessions are characterized by a cleansing effect: the shedding in jobs in recessions is concentrated in low-paying firms, contributing to a positive impact of recessions in labor productivity and explains the counter-cyclical behavior of match quality.

Keywords: Rotation; Churning; Separations and hirings; Wage rigidity; Business cycle

JEL Codes: E24; J21; J63.

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1 Introduction

An outstanding issue in the micro and macro economics literature is the quality of cyclical adjustments in the labor market. A Schumpeterian views tend to stress the role of cleansing effects, increasing the average quality of matches, but recently the role of a sullyng effect of recessions has also been raised [Barlevy \(2001\)](#).

We address this issue using Portuguese matched employer-employee data between 2000 and 2012. We rank firms according to match quality and study the reaction of worker flows and wage rigidity to business cycle (measured by the unemployment rate) variation. We answer the following questions: An increase in the unemployment rate increases the share of employment in high quality firms, acting as a cleasing effect? What are the channels (hires or separations) for this adjustment? What is the role of price (wage) mechanisms in the adjustment?

Churning is crucial to the ability of firms to renew its workforce and, therefore, an important part of the dynamics of employment. Also for workers, churning promotes the a more efficient use of human capital, directing it to the more productive applications, generating a vacancy chain that improves resource allocation in the economy ([Akerlof, Rose and Yellen 1988](#)) and increases the wage profile of young workers ([Topel and Ward 1992](#)).

Stopping the process of hiring and churning in the economy is a structural symptom of a country's economic decline. As with any investment, the hiring decision leads the economic cycle and, therefore, a detailed analysis of this process is important to understand the quality of business cycle adjustments.

Hirings occur when firms need to expand their workforce or to replace workers who leave the firm, either voluntarily or following a dismissal. In the first case, the hiring is related to the firm's growth. The second case happens whenever the company wants to avoid a reduction in the number of employees – firms *churn* workers as hirings and separations occur without a change in employment. In both cases, firms and workers decide on their single most important investment: the choice of the best usage of human capital.

Another critical issue for productivity and cost adjustment are wages. Firms decide how they pay their human capital and this process introduces some form of rigidities as labor is a form of a quasi-fixed input, not only in the assertion of [Oi \(1962\)](#), but also because nominal rigidities arise in wages by a large number of reasons ([Harris and Holmstrom 1982](#), [Beaudry and DiNardo 1991](#)) and these have consequences to the cyclical behavior of wages [Arozamena](#)

and Centeno (2006). It is, thus, crucial to study how firms adjust wages over the business cycle. These are the two aims of this paper. To look at internal adjustment in wage and employment composition, through the churning of workers, and to understand the external dimension of adjustment, through hires and separations.

In itself, this type of rotation does not lead to employment growth and it is almost invisible to the outsider. However, the labor market cycle – employment and unemployment – and the promotion of more productive allocations of resources are closely related to churning.

We show that in Portugal the evolution of employment is predominantly determined by the hiring decisions of firms (a result similar to the one obtained in Hairault, Le Barbanchon and Sopraseuth (2012) for France or Kahn and McEntarfer (2013) for the US). According to the Social Security data, the employment reduction observed since 2007 is associated with a drop in hirings, which happened in all industries. Note that the lower level of hiring is mainly due to reduced rotation of workers in expanding firms. This relationship is similar to the one observed in other advanced economies, in particular in the U.S. (Lazear and Spletzer 2012)

In our empirical exercise, match quality is associated with the level of wages. High-quality firms are less sensitive to the business cycle, both in terms of hires and separations. The high sensitive of hirings to the business cycle come from a significant reduction of new contracts in low-wage firms. The reduction in wages is extended to churning.

The strong reduction in the rotation of workers has a negative impact on the evolution of productivity because it represents a decrease in the investment, by workers and firms, in the search of more productive matches. However, because this is concentrated in low-quality firms it generates a counter-cyclical behavior of match quality.

Wage rigidity varies substantially across firms. Low quality firms have a larger share of minimum wage earners and higher wage rigidity. These measures of wage rigidity show some cyclical behavior. Low-quality firms present, again, a sharper reaction, in particular with an increase in the share of minimum wage workers during periods of high unemployment. All firms increase the share of wage cuts, but low-quality firms react the most. This result can be reconciled with efficiency wage theories.

These results have an important consequence for policy and to the evolution of productivity across the business cycle. Low-match quality firms are on average less productive and their stronger sensitivity to the business cycle may help to explain the cyclical behavior of productivity. This issue deserves attention in the future.

2 Labor market flows and wage rigidity: Definitions

Employment is the result of entry and exit flows of workers in firms. These flows occur simultaneously in most firms. Also, at any moment, there is a number of firms expanding employment, another shedding jobs and still another with stable employment. We measure these flows following the concepts introduced in the seminal work of [Davis, Haltiwanger and Schuh \(1996\)](#).

Formally, we define the following flows:

Hirings: the set of workers who work in the firm in the last month of a given quarter, but were not part of the firm's labor force in the last month of the previous quarter. This definition ignores all the hirings that occurs during the quarter that do not reach the final month of that quarter.

Separations: the set of workers in the firm in the last month of a given quarter who were not part of the firm's labor force in the last month of the following quarter. This definition ignores all workers who separate from the firm during the quarter and return to the job before the last month of that quarter.

Job-to-job transitions: the set of workers that are reemployed in the two months after separation.

Job-to-nonemployment transitions: the set of workers that are not reemployed two months after separation.

Job creation: is the sum of job gains in firms that increase employment between two consecutive quarters (expanding firms).

Job destruction: is the sum of the job reductions in firms that decrease employment between two consecutive quarters (contracting firms).

Two hirings do not always give rise to an increase of two jobs in the firm. For example, if two workers decide to change job in the same period, there will be two hirings and two separations and no change in employment. In other cases, firms promote the simultaneous hiring and separation of workers in order to find the most appropriate worker for their duties. The idea that there could be more workers involved than the net employment gains is defined as excessive rotation of workers or churning. Formally,

Churning: is given by twice the number of separations for expanding firms; twice the number of hires for contracting firms; and the sum of hires and separations for firms with stable employment.

An example helps to understand the concept: if a firm increases its employment by 50 workers, but has 20 separations, overall it had to hire 70 workers. Entry and exit amount to 90 workers, of which 40 workers correspond to churning; the number of workers who did not contribute to the growth of employment in the company.

These flows occur in firms that remain active between two consecutive quarters. But there are also flows related with the birth of new firms and the death of existing firms. Our data do not identify in legal terms start-ups and closures. Nonetheless, we define these flows as:

Firm birth: corresponds to a firm that has workers in a given quarter, but not in the previous one.

Firm death: occurs when a firm with workers in a given job quarter fails to report employment in the following quarter.

These concepts capture closely the economic concepts of entry and exit of firms. Admittedly, some of these firm flows are seasonal closures, in periods in which the revenues do not cover variable costs, firms choose rationally to close temporarily. But even these are important for characterizing the flexibility in the economy and to measure the flows of job creation and destruction.

The discussions surrounding the relevance of wage rigidity to explain labor market flows are far from settled, starting with a convenient definition of wage rigidity. The degree to which nominal wages are downwardly rigid is an empirical question with evidence on all sides [Pissarides \(2009\)](#).

