# Upward nominal wage rigidity

Paulo Guimarães[*], Fernando Martins[†], and Pedro Portugal[‡]

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**Abstract**

In Portugal, as in many other countries in continental Europe, the collective wage agreements between trade unions and employer associations that define wage floors for specific job titles are systematically extended to the whole industry. This means that many firms are obliged to increase the wages of their workforce in order to comply with the newly-agreed base wages. With some trepidation, we call this phenomenon *upward nominal wage rigidity*, in close symmetry with the Keynesian notion of downward nominal wage rigidity.

In this paper we compute for each firm the wage bill increase that is implied by each new collective agreement and investigate how those externally driven wage shocks impact worker turnover and firm failure rates. We thus provide evidence that firms that are more heavily affected by the change in the bargained wage floors decrease their hiring rates and, more importantly, significantly increase their separation rates, which leads to considerable destruction of jobs among continuing firms. Furthermore, higher wage impacts are also associated with greater failure rates.

To further analyze the impact of wage agreements on the wages of new hires and on firms' hiring decisions, we suggest the estimation of a measure that attempts to disentangle

[*]University of South Carolina, CEFUP and IZA. Email: guimaraes@moore.sc.edu

[†]Banco de Portugal, ISEG (University of Lisbon), and Universidade Lusíada de Lisboa. E-mail: fmartins@bportugal.pt

[‡]Banco de Portugal, Universidade Nova de Lisboa and IZA. E-mail: pportugal@bportugal.pt

the strength of internal and external (insider and outsider) wage conditions. Based on this measure we show that firms whose wages of newly-hired workers are more influenced by external wages face significantly lower hiring rates.

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*Key Words*: wage rigidity, worker flows, collective bargaining, newly-hired workers.

# 1 Introduction

The role played by labor market institutions in molding the dynamics of employment and the structure of wages is a matter of considerable debate both empirically and conceptually. Even though there is an ample discussion about the role of labor market institutions and its potential contribution to the sluggish adjustment of employment, there is scant empirical evidence at the micro level about the way collective agreements influence firms' hiring and firing decisions.

Many institutional factors may hamper the efficient allocation of workers and jobs. Caballero and Hammour (2000) stress that a number of distortions in product, input, and credit markets can introduce inefficiencies in the reallocation process. Aside from the impact on flows stemming from quantitative restrictions on labor market adjustment, wage-setting policies, such as legal provisions restricting wage adjustment, wage schedules determined at the sector level, or the presence of national minimum wages also have an impact on the reallocation.

A factor that might affect the allocation of workers and jobs is the widespread practice of extending collective bargaining agreements to non-subscriber workers and employers. Since these agreements establish wage floors for most job titles, their frequent extension is equivalent to setting a wide range of compulsory minimum wages, which are regularly adjusted upward, even if the scope in most cases is restricted to some sectors or industries. In some firms these extensions can result in a wage structure that may not be appropriate for some workers, causing fewer hirings and/or added dismissals. As pointed out by Cahuc and Zylberberg (2009) and Teulings and Hartog (2008), the potential job losses are the result of setting wage floors above the marginal productivity for some workers in firms that are bound by those extensions.

Legal provisions for mandatory extensions exist in several European countries such as Spain, France, Germany, Italy, the Netherlands, and Belgium, and they explain to a great extent the large gap observed between union density and union coverage.[1] The extension of contracts is also

[1]See Visser (2013) for a comprehensive survey of wage bargaining institutions in a wide number of developed countries.

an important feature of the Portuguese wage setting system. Martins (2014) shows that between 2007 and 2011 around 90 percent of the sectoral collective wage agreements in Portugal were extended by the Ministry of Employment. The extension of collective agreements were issued almost uniformly throughout the twelve months of the year.

The scattered timing of these extensions introduces a type of wage rigidity that is very close to that emphasized in some macroeconomic models (Olivei and Tenreyro (2007, 2010) and Card (1990)). These models underscore the importance of the timing of collective wage agreements for the employment fluctuations observed in some advanced economies. Due to contract staggering, they show that wage rigidity is toned down in periods when collective agreements are under negotiation, i.e. the impact of a negative shock on employment depends on the timing of the wage negotiations. If the shock occurs at the time of wage negotiations, the wage bargaining process can reflect the impact of the shock and wages are set accordingly; if the shock occurs after wages have been settled by contracts, wages are unable to be adjusted and the risk of job losses is magnified. Catalán and Villanueva (2012) test this hypothesis for Spain in the period surrounding the late-2008 economic decline. They show that the probability of job separation increased significantly for workers covered by contracts negotiated before the drop in economic activity. Their results also suggest that the automatic extension of collective agreements in Spain during this period accounted for 36 percent of the increase in the probability of job separation for low-skilled workers .

The impact of the (scattered) extension of collective agreements on employment is also examined by Martins (2014). Using data for Portugal covering the period between 2007 and 2011, this study analyzes the impact on employment over the four-month period after the extension of a collective agreement. The results show that over this time window the total number of workers in an industry fell by 1.7 percent. The detrimental effect of these extensions on employment is driven to a large extent by the fall in firms' hirings and not by an increase in separations, which remain largely unaffected. On the other hand, non-formal employment (the so-called service providers),

which is not subject to the extension of wage floors, increased by 1.1 percent. In complement to this exercise the study also examines the impact of the extension of collective agreements on firm entry and exit. The evidence suggests that the entry of new firms is not affected by the extension of collective agreements, while the number of firms that leave an industry increases by 4 percent.

In this paper we also examine the microeconomic link between the increase in wage floors through automatic extension and the employment outcomes. As in Martins (2014), we measure the impact on firms' hirings and separations, and the probability of closure resulting from firms' obligations to adjust their wages upward in order to comply with the new wage floors. We call this phenomenon *upward nominal wage rigidity*. However, unlike the approach followed by Martins (2014), our focus in not on the timing of the extensions but on the magnitude of their impact on each particular firm. For this purpose we compute for each firm (on the basis of each job title) the increase in the total wage bill necessary to comply with new collective wage agreement (*implied wage bill growth*).

