Worker churning and wage rigidity during the financial crisis: the role of firm quality*

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Abstract

This paper studies the behavior of worker flows and wage rigidity in Portugal before and during the recent crisis. The most distinctive feature of the impact of the current crisis on the labor market is the reduction in hirings 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. Hirings have a larger contribution to the Portuguese business cycle than separations. Furthermore, high-quality firms dominate the reaction of the labor market to the economic conditions. The observed halt in labor market flows was not replaced 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 larger and high-paying firms reduce the share of minimum wage workers in recessions. Our results show that in recessions jobs become stickier in high-quality firms and there is a shift in employment towards smaller and low-paying firms. Thus, Portuguese recessions are characterized by a sullying effect: jobs created in recessions are likely to be low-paying and temporary, which magnifies the negative impact of recessions in labor productivity and explains the procyclical 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

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 the 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.

Churning is crucial to the ability of companies to renew its workforce and, therefore, an important part of the dynamics of employment. Also for workers, churning promotes the use of human capital in its most productive application, generating a vacancy chain that improves resource allocation in the economy (Akerlof, Rose and Yellen 1988).

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.

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)

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. At an aggregate level, we show that hirings Granger-causes fluctuations in economic activity, contrary to worker separations, that are pretty much unrelated with the GDP growth rate. Using firm-level data we also show that this association between the business cycle and hirings is explained by the behavior of high-quality firms. These firms react more strongly to business cycle conditions, shrinking their workforce more strongly in recessions and leading the employment pick up in booms.

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. Again, high-quality firms present a sharper reaction, in particular with a reduction in the share of minimum wage workers during periods of high unemployment.

These results have an important consequence for policy and to the evolution of productivity across the business cycle. Larger firms are on average more 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 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.

Although these concepts do not meet the legal definitions, they 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 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*b*). 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 28]

[TABLE 1 HERE; SEE PAGE 21]

Table 1 presents summary statistics of the main variables by firm quality quintiles. Smaller firms have higher growth rates, because they have lower separation rates. The share of the minimum wage is higher in smaller firms (8.7% in the lowest quintile, compared with 5.7% 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 58% for smaller firms and 45% for the largest ones. If instead, we use the more relevant measure of total annual pay we get the same pattern in terms of firm size, but much smaller values for the indicator: 19% for small firms and 13% for large 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 very close to the ones they obtain for the U.S.

In our analysis we split the sample into discrete categories based on the number of workers and the average wage. We compute within industry cut points (measured at one digit industry categories), but we also use deciles computed with the overall distribution of firms. We use the decile of size and wages to create the ten categories. These two measures capture the quality of the firm. Larger firms and those paying higher wages are of higher quality.

4 The Portuguese labor market: structural characteristics

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, along with the reduction in employment. 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 (Centeno and Novo 2012*a*).

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.

5 Hires, separations and churning

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 (Table 2). 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.

[TABLE 2 HERE; SEE PAGE 22]

[FIGURE 2 HERE; SEE PAGE 29]

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 origins 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.

This reduction is particularly important because it focuses on expanding firms, whose churning of workers fell 58%. In contracting firms, churning remained constant. As a result, the rotation in expanding firms represented 56% of the total in 2007 and only 37% in 2012.

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%.

6 The business cycle and labor market flows

In the following two subsections, we analyze the relationship between the business cycle and labor market flows. We start with at the aggregate level by establishing a Granger-causality between 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 The chicken or the egg: GDP and aggregate labor market flows

The motivation to study labor market flows and the business cycle are 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 30]

But which came first, the chicken or the egg? Hires or GDP growth? Separations or GDP decline? Both causalities are possible, but the economic interpretation is different. For instance, labor hoarding is compatible with a situation where only after a downturn (upturn) on GDP firms separate from (hire) workers. On the other hand, if firms hire workers to increase their productive capacity, then the causality flows from the labor market into production. We entertain these two hypotheses in a standard Granger-causality set-up. Formally, we estimate separately the following two models:

$$LMF_t = \beta_0 + \sum_{i=1}^{L} \beta_i LMF_{t-i} + \sum_{j=1}^{K} \psi_j GDP_{t-i} + \varepsilon_t \quad (1)$$

$$GDP_t = \phi_0 + \sum_{i=1}^{L} \phi_i GDP_{t-i} + \sum_{j=1}^{K} \lambda_j LMF_{t-i} + \nu_t, \quad (2)$$

where LMF_t is one of four labor market flows: hiring, separation, job creation, and job destruction rates; GDP_t is the quarter-on-quarter GDP growth rate. Both variables are corrected for quarterly seasonality. In equation (1), if the ψ_j's are jointly statistically significant, then GDP fluctuation Granger-cause labor market flows. However, if the joint significance is that of the λ_j's in equation (2), then labor market flows Granger-cause GDP fluctuations.