We are interested in testing whether the strength of downward pay rigidities vary with firm quality. We follow [Dickens, Goette, Groshen, Holden, Messina, Schweitzer, Turunen and Ward \(2007\)](#) and measure nominal pay rigidity as the ratio of zero wage changes in a given firm and year to the total non positive wage changes in that firm and year.

This measure is interpreted as follows: among the workers who were at risk for receiving a nominal pay decrease, what share did not receive one? This measure is far from perfect. It only captures rigidities among stayers at a firm, and we will see that firms differ quite substantially in

terms of their gross hiring and separation strategies. This measure assumes that all zeros are the consequence of rigidities and they can simply be the result of an optimal wage setting, based in efficiency wage arguments (Akerlof and Yellen 1985), imperfect information or insurance (Harris and Holmstrom 1982) or explicit personnel policies (Doeringer, Piore et al. 1971).

As an alternative we will look at simpler indicators: the share of negative wage changes and the share of workers with the minimum wage. Most arguments made about wage rigidity having an impact on labor demand do not arise from optimal firm behavior that generate apparent rigidity in the form of zero changes, but on the imposition of external restrictions (frictions) to wage setting. In Portugal, the claim that nominal wages could not be reduced was part of the mythical view of the Portuguese labor market until very recently. Negative wage changes are frequent, and we will analyze how they vary over the business cycle and by firm quality. The minimum wage is binding for a large fraction of the Portuguese workers (larger than 15 per cent in 2012) and is indeed the most relevant restriction to the wage setting process in Portugal.

3 Evaluating firm quality

A key variable in our analysis is firm quality. This is not observed directly from the data. In the literature several measures are used as proxies for firm quality. Kahn and McEntarfer (2013) uses firm size and the average wage, but we also know that firm age interacts with firm size as a measure of firm quality Haltiwanger, Jarmin and Miranda (2010).

We follow a standard approach in the literature as in Holzer, Lane, Rosenblum and Andersson (2011) and estimate firm fixed-effects in a log-wage model. The model includes worker fixed-effects and industry dummies. We recover the firm fixed-effects and use them as a constant (over the sample period) indicator of firm quality. The fixed-effects can be considered an index of the firm specific component of wages after controlling for worker and industry effects. The firm fixed-effect is an estimate of the wage premium paid by each firm to its workers holding the sector and all unobserved workers characteristics constant.

An alternative approach implemented at the match level is to run a log-wage model with industry dummies and use the average wage residual as a firm specific component and measure of firm quality. The advantage of this approach is that we obtain a firm quality proxy that varies over time.

4 Data

This paper uses data from the Social Security Records to compute the quarterly jobs and workers flows, and the measures of wage rigidity. The database covers all salaried labor relations with remuneration for the public social security system. The database excludes firms with private pension funds and public employees covered by the specific civil servants system. In the computations, we excluded firms in the primary sector (in which salaried work is not representative) and the financial, public administration, education and health sectors (because they have been gradually incorporated in the general Social Security system, distorting the computations of flows).

In 2004 there was a revision of the Portuguese Labor Code that increased the employment protection in firms with 11 to 20 workers. This reform entailed a change in the pattern of worker flows, documented in [Centeno and Novo \(2012\)](#). For this reason we restrict our dataset to firms with more than 20 workers.

The nature of the information, mandatory firm-reported wage records and its monthly periodicity make these data a unique source of reliable information on the the labor market evolution. The data cover the period from January 2000 to December 2012.

Figure 1 show employment-weighted kernel densities of the main variables used in the paper: churning rate, wage rigidity indicators and firm size. The distributions of churning and size have long right tails and we have substantial variation across firms over this time period in all measures.

[FIGURE 1 HERE; SEE PAGE 24]

[TABLE 1 HERE; SEE PAGE 20]

Table 1 presents summary statistics of the main variables by firm quality quintiles. Low quality firms have higher hiring and separation rates. The share of the minimum wage is higher in low quality firms (11% in the lowest quintile, compared with 0.1% in the highest quintile) and they also show larger values for the rigidity indicators. Computed with the monthly base wage the average rigidity indicator is 45% for low quality firms and 13% for the high quality ones. If instead, we use the more relevant measure of total annual pay we get the same pattern in terms of firm quality, but much smaller values for the indicator: 10% for low quality firms and 4% for high quality ones. These figures are computed with workers that work the full year

in each two consecutive years, a procedure similar to [Kahn and McEntarfer \(2013\)](#) for the U.S. The figures we obtain for Portugal are close to the ones they obtain for the U.S.

5 The Portuguese labor market

There are two dominant characteristics of the Portuguese labor market. On the one hand, the continuous rise in the unemployment rate. This should be interpreted as a structural movement. On the other hand, the labor market is segmented. The Portuguese labor market is split, with a growing share of fixed-term contracts, a low conversion rate of temporary into permanent contracts and a significant wage premium for permanent contracts. These features are the result of a poor functioning of the labor market, with bad consequences on total factor productivity and, consequently, on the production level.

These characteristics are consistent with a significant turnover of workers, as shown in [Hall \(1982\)](#). The rotation of fixed-term contracts is larger, even if nowadays most groups of the economy have significant rotation levels. The share of long-term employment (workers over 45 years and with more than 20 years of tenure) decreased by 18 percentage points since the mid 90s. More than 90 percent of the unemployed who find a job are hired under a fixed-term contract. Consequently, the rotation of workers in Portugal is one of the highest of the European Union and closer to the flows in the U.S. than previous identified (?).

The recent crisis occurred in an adverse environment with many structural weaknesses. Ever since, the Portuguese economy has been unable to create jobs in a sustainable manner. The new jobs are overwhelmingly temporary, which hampers productivity growth and investment in human capital. The evolution of employment and turnover since the end of 2011 must be understood in this general framework.

The weak economic growth in Portugal in the last decade has naturally reflected itself in the behavior of the labor market. Until the outbreak of the financial crisis in 2008, employment gains were only marginal ([Figure 2](#)). The jobs created by expanding firms (the job creation flow) was approximately equal to those destroyed by contracting firms (the job destruction flow). Since 2008, there are systematic job losses, which cumulatively reached 14%.

However, this decline does not result from an increase in the rate of workers separations, but reflects instead a pronounced drop in the firms' hiring rates. Between 2007 and 2012, the quarterly hiring flows decreased 42%, from an average of 240,000 new contracts to only 140

000. The number of firms that hired workers in each quarter decreased from 65 thousand to 40 thousand, and the average number of hires per firm fell from 3.7 in 2007 to 3.5 in 2012.

[FIGURE 2 HERE; SEE PAGE 25]

The evolution of separations is quite diverse from that of hires. Contrary to the common wisdom, in firms with separations the average number of exits remains stable, 3.4 employees per firm, despite the recessionary phase of the economy. Also, the share of firms that separate from workers remained also stable between 2007 and 2012, about a quarter of all firms. Given the reduction in the number of firms, there was a reduction in the number of separations in the Portuguese labor market.

In 2007, employment gained 30,000 jobs; in 2012, 54,000 jobs were lost. This is explained by the different dynamics of job creation and destruction. Two thirds of this difference originates in a lower dynamics of expanding firms. These companies created 130,000 jobs in 2007 and only 71,000 in 2012. The remaining third is justified by a further reduction of employment in contracting firms, from 98,000 job losses to 125,000.