The impact of the upward wage rigidity on each particular firm is conditional on its workers' position in the wage distribution. Indeed, in each firm we can distinguish two major groups of workers: those who are already collecting a base wage equal to or above the newly-agreed wage floor and whose contribution to the implied wage bill growth is zero; and those who are receiving a base wage that is below the new wage floor and whose contribution to the implied wage bill growth is the difference between their current base wage and the new wage floor. The impact of increasing the wage floors is potentially more acute in firms with a greater fraction of the latter group of workers. Our approach differs from that of Martins (2014) also because Martins assumes that the impact of extensions is homogeneous for all workers in the same industry.

In the second part of the paper we perform a different but somewhat complementary exercise by restricting the analysis to the newly-hired employees, i.e. employees with job tenure of less than one year. Most micro-level empirical research aimed at analyzing the degree of wage rigidity has been mostly concerned with wage changes of individual employees. This invariably restricts

the focus of analysis to wages in ongoing employment relationships (see Haefke et al. (2007)). In contrast, the degree of rigidity of wages of newly-hired workers has received much less attention, despite the recognized importance of wages of this particular labor force group for job creation and for understanding the behavior of wages over the business cycle (see Pissarides (2009) and Galuscak et al. (2012)): newly-hired workers are the "marginal" workers that affect the decision of firms to create new jobs.[2]

The purpose of this exercise is to identify the extent to which firms' insider forces are important for the determination of wages of newly-hired workers. Bils et al. (2014) provide empirical evidence supporting the notion that the wages of new hires are partially determined by the prevailing wages of stayers. As Blanchard and Summers (1987) point out, if wage changes are essentially determined by insider factors (such as the internal wage schedule or the wages of workers with the same qualifications), this may generate hysteresis in the economy, so that the impact of shocks may last for long periods. We first analyze the relative importance of internal factors *vis-à-vis* the external factors (such as the wages of workers with similar qualifications and experience or the availability of workers with similar characteristics in the labor market) in the determination of entry wages. We then investigate the impact of the external wages on job flows (i.e. hirings and separations) of newly-hired workers as well as on the probability of firm closure.

The remainder of the paper is structured as follows. A description of the main institutional characteristics of the wage setting process in Portugal is presented in Section 2. In Section 3 we describe the main features of the database used in the paper and explain how the key variables were obtained. Section 4 looks closely at the employment effects of increases in the wage floors

[2]Most empirical research that distinguishes entry wages from wages of ongoing jobs focuses on their different behaviour over the business cycle. Such studies show that wages of newly-hired workers are considerably more volatile that the wages of incumbent workers. However, since the number of workers in ongoing jobs is higher than the number of new hires, the aggregate wage invariably becomes rigid. These studies have highlighted the idea that the wage response to aggregate labor conditions differs considerably between workers in ongoing jobs and newly-hired workers. Carneiro et al. (2012) use matched employer-employee data for Portugal 1986-2005 and find that after controlling for both firm and worker heterogeneity, entry wages are much more procyclical than wages of ongoing jobs.

for each specific job title and estimates the impact of externally driven wage increases on the probability of firm exit. In Section 5 we attempt to disentangle the internal and external drivers of the wages of newly-hired workers in order to reveal the link between external (internal) wages and job flows. Finally, in Section 6 we summarize the main results of our paper and suggest some of their implications.

# 2 Institutional Wage Setting in Portugal

In this section we succinctly describe some of the main institutional characteristics of the wage setting process in Portugal.

The Portuguese Constitution provides the legal principles of collective bargaining and grants unions the power to negotiate. The effects of the agreements are formally recognized and considered valid sources of labor law. Concerning the bargaining mechanisms, two regimes can be distinguished: the conventional regime and the mandatory regime. Conventional bargaining results from the direct negotiation between employers' and workers' representatives. A mandatory regime, on the other hand, does not result from direct bargaining between workers and employers, but is instead dictated by the Ministry of Employment. The systematic extension of industry-wide agreements by the Ministry of Employment is the most important mechanism shaping the formation of wages. Indeed, even though by law the collective agreement only binds the trade union members and the employer associations' affiliated firms that are parties to the agreement, there is no legal mechanism that obliges the trade unions and the employers association to reveal their constituency. This legal conundrum is almost always circumvented by extending the agreement to the whole sector through the use of the so-called "*portarias de extensão*".[3] This means

[3] Article 514 of the Portuguese labor code states that "a collective agreement [...] in force can be applied, entirely or partly, by an extension ordnance to employers and employees in the economic activity and profession considered in the collective agreement. The extension is possible after weighting the social and economic circumstances that may justify it, in particular the identity or economic social similarity of the cases in the extension and the underlying collective agreement."

that wage agreements reached by trade unions and employers' associations with even very low representation have a strong impact in setting wage floors.[4] Indeed, in any given year collective bargaining sets around 30,000 minimum wages that correspond to 30,000 job-titles (see Carneiro et al. (2014), Torres et al. (2013), and Martins (2014)).

Since most collective agreements are industry-wide, covering companies with very different sizes and economic conditions, their contents tend to be general, setting minimum working conditions, especially the base monthly wage for each category of workers, overtime pay and the normal duration of work. Underlying the bargaining process there is a mandatory minimum monthly wage that sets the floor for wage negotiations.[5] National legal minimum wages and pervasive wage floors set by collective bargaining coupled with the legal prohibition of nominal wage cuts (that survives since the 1950s) creates a *de facto* situation of extreme nominal wage rigidity. In the context of the high inflation regime that characterized Portugal in the 1980s and 1990s, this restriction was not binding in real terms, as adjustments in real wages could be achieved by raising nominal wages at a rate below the inflation rate, or for firms paying wages above the corresponding new minimum, by reducing the wage drift. In such a setting, the higher the inflation rate the greater the leeway for manipulating the real wage.

However, in the current low-inflation regime nominal wage rigidity becomes an active restriction. Indeed, in this environment employers' response on the wage margin is limited to the possibility of reducing the wage drift or going for the lowest nominal wage increase possible, ultimately freezing wages. Hence, in a low-inflation regime negative shocks are expected to shift the employment distribution of nominal wage adjustment toward zero, the magnitude of real wage adjustment being conditional on the inflation rate. This is, in fact, what is observed during the

[4]In 2012 a Government resolution stated that the extension would be possible only when the employers' subscribers to the agreements employ at least 50% of the workers of the relevant economic sector.