Table 3 presents the estimates of the coefficients of equation (1) in columns (1)-(4) and of equation (2) in columns (5)-(6). The estimation process allowed for up to four lags of the dependent and of the driving variable. However, the estimates presented correspond to the best models as selected by the Schwarz Information Criterion.

[TABLE3 HERE; SEE PAGE 23]

Before concentrating on "which came first," lets consider how these variables correlate. 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.

In which direction does the Granger-causality flow? The results indicate that GDP growth in the previous quarter is statistically associated with increases in contemporaneous hires and job creation (columns (1) and (3)). When the role of the variables is reversed, the statistically associations are weaker (columns (5) and (7)). The joint tests reported at the bottom of Table (3) have somewhat stronger evidence that the (Granger) causality goes from GDP to hires and job creation. This would be compatible with the hypothesis of labor hoarding. The reverse causality suggests that, after firms increase hires and job creation, GDP growth increases. As with the chicken and the egg, the puzzle remains.

The evidence is clearer in terms of the separation and job destruction rates. There is no statistical association between lagged GDP and the subsequent behavior of separations and job destruction (columns (2) and (4)). For the reverse associations (columns (6) and (8)), contemporaneous GDP growth is not associated with lagged separations and individually with lagged job destruction rates, although jointly the association is significant. As stated earlier, separations and job destruction do not Granger-cause business cycle fluctuations or vice-versa.

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 rate, the GDP growth rate or an indicator for recession, (ii) a vector of firm quality indicators (F_q) – the number of workers, a measure of size or the average wage in the firm, and (iii) their interactions. Additionally, in X_t, we control for the age 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 (3):

$$LMF_{it} = \alpha_0 + \alpha_1 cycle_t + \alpha_2 F_q + \alpha_3 cycle_t \times F_q + \alpha_4 X_{it} + \lambda_i + \delta_t + \epsilon_{tq}. \tag{3}$$

Tables 4 and 6 summarize the coefficients of the models that use, respectively, the number of workers and the average wage as measures of firm quality. The Tables also present the results for the two measures of the cycle: the unemployment rate and the GDP growth rate. In column (1) of Table 4, the dependent variable is the hiring rate. The main effect of the unemployment rate is negative. The impact becomes more negative as firms grow in size and it is statistically different from zero for all firm sizes in our sample. A one percentage point

increase in the unemployment rate entails a 0.2 percentage points reduction in the hiring rate. The sensitivity of the hiring rate to the cycle does not change over the firm size distribution (Figure 5). A different result is obtained in Table 6. When measuring the quality of firms with its average wage, we obtain a negative impact on hirings for low wage firms and no impact for high wage firms (Figure 4).

[TABLES 4 and 6 HERE; SEE PAGE 24 and 26]

In column (2) we study the separations behavior. As in the Granger-causality, separations do not react to the cycle. The main effect of the unemployment rate is not statistically significant at the 1%-level for any firm quality and business cycle measure. 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.

The impact of economic activity on the churning rate is shown in column (3). We conclude that churning in larger firms is more sensitive to the business cycle, but also that it has a different impact along the distribution of firm average wages. For larger firms, good economic times are associated with larger excessive worker rotation (there is a significant re-composition of the workforce). For smaller firm the opposite occurs, they reduce churning in good times and increase it in bad times. This can be seen as the result of large firms being more attractive to workers and offering better matches in booms, which leads to an intense reallocation of workers with positive impact on productivity. The results for the average wage distribution show a U-shaped pattern, with median wage firms reducing churning the most when the unemployment rate is higher.

The final columns ((5) -(7)) present the results for the log of hires, separations and churning, respectively. The business cycle reduces hirings by markedly more for the high quality firms and is neutral for separations.

The impact on employment growth (column 4) of the business cycle reflects these opposing reactions. 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 grow during times of low growth because they have a smaller reduction in hirings. Figures 5 and 4 exhibit

these effects more clearly, plotting the main effect of the unemployment rate as a function of the firm quality (along with the 95% confidence interval). The graph represents the total impact of a one percentage point increase in the unemployment rate on firm employment growth. The employment growth effect is negative and increases steadily across firm quality.

[FIGURES 5 and 4 HERE; SEE PAGE 32 and 31]

We find that smaller 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. Large firms explain most of the business cycle variation of employment.

The main results of this section can be summarized as follows. High quality firms churn more workers and have lower hiring and separation rates. These firms have a larger sensitivity to the business cycle in terms of hirings and churning. In recessions we observe a re-composition of employment towards low quality (smaller and low wage) firms. The high quality firms reduce churning more strongly in recessions. Employment becomes stickier in larger firms. This can be the result of lower hirings and/or a reduction in voluntary quits, that is associated with the fact that separations do not react to the cycle, despite the increase in lay-off.