As mentioned above, the churning of workers plays a role in the allocation of resources in the economy. Typically, firms involved in this process churn about 8 workers per quarter. The dynamics of hires and separations resulted in a fall in churning of 38%. This result points to a greater difficulty of workers and firms to form more productive matches. There are two behaviors explaining this trend: workers reduce voluntary quits, common in downturns (Anderson and Meyer 1994) and firms do not promote the substitution of voluntary quits or redundancies.

An important dimension of the dynamics of Schumpeterian creative destruction is based on the entry and exit of firms. In 2012, this adjustment process resulted in a net reduction of 2,500 firms, in contrast with the increasing number of firms in 2007. There was a reduction of 33% in the creation of new firms and an increase in firm's closures of 23%.

Another striking feature of the Portuguese labor market is wage flexibility. This wage flexibility is reflected in the large share of wage cuts (measured as negative wage changes in two consecutive years in a surviving match). Note that only less than two-thirds of existing matches survive two consecutive years.

[FIGURE 2 HERE; SEE PAGE 25]

A key point in our analysis is to ask if there is any business cycle variation in indicators of wage rigidity.

6 The business cycle and the quality of labor market adjustment

In the following subsections, we analyze the relationship between the business cycle and the quality of labor market adjustments. We start with a simple overview of the aggregate level behavior by comparing the evolution of GDP growth and conventional measures of labor market flows. Then, at the firm level, we study the relationship between firms' choices of hires, separations, and churning with the business cycle.

6.1 An aggregate view of labor market flows

The motivation to study labor market flows and the business cycle is illustrated in Figure 3. The left panel plots the hiring rate along with the quarterly GDP growth rates. These two seem to mimic each other. The right panel show the relationship for the separation rate. The level of association is lower.

[FIGURE 3 HERE; SEE PAGE 26]

A clear pattern emerges: GDP correlates with hires and job creation (odd-numbered columns), but it has a weak association with the measures of worker separations and job destruction (even-numbered columns). This finding is compatible with those found for other economies, for example in the United States in [Shimer \(2007\)](#), which emphasizes the importance of hires and job creation decisions for the fluctuations of employment and unemployment and, therefore, output.

6.2 Firm-level analysis: Hires, separations, churning and the business cycle

We explore the patterns exhibited in the Granger-causality framework using a firm-level regression framework, where we can control for additional potentially confounding factors. We are particularly interested to know which firms lead the process of employment adjustment over the cycle. We measure firm quality using two indicators: the size (number of workers)

and the average wage of firms. After controlling for age, large firms tend to be more productive, and also those paying higher wages, after controlling for the sector of activity. A larger fall in churning, hires and separations for high quality firms will have a negative impact on productivity and economic growth.

We regress LMF_{it} – the hiring, separation, churning rates, or net job creation – of firm i , in time period t , on (i) an indicator of the business cycle – the unemployment rate¹, (ii) a vector of firm quality indicators (F_q) – an estimate of the firm fixed-effects or the firm average wage residual, both measures were obtained from a log-wage model as explained above, and (iii) their interactions. Additionally, in X_t , we control for the age and size of the firm, industry fixed effects, time effects and seasonality, and all the regressions include firm fixed effects.

The model estimated is described in equation (1):

$$LMF_{it} = \alpha_0 + \alpha_1 cycle_t + \alpha_2 F_q + \alpha_3 cycle_t \times F_q + \alpha_4 X_{it} + \lambda_i + \delta_t + \epsilon_{tq}. \quad (1)$$

Table 3 summarizes the coefficients of the models that use the two measures of firm quality (firm fixed-effects and the sector conditional wage). In column (1), the dependent variable is the number of hires. The main effect of the unemployment rate is negative. The impact becomes less negative as firms increase in quality and it is statistically different from zero up to the highest quality percentiles. Given the non-linearity of the model we plot in Figures 4 to 7 the marginal impact of the unemployment rate over the distribution of the two firm quality indicators on the worker flow measures. A one percentage point increase in the unemployment rate entails a reduction of 0.6-0.7 hires. The sensitivity of the number of hires to the cycle is quite different for low and high quality firms. The more negative impacts are estimated for low quality firms, with a reduction in hires that is slightly larger than one, whereas for high quality there is no statistically meaningful effect of the business cycle.

[TABLE 3 HERE; SEE PAGE 22]

[FIGURES 4 to 7 HERE; SEE PAGE 27 to 30]

In column (2) we study the separations behavior. As hinted in aggregated analysis, separations react much less to the cycle. The main effect of the unemployment rate is one-third smaller than the one for hires. The median quality firms reduce separations by 0.3 as a response

¹We have also estimated models with the GDP growth rate or an indicator for recession.

to one percentage point increase in the unemployment rate. Though firms are more likely to make lay-offs in a recession, our findings are consistent with a more-than-offsetting decline in voluntary quits (evidence for this is available for the US in [Shimer \(2005\)](#) and [Hall \(2005\)](#)). This behavior of the composition of separations makes them not responsive to output. In fact, if the composition of separations change over the business cycle, the impact on output is expected to be reduced as the impact on productivity of the two movements is quite diverse.

We investigate this hypothesis in columns (3) and (4) distinguishing the behavior of two types of separations: job-to-job and job-to-nonemployment. We classify a separation as job-to-job if the worker finds a job in a new firm in the two months following the separation. The results are strikingly different. Whereas job-to-job transitions reacts strongly to the cycle, the job-to-nonemployment transitions are not sensitive to the business cycle and may have different impacts for low and high quality firms ([Figure 5](#) and [Figure 7](#)). The attenuated cyclical behavior of separations is the result of a strong negative impact of the unemployment rate on job-to-job transitions and a mild positive impact on job-to-nonemployment transitions.

The impact of economic activity on the churning is shown in column (5). We conclude that churning is lower in recessions and that all firms reduce churning, but low quality firms are more sensitive to the business cycle ([Figures 5](#) and [7](#)). There is a different impact along the distribution of firm quality. For low quality firms, bad economic times are associated with a substantial reduction of excessive worker rotation (-1 worker churned per percentage point increase in the unemployment rate). For high quality firm the opposite occurs, they reduce churning in bad times but to a much smaller extent (-0.2 workers). There is a significant re-composition of the workforce.

This can be seen as the result of large firms being more attractive to workers and offering better matches both in booms and recessions, which leads to a reallocation of workers towards high quality firms in recessions, with positive impact on productivity.

The final column (6) presents the results for employment change. The employment growth effect must be accounted for by the larger impact on hirings, not by a larger reduction in separations. Relatively speaking, low quality firms shrink during times of low growth because they have a larger reduction in hirings. [Figures 4](#) and [6](#) exhibit these effects more clearly. The employment growth effect is negative but decreases steadily across firm quality. The business cycle has no effect on employment for high quality firms.

We find that high quality firms fare relatively better in times of high unemployment in

terms of their employment growth. We believe we have identified an economically important phenomenon at a macro-level. Low quality firms explain most of the business cycle variation of employment, contributing to a countercyclical behavior of match quality and productivity. In recessions jobs flow to high quality firms.

The main results of this section can be summarized as follows. High quality firms churn fewer workers and have lower hiring and separation rates. These firms have a smaller sensitivity to the business cycle in terms of hirings and separations, and consequently also in terms of churning. In recessions, we observe a re-composition of employment towards high quality firms. Employment is stickier in high quality firms and so remains in recessions. This is the result of lower hirings and voluntary quits. Workers do not leave good jobs.