[5]Currently there is a unique legal minimum wage that applies to all workers. Workers formally classified as apprentices receive just 80% of the full rate. The minimum wage is updated annually by the parliament, under government proposal. Decisions on the level of the minimum wage are made on a discretionary basis, usually taking into account past and predicted inflation and after consulting the trade unions.

current recession, in which the wage response is characterized as in the past by no (or limited) nominal negative variations (measured from base pay), but a much greater likelihood than in the past that wage variations are zero; there is also a salient move toward zero in the distribution of wage variations, corresponding approximately to the expected inflation rate and accentuating even more the low distribution spread.[6]

# 3 Dataset

## 3.1 Personnel Tables (*Quadros de Pessoal*)

The data used in this paper come from a longitudinal matched employer-employee dataset known as the Tables of Personnel (*Quadros de Pessoal*) for the years 1986 to 2009. This unique dataset was created by the Portuguese Ministry of Employment and is constructed from a mandatory annual survey addressed to firms with wage earners. It has been conducted every year since 1986 with the exception of 1990 and 2001. The survey covers various firm and establishment characteristics, as well as a set of characteristics of the workforce. Being compulsory, it does not suffer from the non-response problems that often plague standard household and firm surveys. Furthermore, the survey covers almost all Portuguese employees, excluding only Public Administration.

The dataset includes information on the establishment (establishment identifier, location, industry, and employment), the firm (firm identifier, location, industry, legal form, ownership, year of start-up, employment, sales, and capital), and its worker (social security identifier, gender, age, education, skills, occupation, employment status, professional level, seniority, earnings, normal and overtime hours, time elapsed since the last promotion, and classification in the collective bargaining agreement).

[6]Dias et al. (2013) show that besides freezing the base wages, Portuguese firms make frequent use of a number of labor cost-cutting strategies, like freezing or cutting bonuses and other monetary or non-monetary benefits, slowing down or freezing the rate at which promotions are filled, or recruiting new employees at wages lower than those received by the employees that have left the firm. They provide evidence that the availability of these alternative labor-cost adjustment margins that firms can use in bad times makes dismissals a less likely outcome.

## 3.2 The Bargained wage floor

The unique characteristics of our dataset with detailed information about the job title structure within each collective wage agreement provide the means to calculate with a great level of accuracy the bargained wage floor. The bargained wage floor for a given job title - a key variable in our paper - is proxied by the modal base wage for each job title within each collective agreement. As shown in Cardoso and Portugal (2005), the mode of the distribution of the base wage corresponds with remarkable accuracy to the contractual wage set by collective bargaining.

## 3.3 Sample definition and general variables

For the purposes of this paper a subset of variables was selected, certain new variables created, and some observations removed. The final set of variables retained for analysis is given in Table 9 in Appendix A. A number of general restrictions were placed on the data used throughout the paper. Given the specific purpose of our investigation (i.e. the impact of externally-set wage increases), the analysis excludes firms that apply firm-level agreements. In addition, the data exclude those individuals who were not working full time, who were aged less than 18 years and more than 60 years, who earned a nominal wage less than 80 percent of the legal minimum wage in each year legal minimum wage or above the 99.9 percent quantile in each year, and who recorded errors in admission/birth dates, duplicate social security codes or other errors in their social security codes.[7]

The analysis performed herein examines the impact of extensions upon workers flows (hirings, separations and the net job creation), as well as upon the probability of firm exit (failure). Both hirings and separations were computed on the basis of social security identifiers: hirings correspond to the number of new social security identifiers reported by firms in each year compared to the last year (i.e. workers that are new in the database in a given year), whereas separations

[7]Individuals employed outside of mainland Portugal and those in agriculture, hunting, forestry, and fishing (as well as misclassified industries) are also excluded.

are the number of social security identifiers that were reported by firms in the previous year but not in the current year (i.e. workers that left the database in the previous year). Both variables are expressed as a share of total employment in each firm in the previous year (hiring rate and separation rate). The net job creation is simply the difference between the hiring rate and the separation rate. The variable "failure" that is used to gauge the impact of extensions on the probability of firm closure is a binary variable that is equal to 1 in year t for firms whose individual identifier left the database in that year and 0 otherwise. As mentioned before, we use the data from Personnel Tables from 1986 to 2009, excluding the years in which was discontinued (1990 and 2001). As a result, we did not compute these four variables (hiring rate, separation rate, net job creation, and failure) for 1990 and 2001 but also (by construction) for 1986, 1989, 2002 and 2009.

### 3.4 Specific sample restrictions and variables

In Section 4 we will measure the employment effects of increases in the wage floors for each specific job title. To that end we compute for each firm based on each job title within the firm the increase between the actual base wage at time t and the new bargained wage floor set by the collective wage agreement for t+1 (i.e. the increase in the wage bill necessary to comply with the new collective agreement). Assuming that the job title structure in each firm remains unchanged between year t and year t+1, these changes are then aggregated by firm to obtain the "implied wage bill growth". In the imputation of the wage bill growth we excluded values above the 90th percentile to minimize measurement errors.

The exercise to be performed in Section 5 will be restricted to the newly-hired workers. For the purpose of this exercise a worker is considered as "newly-hired" in a given firm if he meets two conditions: i) he has job tenure of less than 12 months; ii) there is at least one worker in the same firm and in the same job title but with a tenure of more than 12 months. A minimum of 10 hirings over the entire period is also imposed as a threshold for a firm to be included in the

sample. In order to disentangle the internal from the external drivers of the wages of newly-hired workers, two key variables are created: the "internal wage" and the "external wage". The latter is the bargained wage floor for each job title whereas the "internal wage" is the modal base wage in each specific job title in each particular firm.