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 (4), 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.

$$WRig_{it} = \alpha_0 + \alpha_1 cycle_t + \alpha_2 F_q + \alpha_3 cycle_t \times F_q + \alpha_4 X_{it} + \lambda_i + \delta_t + \epsilon_{tq}. \quad (4)$$

Tables 5 and 7 summarize the coefficients on the business cycle indicator and its interaction with the firm quality measure. 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. Older firms have more rigid wages, in the sense that they have a larger proportion of zeros in non-positive wage variations. This result is consistent with the incentives literature and the workings of internal labor markets. Older firms freeze wages to a higher extent, when compared with the fraction of wages they cut. However, we obtain that these firms have also a larger share of negative wage changes. Older firms cut wages more often. The share of negative wage changes is not sensitive to the overall business cycle. This needs to be understood as firms establishing their own wage policy, responding to their idiosyncratic economic environment. In fact, as found by among others Burgess, Lane and Stevens (2000), firms human resources policies are very heterogeneous and this is most likely to be observed in their wage policies.

[TABLES 5 and 7 HERE; SEE PAGES 25 and 27]

[FIGURE 6 HERE; SEE PAGE 33]

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) in both Tables. 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 (Figure 6). This is the only wage rigidity indicator that shows a clear cyclical pattern. The lower share of minimum wage workers in high quality firms (and also in older ones) 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 smaller firms is reinforced in recessions by the increase in the share of minimum wage workers.

Wage rigidity varies substantially across firms. Smaller 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, large firms present a sharper reaction, with a reduction in wage rigidity.

The negative impact of recessions is magnified in the labor market. We already showed that employment flows to low quality firms in recessions and that larger and high-paying firms reduce churning when the economic conditions deteriorate. This stickiness of employment in the better firms in reinforced by the increase in low quality jobs in low quality firms.

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 by their size (number of workers) or the average wage. 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 better in recessions; their employment growth shrinks by less. This is because the hires at high-quality firms fall more. It looks as though these firms are more likely to make lay-offs in an economic downturn and to freeze expansion-hires by even more, even if they still keep a modest amount of hiring. 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, while in busts they can grow, relative to these better firms. In contrast, better firms grow relatively faster in boom times (they find it easier to post high-paying vacancies) and experience relatively more separation/less hires in busts.

This set of facts is suggestive of two important implications for workers matching in recessions. First, low-quality firms may have an easier time attracting and retaining high-quality workers in a recession. Second, these firms have a relatively easier time retaining workers in recessions, because they shrink less quickly. Therefore a worker matching to a low-quality firm in a recession is likely to stay there for longer; he or she will have less of an opportunity to make a job-to-job transition to a larger firm.

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 may question this prediction, because resources flow to smaller firms in recessions. This relative ability of smaller 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 small firms. Alternatively, it could be labor demand driven if large firms have a greater need to lay-off workers. Unfortunately, our data does not identify whether a separation was voluntary or involuntary, but it is a path worth exploring in other studies.

Our results are, in general, supportive of the sullying effect Barlevy (2002). We can see this from the labor supply perspective. Workers accept low quality matches, in minimum wage jobs, in low-quality firms ((Bowlus 1995) finds evidence of this type of wage cyclical behavior for the U.S.). But we can also consider the labor demand perspective. There are two possible

channels for the sullying effect. The hiring and churning levels are low; and separations are also low. This implies that the net quality of matches may not 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).

A few extensions should be pursued in the future. First, adding an extra dimension of firm quality using direct measures of worker productivity and/or total factor productivity. Secondly, we can consider exploring the 2004 employment protection reform to study the impact on business cycle sensitivity of worker flows. Finally, and probably most relevant for this study, we will consider a proxy for the distinction between voluntary quits and lay-offs. This information is not available in administrative datasets, but we will explore the job-to-job transitions as a proxy to a voluntary quit. This may shed some light into the non-cyclical behavior of separations, and on the adequacy of a on-the-job search model to explain the cyclical behavior of labor market flows.

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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	0.0271	0.0151	0.0098	0.0067	0.0040
Hiring rate	0.0845	0.08614	0.0855	0.0843	0.0908
Separation rate	0.0578	0.0710	0.0757	0.0776	0.0869
Rigidity Monthly Wage	0.5839	0.5444	0.5137	0.4539	0.2399
Rigidity Annual Wage	0.1863	0.1723	0.1575	0.1315	0.0570
Minimum Wage Share	0.0874	0.0749	0.0718	0.0567	0.0271
Share of Negative Wage Changes	0.3140	0.3179	0.3150	0.3103	0.2966
Churning distribution					
Lowest	0.0130	0.0143	0.0153	0.0160	0.0143
2nd quintile	0.0.321	0.0323	0.0324	0.0326	0.0322
3rd quintile	0.0531	0.0529	0.0533	0.0531	0.0527
4th quintile	0.0911	0.0906	0.0914	0.0903	0.0930
Highest	0.2195	0.2360	0.2456	0.2537	0.2922

Notes: Social Security data, 2000-2012. Weighted by average employment over the sample period. Quintile cutpoints are computed within one-digit industry.