The model behind these results must include on-the-job-search. This mechanism induces a vacancy chain that is severely reduced in recessions, generating lower churning and sticky employment.

Firms adjust labor costs using different adjustment mechanisms. We emphasized the worker and job flow dimension, but this adjustment can also be made through a direct adjustment in wages. We explore the sources of wage rigidity in the next section.

6.3 Firm-level analysis: wage rigidity and the business cycle

There are two possible channels of adjustment of labor costs over the business cycle, the rotation of workers, which captures an external dimension, and the wage adjustment of stayers, which captures an internal dimension of the adjustment. Note that the rotation of workers has itself a wage motivation. Firms replace workers in tasks with reduced demand (that become cost-expensive) with new workers to perform tasks that face increasing demand. It is also possible for firms to promote the replacement of high-tenure, high-paid by low-tenure, low-paid workers.

It is often mentioned that internal adjustments are harder to make because wage rigidity is optimal in many contract models of the labor market. This may occur because of incentive concerns, explicit contractual restrictions or because firms are willing to provide workers with an insurance against market fluctuations that workers end-up paying in the form of lower wages, a premium they pay for being insured.

Nevertheless, we observe a substantial share of negative wage adjustments in Portuguese firms. The existence of these adjustments make it reasonable to consider that firms adjust wages to reflect the economic conditions they face in their product markets. In this section

we explore the behavior of several wage rigidity indicators at the firm level, and detail their evolution over the business cycle and firm quality.

As in the previous section we estimate equation (2), regressing wage rigidity in firm i in period t , $WRig_{it}$ – Dickens et al. (2007) nominal wage rigidity indicator, the share of negative wage changes, or the share of minimum wage workers – among firms of quality q on (i) the business cycle indicator, (ii) the firm quality indicators (F_q) used in the previous section and (iii) their interactions.

$$WRig_{it} = \alpha_0 + \alpha_1 cycle_t + \alpha_2 F_q + \alpha_3 cycle_t \times F_q + \alpha_4 X_{it} + \lambda_i + \delta_t + \epsilon_{tq}. \quad (2)$$

Table 4 summarizes the coefficients on the business cycle indicator and its interaction with the firm quality measures. In column (1), the dependent variable is the Dickens et al. (2007) wage rigidity indicator. Wage rigidity does not change with the business cycle. The results point to the fact that the firm’s age seems to be the main variable that helps in explaining nominal wage rigidity. High quality firms have far less rigid wages, in the sense that they have a smaller proportion of zeros in all non-positive wage variations (the Dickens’ measure). This result is consistent with the incentives literature and the workings of internal labor markets. However, we obtain that these firms have also a larger share of negative wage changes. High quality firms cut wages more often. From the results in column (2) we can conclude that the share of negative wage changes is highly sensitive to the business cycle. In Portugal, firms do increase the share of negative wage changes by 1 to 3 percentage points by each percentage point increase in the unemployment rate.

[TABLE 4 HERE; SEE PAGE 23]

[FIGURES 8 and 9 HERE; SEE PAGES 31 and 9]

It is also important to note that there is a persistent occurrence of negative wage changes in Portuguese firms. This may raise some concerns for efficiency wage theories and have an impact on productivity. The high degree of flexibility hinted by the presence of these wage reductions deserves further analysis.

The impact of economic activity on the share of minimum wage earners is shown in column (3). We conclude that high paying firms decrease the share of minimum wage earners in recessions, while those with lower average wages have the opposite behavior (Figures 8 and

9). The lower share of minimum wage workers in high quality firms may be an indicator that they are more concerned with internal factors affecting productivity and separate from a larger share of low-wage workers in recessions to preserve high-productivity – high-paying matches. In this sense, the low-wage characteristic of low quality firms is reinforced in recessions by the increase in the share of minimum wage workers.

Wage rigidity varies substantially across firms. Low quality firms have a larger share of minimum wage earners, lower average wages and higher wage rigidity in the sense of Dickens' definition. In terms of cyclical behavior, firms' reactions do not vary over the distribution of firm quality, except for the share of minimum wage jobs.

7 Conclusions

The economic and financial crisis has stalled the Portuguese labor market. There is less churning, much less hirings and yet surprisingly, fewer separations. These developments are negative for firms productivity because they reflect the absence of new investment.

In Portugal, the business cycle is largely correlated with the hiring rate, not so much with separations. By not investing in new relations, firms shut-down their biggest engine of growth, human capital. Without access to new jobs, workers' return to their investments in human capital is reduced, which generates under-investment in education and training.

We ask what type of firms drive these results. We measure the quality of firms with two alternative indicators. An estimated firm fixed-effect, obtained from a wage regression with worker and firm fixed-effects (in the spirit of [Holzer et al. \(2011\)](#)) and the estimated wage residuals after controlling for industry. Our results do not depend of the specific quality measure we use.

Using employer-employee matched data, we find that low quality firms fare relatively worse in recessions; their employment growth shrinks by more. This is because the hires at high-quality firms do not fall (or fall by much less). Low quality firms are more likely to make lay-offs in economic downturns and to freeze hires by even more, even if they still keep a modest amount of hiring. High quality firms are much less sensitive to the business cycle. The large internal labor market of these firms allow them to shield their workers from the vagaries of the external labor market.

This set of results is consistent with the need by low quality firms to continually replenish

their stock of workers in boom times when they lose their workforce to better firms. In contrast, better firms hold on employment relatively more successfully in recessions (they find it easier to post high-paying vacancies).

Low-quality firms have an hard time attracting and retaining high-quality workers in recessions. These firms have a relatively easier time hiring workers in booms, because they expand more quickly. Therefore a worker matching to a low-quality firm in a boom is not likely to stay there for a long period; he or she will have tend to leave the firm as soon as the business cycle changes.

Following Schumpeter (1939), economists advanced the notion that recessions serve a cleansing mechanism, reallocating resources from least to most productive firms. Our results on employment growth confirm this prediction, because resources flow to high quality firms in recessions. This relative ability of high quality firms to retain their workforce in recessions could be labor supply driven if the decline in voluntary quits in recessions has a larger impact in better firms. Alternatively, it could be labor demand driven if large firms have a greater ability to retain workers.

Our results are, in general, not supportive of the sullyng effect [Barlevy \(2002\)](#). We can see this from the labor supply perspective. In our data, workers accept low quality matches, in low-quality, firms during booms, and these jobs are short-lived and severely destroyed in recessions. But we can also consider the labor demand perspective. There are two possible channels that go against the sullyng effect. The hiring and churning levels are lower; and separations are also lower. This implies that matches become stickier overall, but the adjustment is concentrated in the low end of the match quality, as a consequence, the net quality of matches may increase in recessions.

Workers reduce the wage cut-off for voluntary quits and accept lower wages. Theoretical and empirical models of job matching are consistent with this behavior of the labor market, as [Jovanovic \(1979\)](#), [Beaudry and DiNardo \(1991\)](#) and [Arozamena and Centeno \(2006\)](#).