# 4 The impact of upward nominal wage rigidity on job flows and firm closures

In this section we look closely at the employment effects of increases in the wage floors for each specific job-title. For this purpose we compute for each firm, based on each job title within the firm, the increase in the wage bill necessary to comply with the new collective agreement. For this we took the job-title structure of the workforce of form i at year t, and assuming that the same exact job-title structure would prevail at year t+1, obtained the increases in the base wage that would place those workers at the new wage floors, and aggregated all positive wage increases to define the implied wage bill growth. At this stage it is worth mentioning that different firms may face two distinct situations: first, the worker is already collecting a wage equal to or above the newly-agreed wage. In this case the contribution to the implied wage bill growth will be zero. Second, the worker is receiving a base wage that is below the new minimum. In this case, the contribution is, of course, the difference between the current base wage and the new wage floor.

Within each firm both cases are possible. The larger the fraction of workers that are paid below the new job title wage floor, the larger will be the implied wage bill growth. Collective agreements that settle higher wage increases will also, of course, engender higher wage bill increases. The implied wage bill change is our critical treatment variable. The identification of the employment effects of these externally imposed wage changes depends, of course, on the past wage policy of the firm, the job title structure of the workforce, and the size of the newly agreed wage floor

increases. In this sense, this methodology is a straightforward generalization of the one suggested by Abowd et al. (2000) to study the impact of minimum wage increases in France and the USA. Portugal and Cardoso (2006) exploit a similar strategy to analyze the impact of a subminimum wage hike on the workers' accession and separation rates. To measure the effect of an increase in the wage bill implied by the updating of the wage floors settled by collective agreement on net job creation, we specified a simple labor demand equation in first differences:

$$\triangle y_{ft} = \xi \triangle wb_{ft} + \triangle x'_{ft}\beta + \lambda_t + \varepsilon_{ft} \tag{1}$$

where $\triangle y_{ft}$ stands for the net job creation rate, hiring rate, or separation rate in firm $f$ at time $t$. $\triangle wb_{ft}$ represents the implied wage bill growth, $x'_{ft}$ denotes a vector of explanatory variables (firm age, change in the market share and change in base wages), $\lambda_t$ represents a set of time (yearly) effects, and $\varepsilon_{ft}$ is a conventional error term.

The results provided in the first column of Table 1 suggest a strong impact on net job creation resulting from externally driven changes in the wage bill of the firms. According to our estimates, a 10 percent (real) increase in the wage bill leads to an employment decrease of 2.1 percent (not too far from the "consensus" estimate of the long-run elasticity of labor demand of -0.6 shown in Hamermesh (1993)). The presence of firm's age, firm's average wage, and firm's market share are not especially revealing but their inclusion (or exclusion) does not materially change the estimates of the implied wage bill growth regression coefficient. The estimates shown for the determinants of the hiring rate and the separation rate (columns 2 and 3 from Table 1) indicate that the impact of exogenous changes in wages produced via changes in collective agreements is largely driven by increases in separation rates (which increase by 2.29 percentage points in response to a 10 percent increase in the wage bill) rather than by decreases in hiring rates.

So far, we have taken the (job title specific) wage floors settled at the bargaining table as

Table 1: The impact of increases in bargained wage floors on firms' net job creation
OLS estimators

| | Dependent variables | | | | | |
|---|---|---|---|---|---|---|
| | Net job creation | | Hiring rate | | Separation rate | |
| implied wage bill growth | −0.2096 | −0.2542 | 0.0193 | −0.0075 | 0.2289 | 0.2467 |
| | (0.1003) | (0.0950) | (0.0783) | (0.0623) | (0.0657) | (0.0691) |
| firm age | −0.0143 | - | −0.0373 | - | −0.0230 | - |
| | (0.0015) | | (0.0012) | | (0.0015) | |
| △market share | 0.0097 | - | −0.0020 | - | −0.0117 | - |
| | (0.0269) | | (0.0190) | | (0.0262) | |
| △base wages | 0.0004 | - | −0.0279 | - | −0.0283 | - |
| | (0.0056) | | (0.0050) | | (0.0064) | |
| number of firms/workers | 833,216/1,062,035 | | | | | |
| yearly dummies | YES | | | | | |

The implied wage bill growth is calculated in the following way. Within each firm, for each worker in a given job title we compute the change between the actual base wage at time t and the new wage floor set by the collective wage agreement for t+1; these changes are then aggregated by firm to obtain the implied wage bill growth.

largely exogenous to the firm. But at least some firms are represented in the bargaining process. Since we cannot identify which firms are part of the bargaining and which are excluded, we still face endogeneity issues. One way to circumvent this problem is to account in the estimation for distinct time trend with each contract. A fully flexible way to proceed is simply to include a full set of contract/year dummies, removing (filtering) contract heterogeneity and contract time variation from the estimation. That is, the estimating equation is now:

$$\triangle y_{ft} = \xi \triangle wb_{ft} + \triangle x'_{ft}\beta + \lambda_{ct} + \varepsilon_{ft} \tag{2}$$

where $\lambda_{ct}$ identifies the collective agreement ruling the bargained wages of firm $f$ at time $t$.

Proceeding in this way we obtained the results shown in Table 2. The coefficients on the implied wage bill growth do not differ from those obtained earlier. This result is less surprising

Table 2: The impact of increases in bargained wage floors on firms' net job creation
least square dummy variable estimators

| | Dependent variables | | | | | |
|---|---|---|---|---|---|---|
| | Net job creation | | Hiring rate | | Separation rate | |
| implied wage bill growth | −0.3269 | −0.2959 | 0.0122 | 0.1115 | 0.3390 | 0.4115 |
| | (0.0493) | (0.0444) | (0.0336) | (0.0293) | (0.0417) | (0.0387) |
| firm age | −0.0182 | - | −0.0311 | - | −0.0129 | - |
| | (0.0015) | | (0.0011) | | (0.0012) | |
| △market share | 0.0179 | - | −0.0122 | - | −0.0300 | - |
| | (0.0266) | | (0.0164) | | (0.0219) | |
| △base wages | −0.0004 | - | −0.0146 | - | −0.0143 | - |
| | (0.0052) | | (0.0034) | | (0.0052) | |
| number of firms/workers | 833,216/1,062,035 | | | | | |
| collective wage agreements × year(s) dummies | YES | | | | | |

The implied wage bill growth is calculated in the following way. Within each firm, for each worker in a given job title we compute the change between the actual base wage at time t and the new wage floor set by the collective wage agreement for t+1; these changes are then aggregated by firm to obtain the implied wage bill growth.

than it may seem, since by taking first differences we are already removing the firm's cross-sectional variation.