Table 2: Labor market flows in 2007 and 2012

	Total economy			
	2007	2012	$\Delta(12-07)$	% 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: Chickens or eggs: Granger-causality of labor market flows and GDP

	Dependent variable							
	H_t	S_t	JC_t	JD_t	GDP_t			
Lags	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP	**1**	**1**	**1**	**1**	1	1	1	1
H	1				**2**			
S		4				**2**		
JC			1				**4**	
JD				2				**2**
Number of quarters	50	47	50	49	49	49	47	49
Adjusted-R^2	0.94	0.87	0.94	0.76	0.08	-0.04	0.12	0.09
Granger-causality	**6.16**	1.79	**6.74**	0.16	**3.16**	0.23	**2.74**	**3.63**
F-test p-value	**(0.017)**	(0.188)	**(0.013)**	(0.696)	**(0.052)**	(0.797)	**(0.041)**	**(0.035)**

Notes: Selected regressions based on the Schwarz Information Criterium. Quarterly seasonally adjusted data, covering 2000:Q2 to 2012:Q4. GDP_t is the quarter-on-quarter GDP growth rate; H_t and S_t are the hires and separations rates; and JC_t and JD_t are the job creation and job destruction rates.

Table 4: Firm flows by firm size and economic conditions

	Hire rate		Separation rate		Churning rate		Employment change		Log of hires		Log of separations		Log of churning	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
GDP growth	0.004	0.522	0.005	0.258	-0.005	0.218	-0.292	0.000	-0.284	0.000	-0.030	0.413	-0.214	0.001
Log Size	0.031	0.003	-0.098	0.000	0.055	0.000	1.680	0.000	0.951	0.000	-0.862	0.000	0.111	0.001
Log Size^2	-0.002	0.100	0.006	0.000	-0.003	0.000	-0.120	0.000	0.024	0.000	0.156	0.000	0.092	0.000
Log Size × GDP growth	-0.002	0.432	-0.002	0.167	0.002	0.342	0.112	0.000	0.100	0.000	0.002	0.895	0.072	0.001
Log Size^2 × GDP growth	0.000	0.224	0.000	0.258	0.000	0.708	-0.008	0.003	-0.007	0.001	0.000	0.961	-0.005	0.003
Log Firm Age	-0.855	0.000	-0.068	0.025	-0.090	0.010	-0.342	0.000	-1.178	0.000	0.133	0.000	0.063	0.002
Log Firm Age^2	0.252	0.000	0.020	0.035	0.014	0.194	0.011	0.484	0.249	0.000	-0.065	0.000	-0.094	0.000
Log Firm Average Wage	-0.100	0.003	0.034	0.149	0.024	0.214	-0.056	0.885	0.539	0.030	0.282	0.234	0.678	0.000
Log Firm Average Wage^2	0.006	0.016	0.000	0.808	-0.001	0.463	-0.047	0.113	-0.051	0.005	0.022	0.210	-0.041	0.002
Unemployment Rate	-0.003	0.060	-0.003	0.172	0.002	0.162	0.160	0.000	0.166	0.000	0.035	0.019	0.126	0.000
Log Size	0.024	0.065	-0.108	0.000	0.064	0.000	2.173	0.000	1.410	0.000	-0.792	0.000	0.437	0.000
Log Size^2	0.001	0.301	0.001	0.223	-0.001	0.039	-0.064	0.000	-0.063	0.000	-0.008	0.065	-0.047	0.000
Log Size × U Rate	0.000	0.114	0.000	0.380	0.000	0.207	0.005	0.000	0.004	0.000	0.000	0.576	0.003	0.000
Log Size^2 × U Rate	0.000	0.114	0.000	0.380	0.000	0.207	0.005	0.000	0.004	0.000	0.000	0.576	0.003	0.000
Log Firm Age	-0.853	0.000	-0.068	0.026	-0.089	0.011	-0.321	0.000	-1.161	0.000	0.138	0.000	0.089	0.000
Log Firm Age^2	0.251	0.000	0.020	0.035	0.013	0.221	-0.006	0.685	0.231	0.000	-0.070	0.000	-0.113	0.000
Log Firm Average Wage	-0.111	0.001	0.038	0.110	0.011	0.566	-0.434	0.249	0.074	0.754	0.178	0.410	0.255	0.138
Log Firm Average Wage^2	0.006	0.007	0.000	0.945	0.000	0.938	-0.020	0.479	-0.018	0.296	0.029	0.072	-0.012	0.344
Number of observations	364393		364393		364393		233872		268771		295195		233872	
Number of firms	9962		9962		9962		9844		9962		9967		9844	

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 5: Wage rigidity, firm size and economic conditions