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Tables and Figures

Table 1: Flows and wage rigidity indicators, employment weighted means by firm type

Indicator	Lowest	2nd	3rd	4th	Highest
Growth rate	-0.0058	-0.0035	0.0025	-0.0009	-0.0034
Hiring rate	0.0778	0.0867	0.1071	0.0628	0.0387
Separation rate	0.0836	0.0902	0.1046	0.0637	0.0421
Rigidity Monthly Wage	0.4480	0.3072	0.1767	0.1927	0.1339
Rigidity Annual Wage	0.0984	0.0838	0.0466	0.0616	0.0407
Minimum Wage Share	0.1104	0.0417	0.0170	0.0058	0.0010
Share of Negative Wage Changes	0.2526	0.2568	0.2506	0.2947	0.2848
Churning distribution					
Lowest	0.0138	0.0147	0.0142	0.0140	0.0120
2nd quintile	0.0273	0.0272	0.0278	0.0279	0.0274
3rd quintile	0.0418	0.0421	0.0423	0.0426	0.0414
4th quintile	0.0662	0.0685	0.0671	0.0674	0.0651
Highest	0.2903	0.2495	0.2203	0.1534	0.1238

Notes: Social Security data, 2000-2012. Weighted by average employment over the sample period. Firm type is proxied by the estimated firm fixed-effects in a log-wage model with worker fixed-effects and industry dummies.

Table 2: Labor market flows in 2007 and 2012

	2007	2012	Total economy $\Delta(12 - 07)$	% change
Employment	2,427,401	2,093,135	-334,266	-13.8%
Hires	244,174	142,178	-101,996	-41.8%
Number of firms with hires	65,118	40,546	-24,572	-37.7%
Average hires per firm	3.7	3.5		
Separations	213,100	196,114	-16,986	-8.0%
Number of firms with separations	63,477	57,363	-6,114	-9.6%
Average separations per firm	3.4	3.4		
Job creation	129,294	70,605	-58,689	-45.4%
Number of firms with job creation	46,581	27,111	-19,470	-41.8%
Average job creation per firm	2.8	2.6		
Job destruction	98,220	124,541	26,322	26.8%
Number of firms with job destruction	41,687	44,770	3,084	7.4%
Average job destruction per firm	2.4	2.8		
Churning	229,761	143,146	-86,615	-37.7%
Number of firms with churn	29,163	18,638	-10,525	-36.1%
Workers churned per firm	7.9	7.7		
Churning in expanding firms	128,019	-58.2%		
Expanding firms with churn	10,626	5,203	-5,423	-51.0%
Workers churned in expanding firm	12.0	10.3		
Churning in contracting firms	69,665	68,896	-769	-1.1%
Contracting firms with churn	7,373	6,046	-1,327	-18.0%
Workers churned in contracting firm	9.4	11.4		
Churning in stable firms	32,077	20,737	-11,340	-35.4%
Stable firms with churn	11,164	7,389	-3,775	-33.8%
Workers churned in stable firm	2.9	2.8		

Notes: Social Security wage records cover all salaried relations with remunerations subject to contributions to the public social security system; the data excludes firms with private pension funds and public employees covered by specific civil servant systems. Furthermore, for comparability reasons and relevance, our analysis excludes firms in the primary, financial, public administration, education, and health sectors.

Table 3: Firm flows by firm size and economic conditions

	Hires		Separations		Job to non-employment		Job to job		Churning		Employment change	
	Coef.	<i>p</i>	Coef.	<i>p</i>	Coef.	<i>p</i>	Coef.	<i>p</i>	Coef.	<i>p</i>	Coef.	<i>p</i>
Unemployment rate	-0.687	0.000	-0.350	0.000	0.013	0.904	-0.457	0.000	-1.004	0.000	-0.337	0.001
Firm fixed effect \times Unemployment rate	1.064	0.000	-0.200	0.313	-0.422	0.019	0.222	0.216	1.079	0.000	1.264	0.000
Firm fixed effect ² \times Unemployment rate	0.661	0.016	1.667	0.000	1.695	0.000	0.309	0.339	1.428	0.021	-1.006	0.004
Number of observations	373023		373023		295420		295420		373023		373023	
Number of firms	10031		10031		9968		9968		10031		10031	
Unemployment Rate	-0.632	0.000	-0.235	0.002	0.133	0.272	-0.427	0.000	-0.886	0.000	-0.397	0.000
Sector conditional wage	-3.272	0.000	3.179	0.000	2.809	0.000	0.847	0.140	-1.671	0.089	-6.451	0.000
Sector conditional wage ²	1.232	0.030	1.094	0.232	1.757	0.030	-0.066	0.917	1.305	0.016	0.138	0.893
Sector conditional wage \times U Rate	0.168	0.002	-0.044	0.541	-0.082	0.147	0.011	0.855	0.220	0.047	0.212	0.000
Sector conditional wage ² \times U Rate	0.334	0.000	0.157	0.009	0.094	0.045	0.106	0.005	0.404	0.000	0.178	0.002
Number of observations	372582		372582		295223		295223		372582		372582	
Number of firms	10031		10031		9968		9968		10031		10031	

Notes: Regressions weighted by average employment over the sample period. Regressions control for main effects of firm quality, a constant, industry fixed-effects, quarter and year fixed-effects and firm fixed-effects. Standard errors are clustered by period (quarter and year).

Table 4: Wage rigidity, firm size and economic conditions

	Rigidity		Share negatives		Share min. wage	
	Coef.	<i>p</i>	Coef.	<i>p</i>	Coef.	<i>p</i>
Unemployment rate	0.011	0.407	0.025	0.001	0.000	0.979
Firm fixed effect \times Unemployment rate	0.003	0.301	-0.0003	0.674	-0.002	0.047
Firm fixed effect ² \times Unemployment rate	-0.028	0.000	-0.016	0.035	-0.012	0.009
Number of observations	89771		94612		94612	
Number of firms	9763		10025		10025	
Unemployment Rate	0.009	0.565	0.021	0.009	-0.004	0.140
Sector conditional wage	0.016	0.817	-0.268	0.008	0.054	0.247
Sector conditional wage ²	0.030	0.638	0.067	0.377	-0.065	0.147
Sector conditional wage \times U Rate	-0.014	0.121	-0.007	0.528	-0.024	0.004
Sector conditional wage ² \times U Rate	0.003	0.730	-0.001	0.967	0.019	0.006
Number of observations	89741		94575		94575	
Number of firms	9763		10025		10025	

Notes: Regressions weighted by average employment over the sample period. Regressions control for main effects of firm quality, a constant, industry fixed-effects, quarter and year fixed-effects and firm fixed-effects. Standard errors are clustered by period (quarter and year). *Rigidity* is the fraction of wages with zero nominal change on wages with non-positive nominal change. *Share negative* is the fraction of wages with negative nominal change on all wage changes in the firm. *Share min. wage* is the fraction of workers earning exactly the minimum wage.