A frequently neglected dimension of the employment adjustment is its corresponding extensive margin, that is, the entry and exit of firms (Addison et al. (2014)). In the current exercise any attempt to guess the effect of collective bargaining on the entry rates of firms would be a "*tour de force*", despite the potential importance of such an inquiry. Nonetheless, our sampling plan allows us to estimate how externally driven wage increases impact the probability of firm exit. To this end we specified a simple probit regression model taking the same covariates as before.

The regression results on the determinants of the failure of firms are given in Table 3. The main thrust of the estimation is the indication that the estimate of the quasi-elasticity of labor demand through firm closure is equal to 0.78, meaning that a 10 percent increase in the wage bill generated by the increase in the bargained wage floor increases the probability of firm closure by 7.8 percentage points. This appears to be a fairly sizeable effect, since the average failure rate in

the current sample is around 10.8 percent.

Table 3: The impact of increases in bargained wage floors on the probability of firm closure
probit estimators

| | Dependent variable: failure | | | |
|---|---|---|---|---|
| | Probit estimates | | Marginal effects | |
| implied wage bill growth | 4.3844 | 5.0703 | 0.6317 | 0.8703 |
| | (0.0808) | (0.0626) | (0.0117) | (0.0108) |
| firm age | −0.0961 | - | −0.0139 | - |
| | (0.0023) | | (0.0003) | |
| △market share | −0.1197 | - | −0.0172 | - |
| | (0.0675) | | (0.0097) | |
| △base wages | −0.1103 | - | −0.0159 | - |
| | (0.0132) | | (0.0019) | |
| △firm size | −0.2327 | | −0.0335 | |
| | (0.0046) | | (0.0007) | |
| number of firms/workers | 971,720/1,291,806 | | | |
| yearly dummies | YES | | | |

The implied wage bill growth is calculated in the following way. Within each firm, for each worker in a given job title we compute the change between the actual base wage at time t and the new wage floor set by the collective wage agreement for t+1; these changes are then aggregated by firm to obtain the implied wage bill growth. Failure is a binary variable that is equal to 1 for firms whose individual identifier left the database and 0 otherwise.

# 5 The impact of external wages on hirings and separations of newly-hired workers

## 5.1 How important are external wages for the determination of wages of newly-hired workers

So far we have focused on the wage behavior of workers that were assumed to stay in the same firm, that is, of (potential) job stayers. Given the nature of the exercise we neglected by construction the wage behavior of new hires. But as discussed above, the determinants of entry wages are critical at both the theoretical and the empirical levels. In this section we shall attempt to disentangle the internal from external drivers of the wages of newly-hired workers. Once we succeed distinguishing between firms with different degrees of externally (internally) driven entry wages, we should be able to unveil the link between external (internal) wages and job flows.

The importance of internal wages driving entry wages has a number of implications. First, it may signify that firms more often than not choose to negotiate entry wages above the wage floors defined by the collective agreements. This may be due to fairness considerations or other strategic considerations (e.g., incentive contracting). In any case, such a finding would provide direct empirical evidence supporting the notion that the wages of new hires are partially determined by the prevailing wages of stayers, as hinted at in Bils et al. (2014). Second, by negotiating wages above the external option of the worker, those firms are more likely to avoid worker turnover and retain those workers, therefore decreasing worker separations. Third, because a significant fraction of firms offer wages above the minimum defined at the bargaining table (typically sectoral), they may benefit from the wage cushion (Cardoso and Portugal (2005)) engendered by the difference between the actual wage paid and the bargained wage. Confronted with a negative shock in the product demand or in the costs of inputs, those firms may better adjust through wages than firms that are remunerating their workers at the established minimum.

If this argument has some value, one should expect lower failure rates and less employment volatility among firms that are less constrained by external wages. On the other hand, if the bargaining power of the workers, that is, the union power, is strong enough, wage floors agreed through collective negotiations may not leave space for firms to settle wages above the external wages. In this case, where external wages are binding (as in, for example, Dolado et al. (1997) for unskilled workers) the wage cushion will be small and the firms may lack room for maneuver to successfully adjust to negative product demand shocks. Fourth, there is convincing empirical evidence showing that that the wage policy of the firms is notoriously heterogeneous. The fact that firm fixed effects account for a large fraction of the wage variation (Torres et al. (2013)) is a clear sign that firms often cannot be taken as wage takers. Webber (2013) argues forcefully that the labor supply elasticities faced by the firms are relatively low, indicating that firms detain significant monopsony power (Manning (2003)). If, indeed, monopsony power plays an important role, it should influence the relative strength of internal and external factors in the determination of wages.

To better understand the nexus between entry wages and employment adjustments, we first provide a measure of the importance of inside and outside wages to next investigate, as before, the impact of externally driven wages on job flows. In order to compute such a measure, we start by computing two wage statistics: the prevailing wage at the firm level for the job title that corresponds to the new hire - this statistic we shall call internal wage; and the bargained wage floor that corresponds to the job title of the new hire - this statistic we shall call external wage.

The way we measure the relative importance of internal and external wages driving the wages of new hires is simple but unconventional. In essence, what we do is run a regression of the entry wage on the internal and external wages as well as on a set of time dummies. Because we need to distinguish the wage policy of the firms, we allow the regression coefficients on the two wage regressors to change from one firm to another. In other words, the model we wish to estimate relates the entry wages of workers to the "internal" and "external" wages in the same job title.