	Rigidity		Share negatives		Share min. wage	
	Coef.	p	Coef.	p	Coef.	p
GDP growth	0.067	0.073	-0.001	0.971	-0.028	0.285
Log Size	-0.129	0.069	-0.011	0.755	-0.008	0.273
Log Size^2	0.005	0.397	-0.001	0.838	0.000	0.728
Log Size $\times$ GDP growth	-0.018	0.297	-0.016	0.160	0.009	0.252
Log Size^2 $\times$ GDP growth	0.002	0.342	0.002	0.123	-0.001	0.348
Log Firm Age	0.062	0.054	0.239	0.000	-0.010	0.098
Log Firm Age^2	-0.037	0.012	-0.079	0.000	0.014	0.000
Log Firm Average Wage	-0.018	0.929	-0.761	0.000	-0.628	0.006
Log Firm Average Wage^2	-0.003	0.849	0.040	0.003	0.041	0.010
Unemployment Rate	-0.011	0.320	0.010	0.227	0.013	0.088
Log Size	-0.197	0.053	-0.050	0.245	0.035	0.009
Log Size^2	0.009	0.049	0.006	0.022	-0.005	0.016
Log Size $\times$ U Rate	-0.001	0.036	-0.001	0.007	0.000	0.018
Log Size^2 $\times$ U Rate	-0.001	0.036	-0.001	0.007	0.000	0.018
Log Firm Age	0.039	0.234	0.235	0.000	-0.009	0.096
Log Firm Age^2	-0.029	0.052	-0.078	0.000	0.013	0.000
Log Firm Average Wage	0.027	0.901	-0.718	0.001	-0.657	0.004
Log Firm Average Wage^2	-0.005	0.729	0.037	0.007	0.043	0.006
Number of observations	89759		94593		94593	
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.

Table 6: Firm flows by firm average wage and economic conditions

	Hire rate		Separation rate		Churning rate		Employment change		Log of hires		Log of separations		Log of churning	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
GDP growth	-0.029	0.744	0.041	0.190	-0.130	0.019	-2.554	0.006	-2.047	0.011	0.475	0.292	-1.688	0.009
Log Firm Average Wage	-0.090	0.006	0.040	0.109	0.039	0.069	-0.032	0.933	0.631	0.008	0.386	0.114	0.776	0.000
Log Firm Average Wage^2	0.005	0.029	0.000	0.985	-0.002	0.166	-0.049	0.095	-0.058	0.001	0.014	0.426	-0.049	0.001
Log Wage × GDP growth	0.010	0.684	-0.011	0.212	0.040	0.014	0.743	0.006	0.604	0.010	-0.124	0.337	0.502	0.007
Log Wage^2 × GDP growth	-0.001	0.628	0.001	0.268	-0.003	0.010	-0.053	0.006	-0.044	0.009	0.007	0.426	-0.037	0.006
Log Size	0.031	0.003	-0.098	0.000	0.054	0.000	1.676	0.000	0.947	0.000	-0.863	0.000	0.109	0.005
Log Size^2	-0.002	0.101	0.006	0.000	-0.003	0.000	-0.120	0.000	0.024	0.000	0.156	0.000	0.092	0.000
Log Firm Age	-0.854	0.000	-0.068	0.024	-0.090	0.010	-0.338	0.000	-1.174	0.000	0.133	0.000	0.066	0.001
Log Firm Age^2	0.252	0.000	0.020	0.034	0.014	0.196	0.010	0.525	0.248	0.000	-0.065	0.000	-0.094	0.000
Unemployment Rate	0.035	0.009	0.005	0.755	0.098	0.000	1.036	0.000	1.254	0.000	0.254	0.147	1.099	0.000
Log Firm Average Wage	0.058	0.191	0.088	0.054	0.342	0.000	1.940	0.018	3.430	0.000	1.422	0.004	3.411	0.000
Log Firm Average Wage^2	-0.007	0.034	-0.004	0.210	-0.025	0.000	-0.184	0.003	-0.259	0.000	-0.069	0.051	-0.242	0.000
Log Wage × U Rate	-0.012	0.002	-0.002	0.601	-0.030	0.000	-0.297	0.000	-0.368	0.000	-0.082	0.105	-0.327	0.000
Log Wage^2 × U Rate	0.001	0.001	0.000	0.455	0.002	0.000	0.021	0.000	0.026	0.000	0.007	0.063	0.024	0.000
Log Size	0.028	0.008	-0.099	0.000	0.052	0.000	1.665	0.000	0.927	0.000	-0.874	0.000	0.088	0.024
Log Size^2	-0.002	0.155	0.006	0.000	-0.003	0.000	-0.119	0.000	0.025	0.000	0.157	0.000	0.094	0.000
Log Firm Age	-0.853	0.000	-0.068	0.025	-0.089	0.012	-0.316	0.000	-1.152	0.000	0.135	0.000	0.089	0.000
Log Firm Age^2	0.251	0.000	0.020	0.035	0.013	0.231	-0.005	0.743	0.232	0.000	-0.066	0.000	-0.108	0.000
Number of observations	364393		364393		364393		233872		268771		295195		233872	
Number of firms	9962		9962		9962		9844		9962		9967		9844	

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 7: Wage rigidity indicators by firm average wage and economic conditions