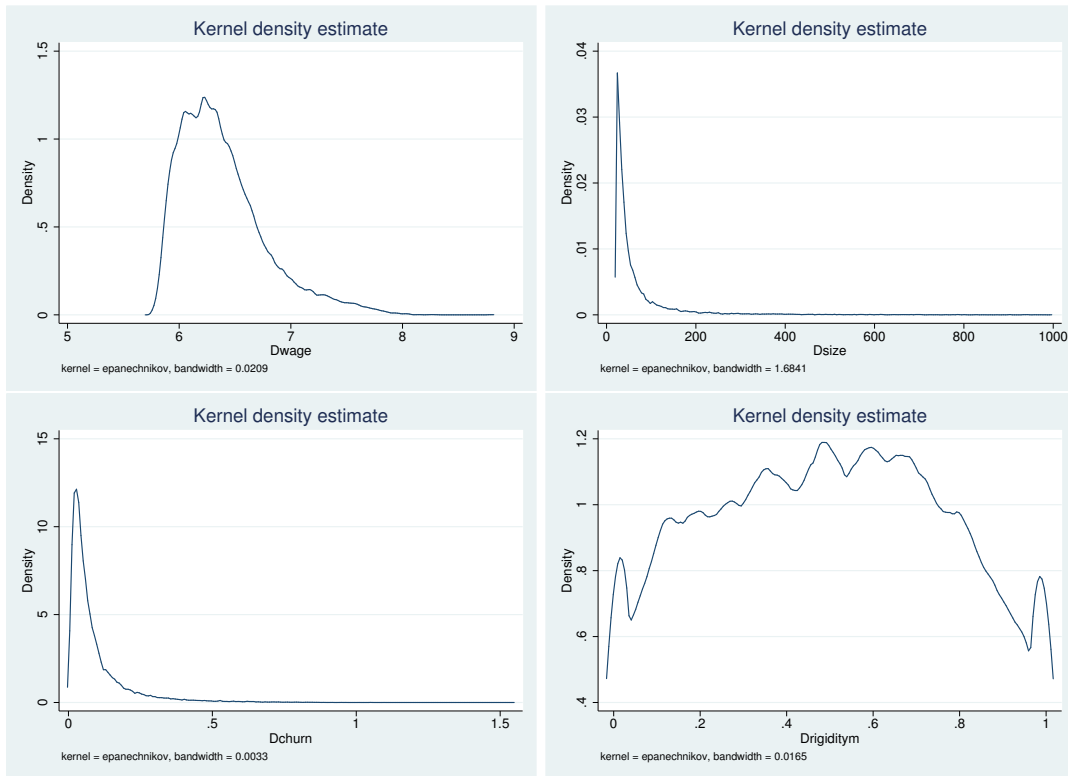


Figure 1: *Upper left:* Average firm wage. *Upper right:* Average firm size. *Lower left:* Average churning rate. *Lower right:* Average firm wage rigidity indicator, base wages. Social Security data, 2001-2012. Only firms with more than 20 workers.

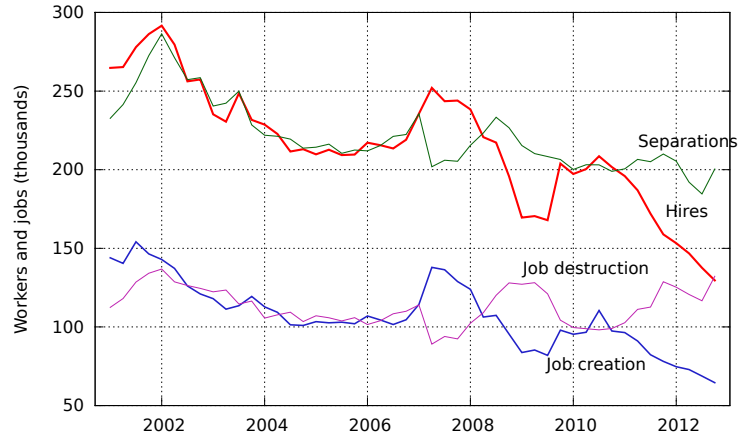


Figure 2: Hires, separations, creation and job destruction rates. Social Security data, 2001-2012.

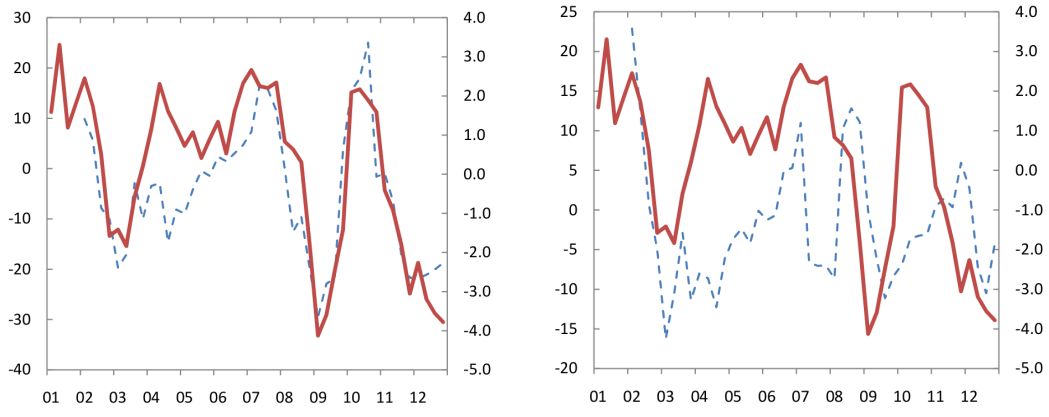


Figure 3: *Left panel:* Hires (dashed line), *Right panel:* separations (dashed line) and GDP growth (solid lines, right scale). Social Security data and National Accounts, 2001-2012.

Wage residuals conditional on CAE

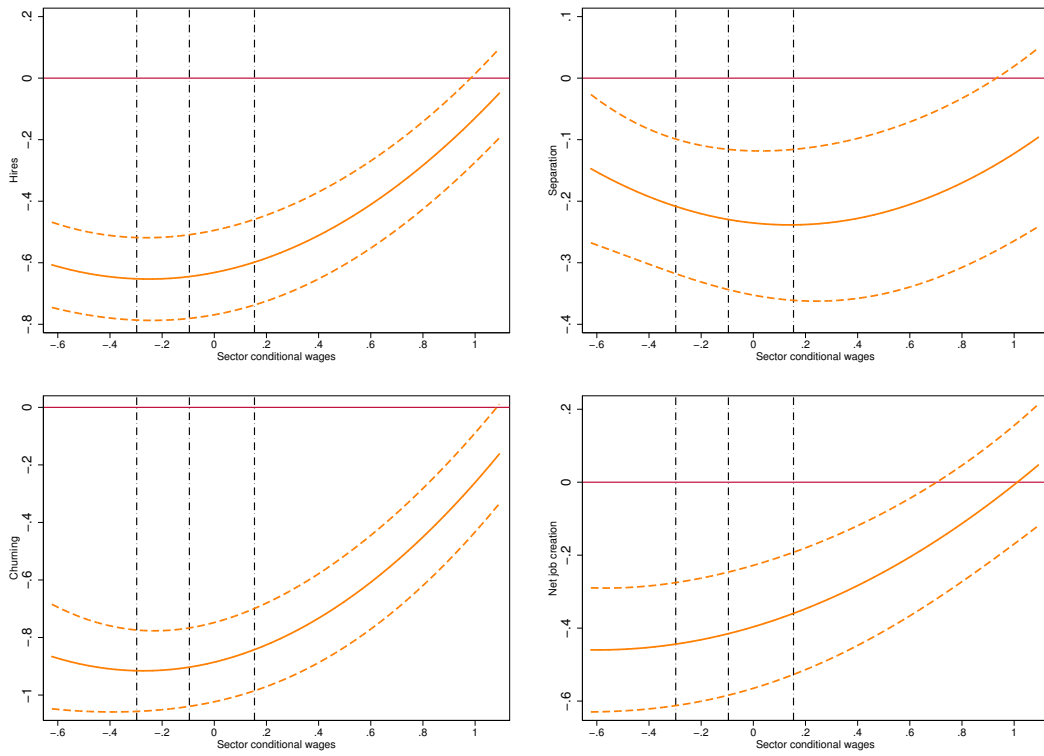


Figure 4: Marginal impact of the unemployment rate over the firm quality as measured by firm average wage residuals.