Specifically, our model consists of:

$$w_{ifjt} = w^I_{fjt}\beta^I_f + w^o_{jt}\beta^o_f + \alpha_f + \lambda_t + \varepsilon_{ifjt} \tag{3}$$

where $w_{ifjt}$ is the (log of) entry wage of worker $i$ in firm $f$, in job $j$ at time $t$, $w^I_{fjt}$ is the corresponding "internal" wage (the mode wage of ongoing workers in the same professional category, firm and year) and $w^o_{fjt}$ is the "external" wage (the minimum contractual wage for the same job title and year). The $\alpha_f$ is a standard firm fixed-effect that accounts for unique firm (or industry) characteristics that affect all entry wages alike (firm internal organization, higher productivity, etc) and $\lambda_t$ is a time fixed effect. Note that the $\beta$ coefficients in the above equation are specific to each firm, reflecting the fact that firms place different weights on "internal" and "external" wages when setting entry level wages. Direct estimation of the above model cannot be implemented using the standard procedure to deal with a model with one fixed effect. In Appendix B we detail the procedure to find the exact least squares solution for the parameters of the above model.

The regression coefficients of the (internal and external) wage variables can straightforwardly be interpreted as the weights attached to such drivers in the formation of starting wages.[8] Figures 1 and 2 show the distribution of both the "internal" wage and "external wage" fixed effects, whereas Table 4 illustrates how the mean of the distribution for the external wage fixed effect varies according to gender, degree of centralization of wage bargaining, type of contract, sector, and worker age.

Results from Table 4 show that firm internal wage structure is relatively more important for the determination of wages of new workers: It accounts on average for 56 percent of the determination of base wages of newly-hired workers. However, the importance of externally-set wages is far from being negligible, as it accounts on average for 31 percent.

[8]To mitigate the unavoidable sampling error that result from firms with very low recruitments, we excluded weights below zero and above one.

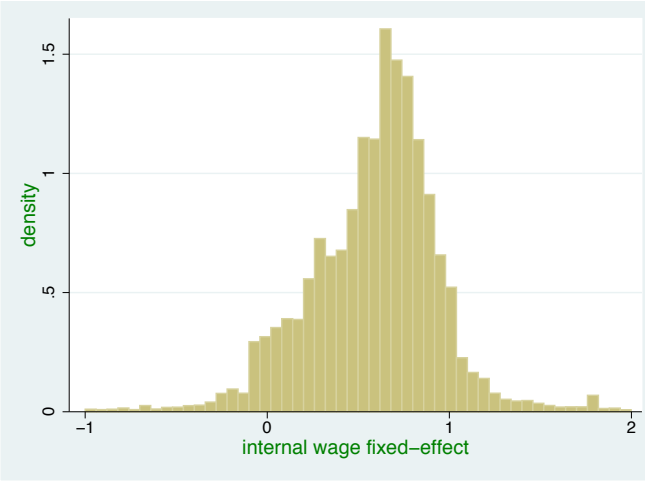


Figure 1: Internal wage fixed-effect

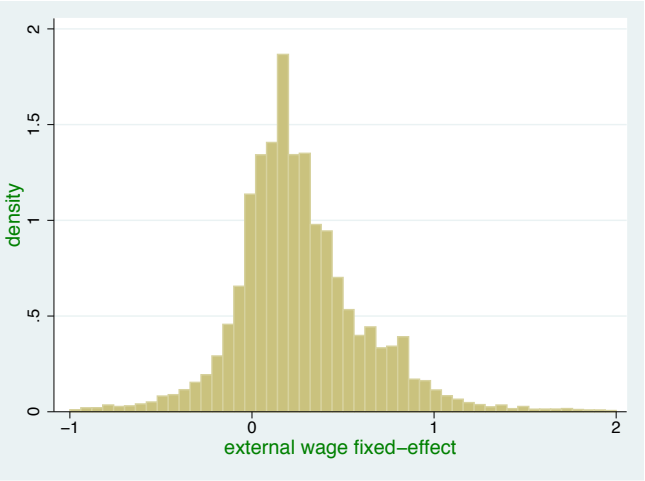


Figure 2: External wage fixed-effect

Table 4: The determinants of wages of newly-hired workers
internal vs. external factors

| | Internal wage | External wage | Number of workers |
|---|---|---|---|
| Full sample | 0.562 | 0.312 | 1,454,695 |
| Men | 0.571 | 0.309 | 894,157 |
| Women | 0.547 | 0.319 | 560,538 |
| Manufacturing | 0.554 | 0.334 | 444,129 |
| Construction | 0.585 | 0.341 | 280,846 |
| Non-financial business services | 0.548 | 0.277 | 417,259 |
| Financial services | 0.418 | 0.520 | 41,710 |
| Trade | 0.595 | 0.273 | 260,728 |
| Workers older than 30 | 0.566 | 0.311 | 613,182 |
| Workers under the age of 30 | 0.559 | 0.314 | 841,513 |

The "external wage" is the bargained wage floor for a given job title proxied by the mode of the base wage for each job title within each collective agreement; the "internal" wage is the mode of the base wage in each specific job title in each particular firm. In both cases the values are expressed in logarithms. The sample excludes firms that apply firm-level collective agreements. Observations: 1,454,695 newly hired workers.

## 5.2 How externally-set wages impact on firms' hirings and separations of newly-hired workers

The importance attached to the role of internal wages seems to vindicate the notion that entry wages are largely driven by the wages of job stayers, as forcefully argued by Bils et al. (2014). More generally, it is also consistent with the hysteresis story of Blanchard and Summers (1987). From the evidence that internal wages are good predictors of the wages of new hires it cannot be concluded that external wage constraints, such as those defined by wage floors, do not play a role. To shed some light on this issue we estimate a regression model on the determinants of job flows. In particular, we specified the following equation:

$$\triangle y_{ft} = \theta ew_f + \triangle x'_{ft}\beta + \lambda_t + \varepsilon_{ft} \tag{4}$$

where $ew_f$ is the estimated external wage weight for firm $f$ obtained from equation 3, that is $\hat{\beta}^o_f$. As before, $\triangle y_{ft}$ stands for the net job creation rate, hiring rate, or separation rate in firm $f$ at time $t$, $x'_{ft}$ denotes a vector of explanatory variables, $\lambda_t$ represents a set of time (yearly) effects, and $\varepsilon_{ft}$ is a conventional error term.