	Rigidity		Share negatives		Share min. wage	
	Coef.	p	Coef.	p	Coef.	p
GDP growth	-1.477	0.358	-0.998	0.556	-2.260	0.053
Log Firm Average Wage	-0.185	0.364	-0.857	0.000	-0.733	0.004
Log Firm Average Wage^2	0.009	0.530	0.046	0.000	0.048	0.006
Log Wage $\times$ GDP growth	0.399	0.366	0.259	0.579	0.629	0.054
Log Wage^2 $\times$ GDP growth	-0.026	0.383	-0.017	0.594	-0.043	0.056
Log Size	-0.122	0.105	-0.009	0.815	-0.009	0.141
Log Size^2	0.004	0.507	-0.001	0.793	0.000	0.870
Log Firm Age	0.067	0.059	0.239	0.000	-0.010	0.085
Log Firm Age^2	-0.041	0.017	-0.080	0.000	0.012	0.001
Unemployment Rate	0.321	0.276	0.061	0.879	0.813	0.009
Log Firm Average Wage	0.330	0.646	-0.863	0.322	0.933	0.070
Log Firm Average Wage^2	-0.020	0.686	0.051	0.391	-0.065	0.068
Log Wage $\times$ U Rate	-0.081	0.333	-0.006	0.956	-0.226	0.009
Log Wage^2 $\times$ U Rate	0.005	0.377	0.000	0.997	0.016	0.010
Log Size	-0.098	0.188	0.008	0.823	-0.005	0.425
Log Size^2	0.002	0.707	-0.002	0.572	0.000	0.441
Log Firm Age	0.054	0.165	0.236	0.000	-0.005	0.305
Log Firm Age^2	-0.038	0.041	-0.079	0.000	0.004	0.029
Number of observations	89759		94593		94593	
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.

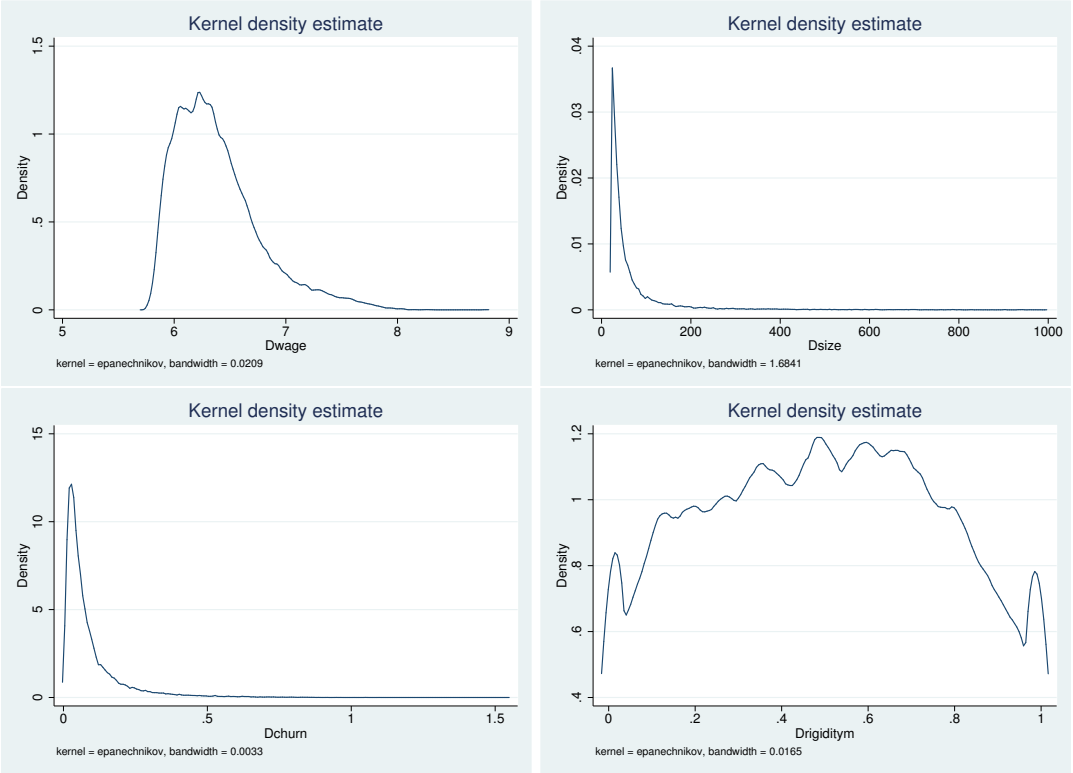

Figure 1: *Upper left:* Average firm wage. *Upper right:* Average firm size.
Lower left: Average churning rate. *Lower right:* Average firm wage rigidity indicator, base wages.
Social Security data, 2001-2012. Only firms with more than 20 workers.