Upper left: Hires. *Upper right:* Separations.

Lower left: Churning. *Lower right:* Net job creation.

Social Security, 2001-2012.

Wage residuals conditional on CAE

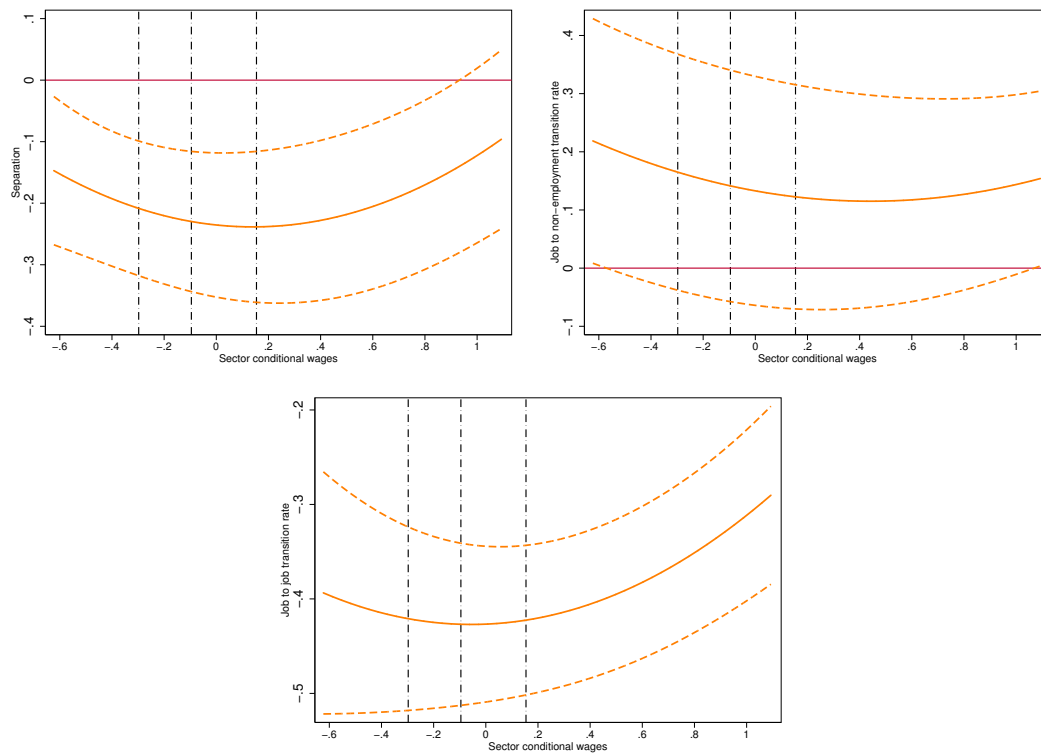


Figure 5: Marginal impact of the unemployment rate over the firm quality as measured by firm average wage residuals.

Upper left: Separations. *Upper right:* Job to Unemployment.

Lower left: Job to Job.

Social Security, 2001-2012.

FE: Worker; Firm – Wages as a function of CAE

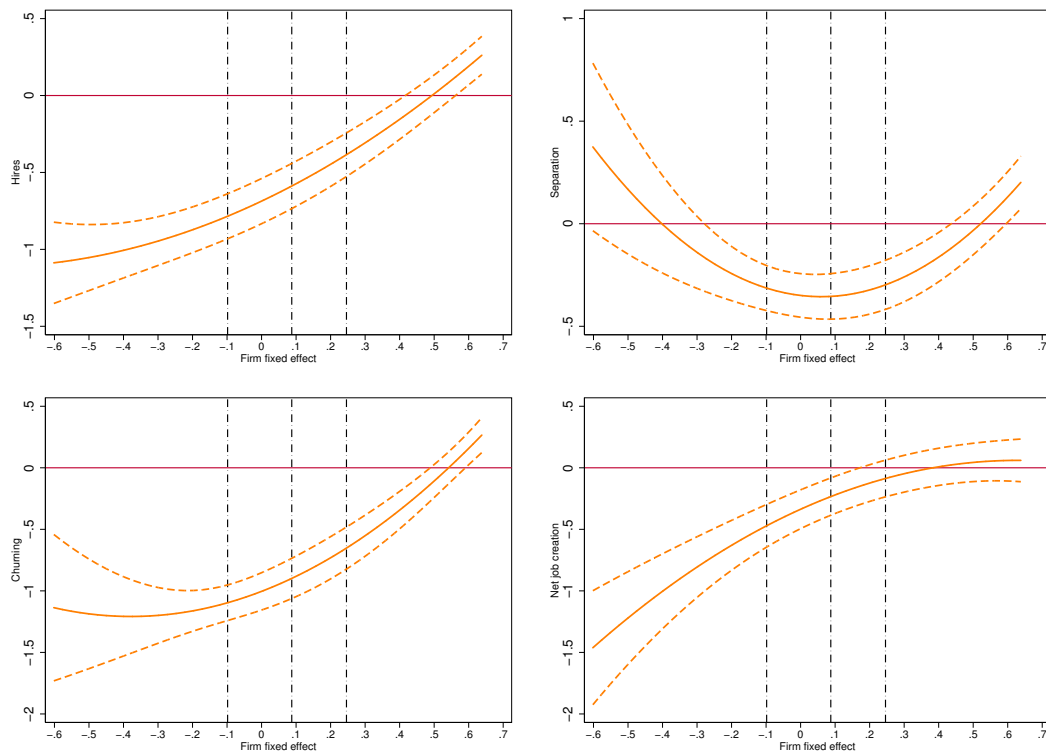


Figure 6: Marginal impact of the unemployment rate over the firm quality as measured by firm fixed effects.

Upper left: Hires. Upper right: Separations.

Lower left: Churning. Lower right: Net job creation.

Social Security, 2001-2012.