The estimation results are shown in Table 5. Here the critical parameter is the regression coefficient for the external wage variable: a 10 percent increase in the external wage weight generates a 0.3 percentage point decrease in the net job creation rate. Interestingly this result is now largely driven by the sizeable hiring rate decrease (-0.7 percentage points), because the impact on separation rates is negative (-0.4 percentage points). More generally, these results clearly indicate that the internal and external wage weights contain relevant information that can help us to predict employment outcomes. When we turn our attention to the effect of external wages on the failure rate, we find that firms whose wage policies are more driven by external wages face higher probabilities of failure. A 10 percent increase in the external wage weight is

Table 5: The impact of externally set wages on firms' net job creation

| | Dependent variables | | | | | |
|---|---|---|---|---|---|---|
| | OLS estimates | | | | | |
| | Hiring rate | | Separation rate | | Net job creation | |
| external wage weight | −0.0438 | −0.0663 | −0.0257 | −0.0360 | −0.0181 | −0.0303 |
| | (0.0068) | (0.0072) | (0.0062) | (0.0074) | (0.0057) | (0.0063) |
| firm age | - | −0.0879 | - | −0.0436 | - | −0.0443 |
| | | (0.0025) | | (0.0023) | | (0.0017) |
| △market share | - | 0.0309 | - | −0.0223 | - | 0.0532 |
| | | (0.0227) | | (0.0221) | | (0.0251) |
| △base wages | - | −0.1456 | - | −0.0584 | - | −0.0871 |
| | | (0.0259) | | (0.0231) | | (0.0152) |
| number of firms | 271,625 | 182,879 | 271,625 | 182,879 | 271,625 | 182,879 |

Bootstrapped standard errors in parentheses. The "external wage" is the bargained wage floor for a given job title proxied by the mode of the base wage for each job title within each collective agreement. Failure is a binary variable that is equal to 1 for firms whose individual identifier left the database and 0 otherwise. Results are weighted by the number of recruitments in each firm.

associated with a 0.1 percentage point increase in the probability of firm closure (Table 6).

A thorny problem that emerges from our approach comes directly from the assumption that the wage policy of the firm is exogenous. The notion that the wage policy of the firm regarding the definition of entry wages is independent from the error term is clearly questionable, to say the least. Whereas the definition of the external wages is largely exogenous to the firm, the decision to pay above the external wage floors can hardly be argued to be exogenous. Fortunately we can rely on the information regarding the identification of each collective agreement that binds each firm to construct a valid instrument. In other words, we shall replace the external weight variable by its estimated value from an auxiliary regression that simply regresses the external weight on a set of dummy variables identifying the ruling wage agreement. The estimating equation is now:

$$\triangle y_{ft} = \theta \hat{ew}_f + \triangle x'_{ft}\beta + \lambda_t + \varepsilon_{ft} \tag{5}$$

Table 6: The impact of externally set wages on the probability of failure

| | Dependent variable: failure | | | |
|---|---|---|---|---|
| | Probit estimates | | Marginal effects | |
| external wage weight | 0.3261 | 0.2582 | 0.0122 | 0.0099 |
| | (0.0029) | (0.0025) | (0.0001) | (0.0001) |
| firm age | −0.0823 | - | −0.0031 | - |
| | (0.0008) | | (0.0000) | |
| △market share | 0.1078 | - | 0.0040 | - |
| | (0.0102) | | (0.0004) | |
| △base wages | −0.3273 | - | −0.0123 | - |
| | (0.0057) | | (0.0021) | |
| △firm size | −0.3983 | - | −0.0149 | - |
| | (0.0015) | | (0.0001) | |
| number of firms | 182,879 | 271,625 | 182,879 | 271,625 |
| yearly dummies | | | YES | |

Bootstrapped standard errors in parentheses. The "external wage" is the bargained wage floor for a given job title proxied by the mode of the base wage for each job title within each collective agreement. Failure is a binary variable that is equal to 1 for firms whose individual identifier left the database and 0 otherwise. Results are weighted by the number of recruitments in each firm.

where $e\hat{w}_f$ is the predicted estimated external wage weight for firm $f$ obtained from an auxiliary regression that regresses the external wage weight on a set of dummy variables identifying the ruling wage agreement.

Tables 7 and 8 exhibit the results from this two-stage approach. Now the regression coefficient for the external wage variable is -0.13, which means that a 10 percent increase in the external wage weight generates a 1.3 percentage point decrease in the net job creation rate. As before, this result is now largely driven by the sizeable hiring rate decrease (-1.7 percentage points), because the impact on separation rates is small but negative (-0.4 percentage points).

Table 7: The impact of externally set wages on firms' net job creation and failure rate instrumental variable estimates

| | Dependent variables | | | | | |
|---|---|---|---|---|---|---|
| | OLS estimates | | | | | |
| | Hiring rate | | Separation rate | | Net job creation | |
| estimated external wage weight | −0.0696 | −0.1674 | −0.0199 | −0.0367 | −0.0895 | −0.1307 |
| | (0.0081) | (0.0077) | (0.0082) | (0.0097) | (0.0093) | (0.0094) |
| firm age | - | −0.0866 | - | −0.0412 | - | −0.0454 |
| | | (0.0005) | | (0.0006) | | (0.0007) |
| △market share | - | 0.0155 | - | −0.0322 | - | 0.0477 |
| | | (0.0105) | | (0.0120) | | (0.0135) |
| △base wages | - | −0.0305 | - | −0.0200 | - | −0.0106 |
| | | (0.0042) | | (0.0045) | | (0.0048) |
| number of firms | 271,625 | 182,879 | 271,625 | 182,879 | 271,625 | 182,879 |

Bootstrapped standard errors in parentheses. The "external wage" is the bargained wage floor for a given job title proxied by the mode of the base wage for each job title within each collective agreement. The collective agreement that binds each particular firm is taken as an instrument of the external wage. Failure is a binary variable that is equal to 1 for firms whose individual identifier left the database and 0 otherwise. Results are weighted by the number of recruitments in each firm.