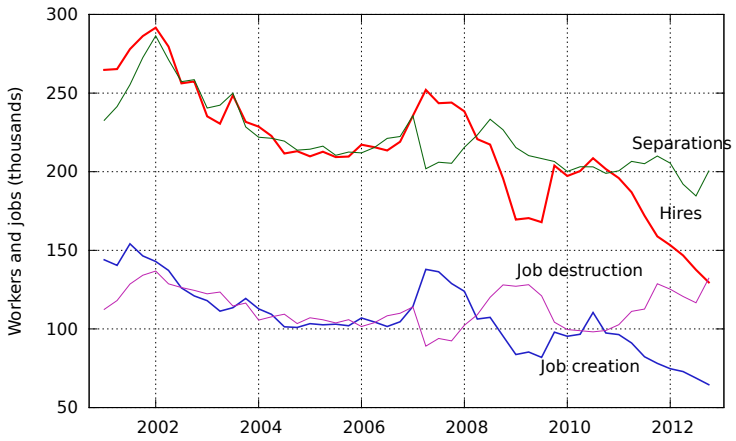

Figure 2: Hires, separations, creation and job destruction rates. Social Security data, 2001-2012.

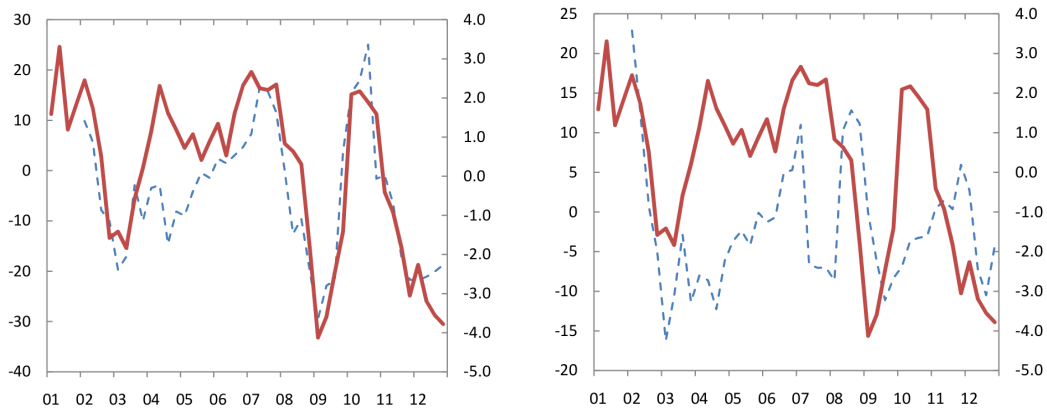

Figure 3: *Left panel:* Hires (dashed line), *Right panel:* separations (dashed line) and GDP growth (solid lines, right scale).
Social Security data and National Accounts, 2001-2012.

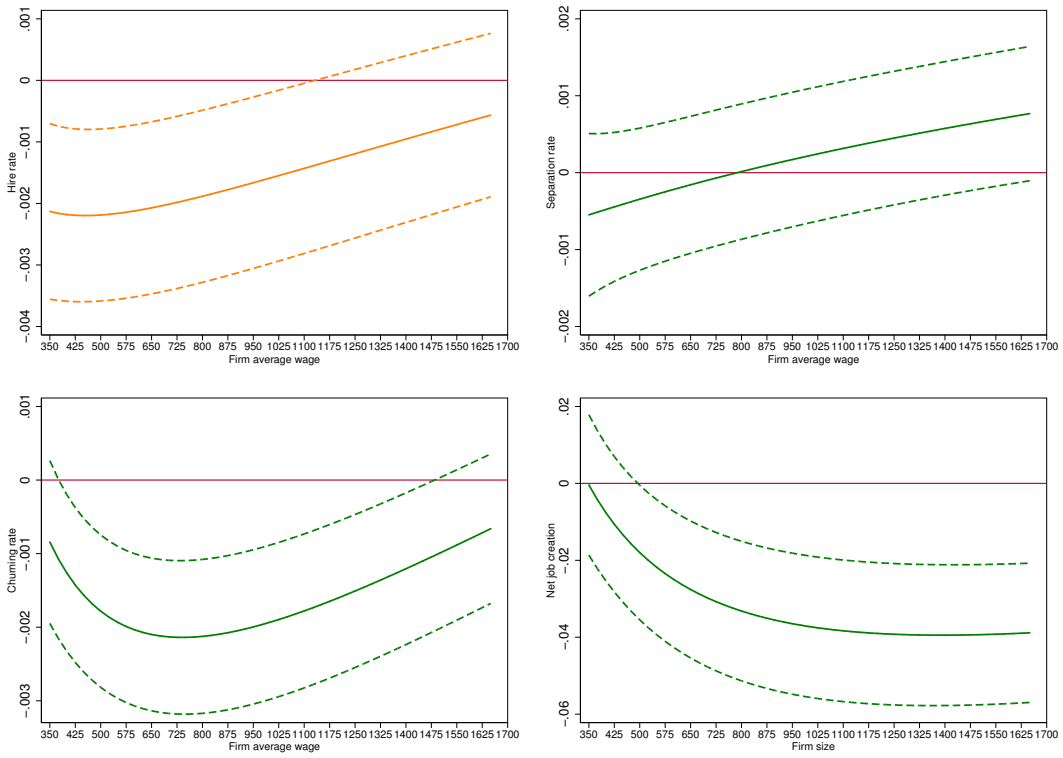

Figure 4: Marginal impact of the unemployment rate over the firm quality as measured by the average firm wage.
Upper left: Hire rate. *Upper right:* Separation rate.
Lower left: Churning rate. *Lower right:* Net job creation.
Social Security, 2001-2012.