FE: Worker; Firm – Wages as a function of CAE

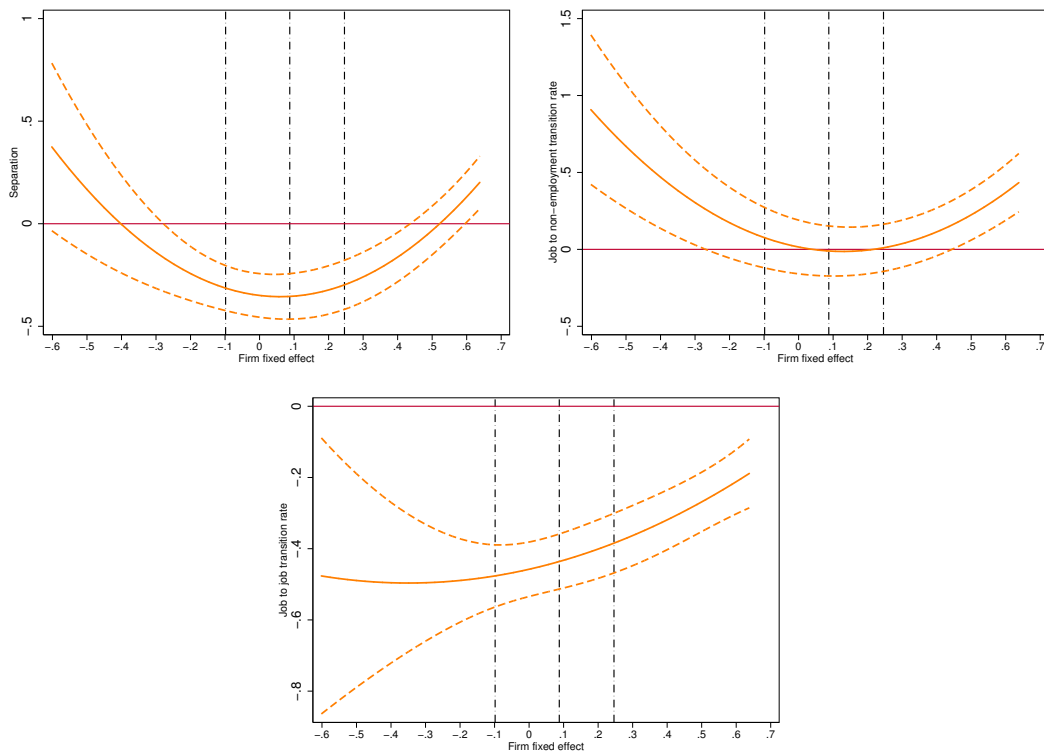


Figure 7: Marginal impact of the unemployment rate over the firm quality as measured by firm fixed effects.

Upper left: Separations. *Upper right:* Job to Unemployment.

Lower left: Job to Job.

Social Security, 2001-2012.

Wage residuals conditional on CAE

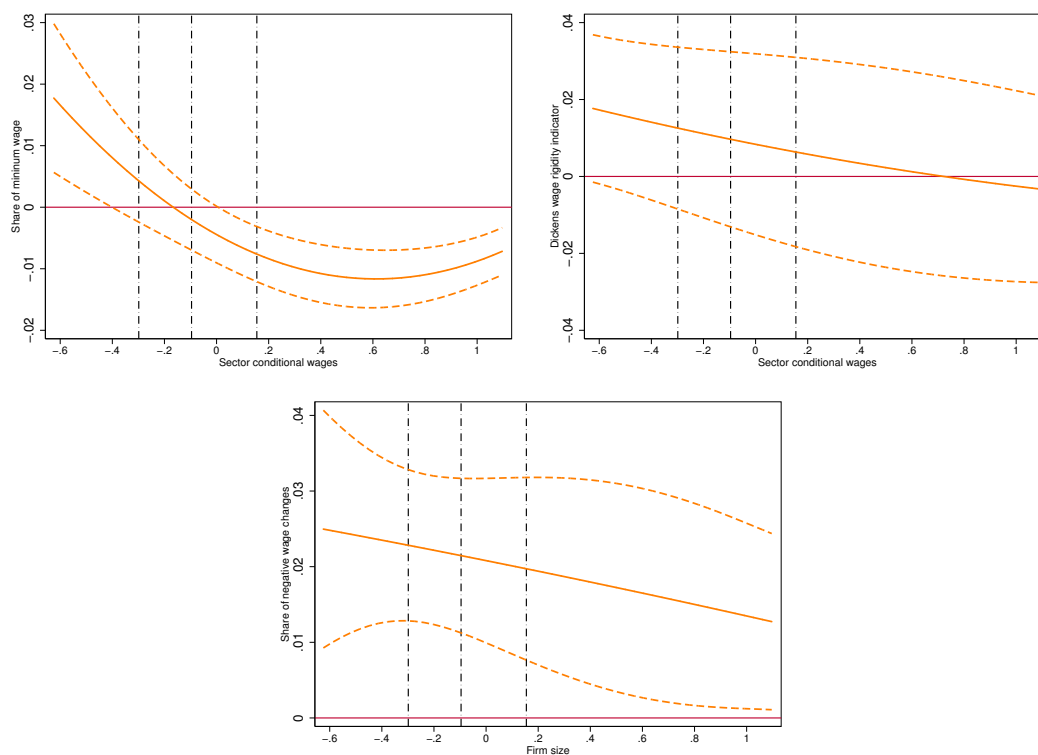


Figure 8: Marginal impact on wage rigidity indicators of the unemployment rate over the firm quality as measured by firm average wage residuals.

Upper left: Dickens' wage rigidity indicator. *Upper right:* Share of minimum wage workers.

Lower left: Share of negative wage changes.

Social Security, 2001-2012.

FE: Worker; Firm – Wages as a function of CAE

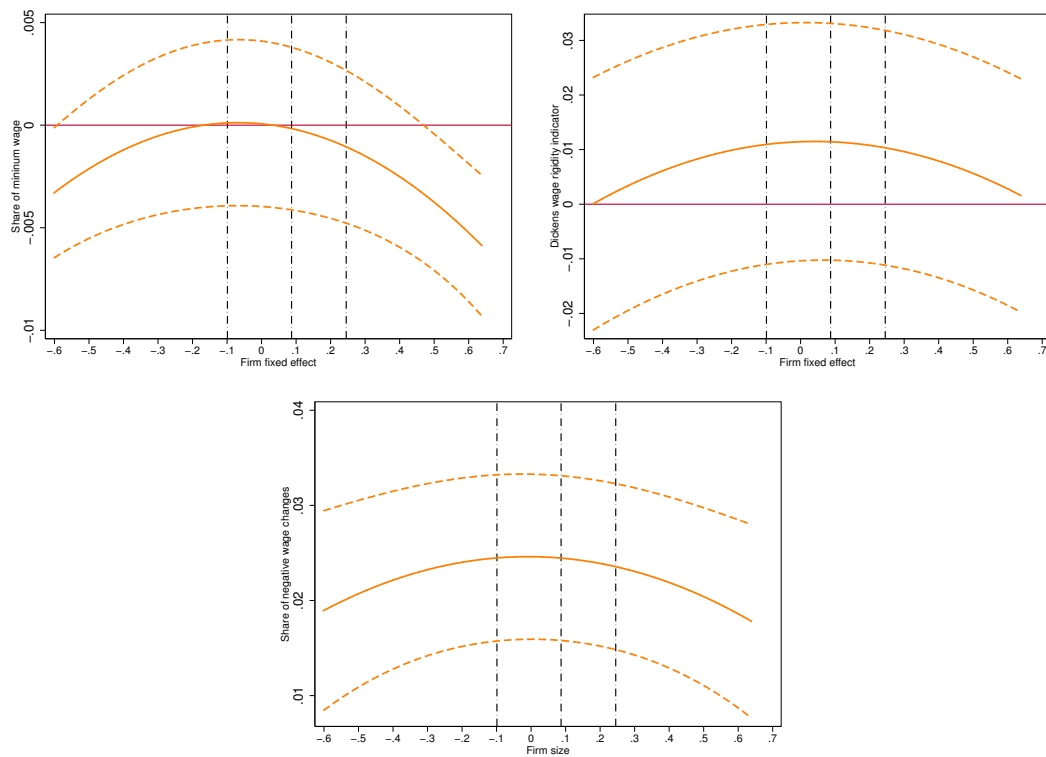


Figure 9: Marginal impact on wage rigidity indicators of the unemployment rate over the firm quality as measured by firm fixed effects.

Upper left: Dickens' wage rigidity indicator. *Upper right:* Share of minimum wage workers.

Lower left: Share of negative wage changes.

Social Security, 2001-2012.