Table 8: The impact of externally set wages on firms' net job creation and failure rate instrumental variable estimates

| | Dependent variable: failure | | | |
|---|---|---|---|---|
| | Probit estimates | | Marginal effects | |
| estimated external wage weight | 1.4910 | 1.6607 | 0.1028 | 0.1097 |
| | (0.1187) | (0.0935) | (0.0082) | (0.0063) |
| firm age | −0.0944 | - | −0.0065 | - |
| | (0.0076) | | (0.0005) | |
| △market share | −0.1695 | - | −0.0117 | - |
| | (0.1448) | | (0.0100) | |
| △base wages | −0.1930 | - | −0.0133 | - |
| | (0.0475) | | (0.0033) | |
| △firm size | −0.2241 | - | −0.0154 | - |
| | (0.0214) | | (0.0015) | |
| number of firms | 182,879 | 271,625 | 182,879 | 271,625 |
| yearly dummies | | | YES | |

Bootstrapped standard errors in parentheses. The "external wage" is the bargained wage floor for a given job title proxied by the mode of the base wage for each job title within each collective agreement. The collective agreement that binds each particular firm is taken as an instrument of the external wage. Failure is a binary variable that is equal to 1 for firms whose individual identifier left the database and 0 otherwise. Results are weighted by the number of recruitments in each firm.

# 6 Conclusions

Every year in Portugal collective agreements update the wage floors of around 30,000 job titles (Carneiro et al. (2014), Torres et al. (2013), and Martins (2014)). Given the widespread use of extension mechanisms ("*portarias de extensão*"), the coverage of those "minimum wages" is close to 90 percent of all dependent workers in the private sector. This occurs despite the fact that the union density rates are very low (around 10 percent according to Portugal and Vilares (2013)).

This means that in the Portuguese labor market firms confront not only severe downward nominal wage rigidity because nominal wage cuts are forbidden (Dickens et al. (2007)), but also what we tentatively call "upward nominal wage rigidity". These wage rigidities are similar in nature to the frictions generated by nationwide mandatory minimum wages, in the sense that many firms are forced to increase their wages to comply with the updated wage agreements.

In this paper we explore an unusually rich matched employer-employee data set, one that provides for each worker the identification of the collective agreement (and the corresponding job title) binding the formation of base wages. In this setup we estimate for each firm the wage bill growth that is implied by the signature of a new contract. We then present evidence showing that the firms that are more strongly affected by the change in the bargained wage floors decrease their hiring rates and, more importantly, significantly increase their separation rates, leading to fairly sizeable higher job destruction rates. Furthermore, higher wage impacts are also associated with greater failure rates of firms. These results are consistent with those provided by Martins (2014) and Catalán and Villanueva (2012), despite their use of distinct identification strategies.

When we focused on the stock of employed workers, we observe the impact of externally driven wage increases being largely concentrated on (higher) worker separations, but when we look at the determinants of the wages of new hires, what we see is that the role of external wages is more intense among (lower) worker accessions.

The set of empirical results collected in the current essay call into question the functionality

of the architecture of the Portuguese wage setting system. In particular, it raises very serious concerns with respect to the widespread use of extension mechanisms. Also, the limited role played by the workers councils in the Portuguese legal framework seriously dampens any moves toward a decentralized (firm based) system of wage negotiations. Furthermore, given the low representativeness of the unions and of the employer associations, it may well be possible that higher wage firms and higher wage workers engage in a strategic behavior, seeking to avoid the competition of lower wage firms and lower wage workers.

In this framework it seems to be justified to limit the extension of wage agreements to criteria based on the representativeness of the negotiation partners, as recently approved in Portugal. The praised German experience (Dustmann et al. (2014)) favoring opting out clauses and decentralized mechanisms where worker councils play an important role should also be given serious consideration, even though the governance structure of the Portuguese system of industrial relations is, unlike the German one, firmly rooted in legislation and overwhelmingly governed by the political process.

# Appendix A - Description of variables

Table 9: Description of the variables used in the paper

| Variables | Description |
|---|---|
| Bargained wage floor | Modal base wage for each job title within each collective agreement |
| Hiring rate | Number of new social security identifiers reported by firms in each year as a share of total employment in each firm |
| Separation rate | Number of social security identifiers that cease to exist in each year as a share of total employment in each firm |
| Net job creation | Difference between the hiring rate and the separation rate |
| Failure | Binary variable that is equal to 1 for firms whose individual identifier left the database and 0 otherwise |
| Implied wage bill growth | Sum of all the increases between the actual base wage at time t and the new bargained wage floor for t+1 for every worker in each job title |
| Internal wage | Modal base wage in each specific job title in each firm |
| External wage | Weight of the external wage |
| Market share | Share of firms' sales in the 5-digit sector |
| Firm age | Number of years since start-up |
| Firm size | Number of workers in each firm |

# Appendix B - Least squares solution to the model presented in Section 5

The estimation of the model shown in section 5 cannot be implemented using the standard procedure to deal with a model with one fixed effect. This is because the number of $\beta$ coefficients that would need to be estimated $(2 \times 15,787)$ is too large to allow for the application of the within estimator. However, it is still possible to find the exact least squares solution to the model (equation 3).

The trick is to estimate the model in two steps making use of the Frisch-Waugh-Lovell (FWL) theorem and the fact that for a subset of variables the firm-level observations are independent. In the first step we expurgate from $w_{ifjt}$ and $x_t$ the effect of the other variables in the model. This amounts to calculating the residual of regressions on $w^I_{fjt}$ and $w^o_{jt}$ for each individual firm. Then we regress the residual of $w_{ifjt}$ on the residual of the $x_t$ and obtain $\widehat{\gamma}$, the OLS estimate of $\gamma$. To obtain the OLS estimates of $\beta^I_f$, $\beta^o_f$ and $\alpha_f$ we need only to regress $w_{ifjt} - x_t\widehat{\gamma}$ on $w^I_{fjt}$ and $w^o_{jt}$ again for each individual firm. The constant term on firm level regressions are the OLS estimates of the $\alpha_f$ and the standard errors obtained by this procedure are correct as long as we adjust the degrees of freedom.[9]

[9]The Stata user-written program *regintfe* programmed by one of the authors implements this method. The code is available on the Statistical Software Components (SSC) Archive.

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