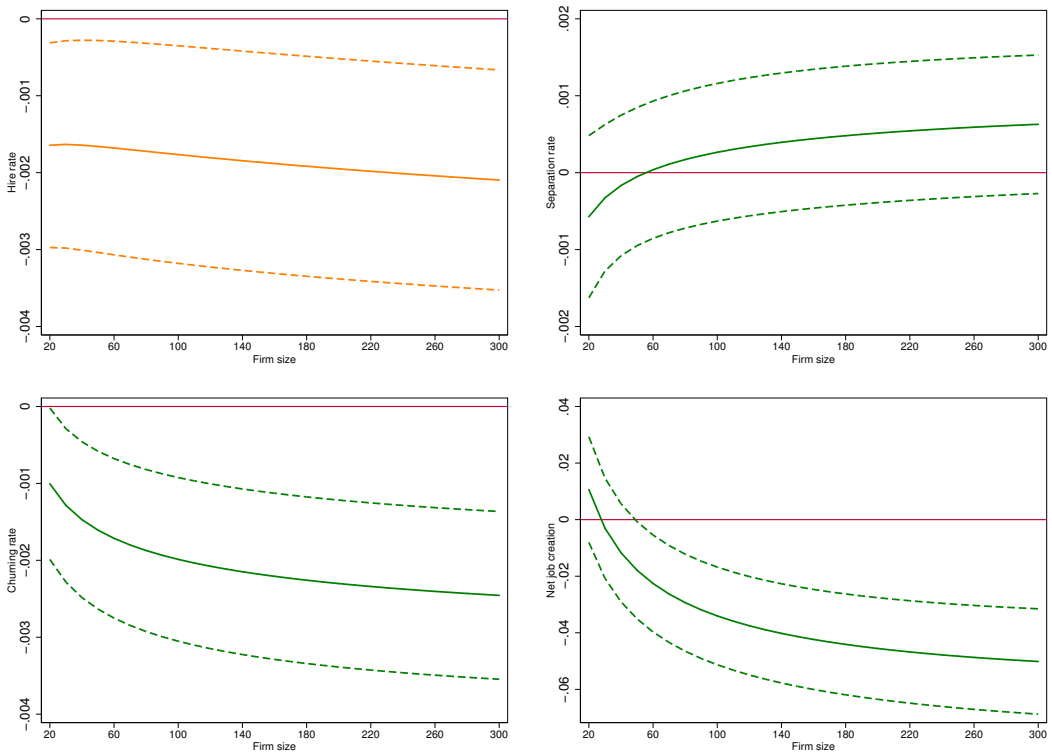

Figure 5: Marginal impact of the unemployment rate over the firm quality as measured by the firm size.
Upper left: Hire rate. *Upper right:* Separation rate.
Lower left: Churning rate. *Lower right:* Net job creation.
Social Security, 2001-2012.

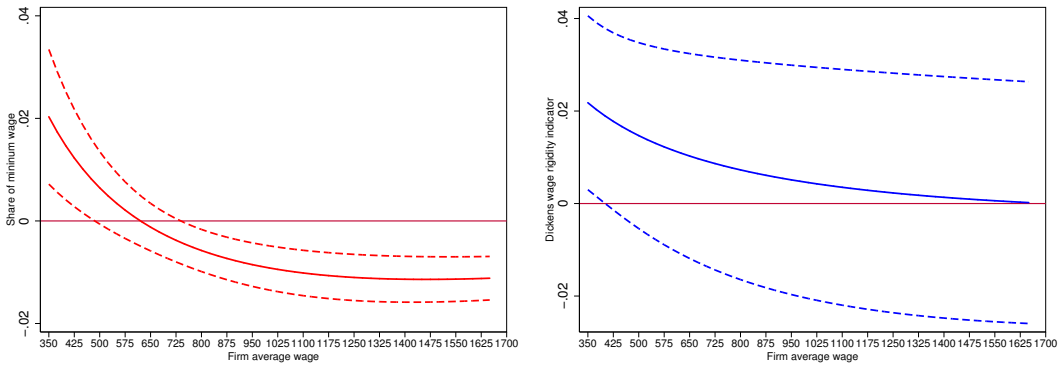

Figure 6: Marginal impact on wages rigidity indicators of the unemployment rate over the firm quality as measured by the average firm wage.
Left panel: Dickens' wage rigidity indicator. *Right panel:* Share of minimum wage workers. Social Security, 2001-2012.