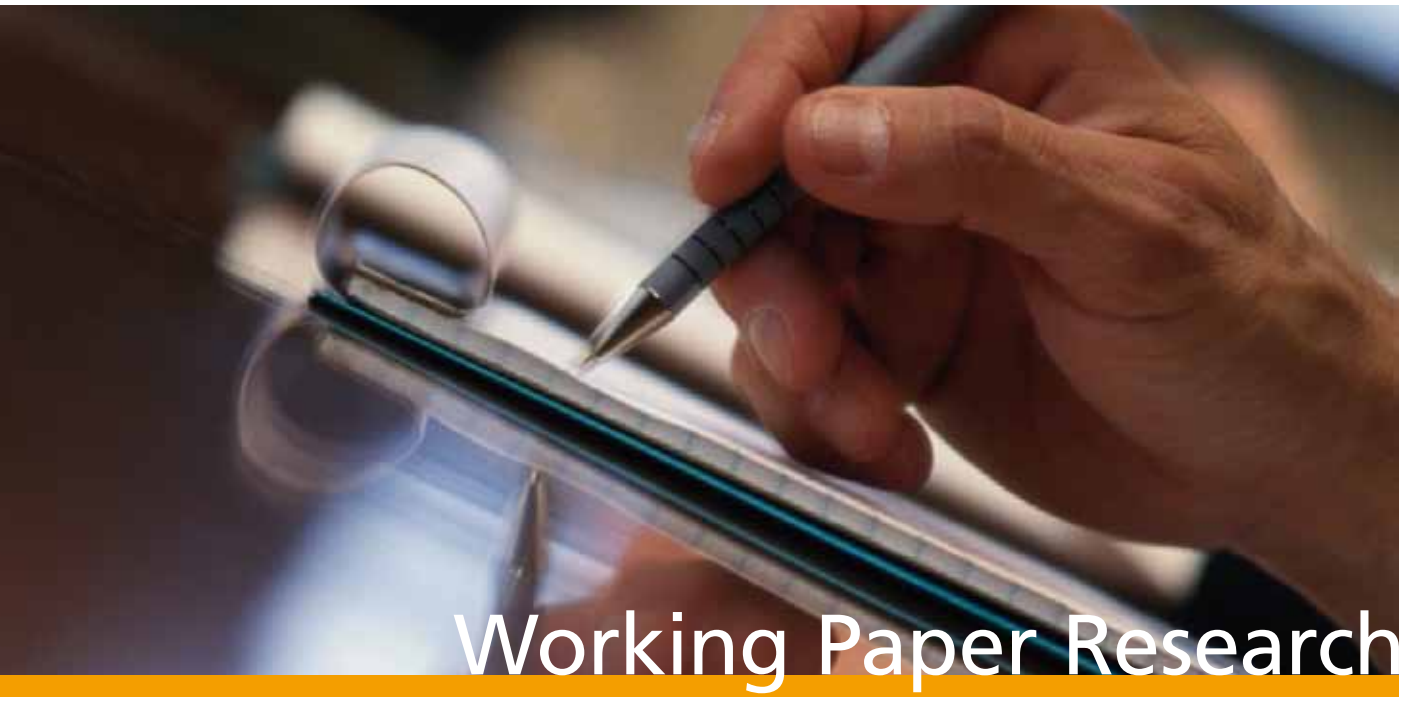
The incidence of nominal and real wage rigidity: An individual-based sectoral approach



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Abstract

This paper presents estimates based on individual data on downward nominal and real wage rigidities for thirteen sectors in Belgium, Denmark, Spain and Portugal. Our methodology follows the approach recently developed for the International Wage Flexibility Project, whereby resistance to nominal and real wage cuts is measured through departures of observed individual wage-change histograms from an estimated counterfactual wage-change distribution that would have prevailed in the absence of any rigidity. We evaluate the role of worker and firm characteristics in shaping wage rigidities. We also confront our estimates of wage rigidities with structural features of the labour markets studied, such as the wage bargaining level, variable pay policy and the degree of product market competition. We find that the use of firm-level collective agreements in countries with rather centralised wage formation reduces the degree of real wage rigidity. This finding suggests that some degree of decentralisation within centralised countries allows firms to adjust wages downwards, when business conditions take a turn for the worse.

Key Words: wage rigidity, wage-bargaining institutions

JEL Classification: J31

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1. Introduction

The moderate levels of inflation experienced in the industrialized countries during the last decade have awakened renewed interest on an old argument: can inflation grease the wheels of the labour market? In an influential paper, Tobin (1972) argued that if central bankers aim at too low inflation rates they might hamper the functioning of labour markets. In his reasoning, moderate levels of inflation help the adjustment of relative wages if workers (or firms) are reluctant to nominal wage cuts. If inflation is too low, downward nominal wage rigidity pushes up wages and causes higher unemployment (Akerlof et al. 1996). Hence, the extent of downward nominal wage rigidity prevailing in the economy has stark implications for the optimal level of inflation (Fagan and Messina, 2009).

Recently, a growing literature has emphasized the importance of real, rather than nominal wage rigidities for understanding macroeconomic fluctuations. Hall (2005) argues that the dynamic properties of standard matching models are greatly improved when real wage rigidity is taking into consideration. Within the new Keynesian literature, Blanchard and Galí (2007) show the importance of real wage rigidity to understand the dynamic trade-offs between inflation and unemployment found in the data, and as a fundamental source of inflation inertia.

This renewed interest and the increasing availability of individual and firm level data with relatively accurate information on individual wages materialized in a flourishing literature assessing the extent of downward nominal wage rigidities in different countries and periods (see references in Section 2). Most previous literature has focused on downward nominal wage rigidity (see surveys in Camba-Mendez et al (2003) and Holden (2004)). Recently, the micro literature has been extended to consider downward real wage rigidities. The International Wage Flexibility Project (IWFP), a large network studying wage rigidities from individual data in 17 OECD countries showed that in many wage change distributions (mostly observed in European countries) there are asymmetries around the expected rate of inflation, rather than at zero wage changes (Dickens et al. 2007). This was interpreted as evidence of downward real wage rigidity, and raised a number of questions such as the determinants and consequences of nominal versus real rigidities, and their relationship with inflation.

This paper applies the methodology from the IWFP to study the causes of downward wage rigidity (DWR). Unlike Dickens et al. (2007 and 2009) where nominal and real rigidity are measured from individual wage change distributions at the aggregate level, we estimate downward nominal wage rigidity (DNWR) and downward real wage rigidity (DRWR) based on individual data for 13 sectors (both manufacturing and services) in 4 countries: Belgium, Denmark, Spain and Portugal. The time frame of the study includes 1990-2007, although the available years vary from country to country. To our knowledge, this is the first paper exploiting

sectoral measures of wage rigidity based on individual data[1]. The sectoral approach of the paper has several advantages, which allow us adding to the existing literature in a number of dimensions. First, we provide a test for robustness of previous results. Our sectoral data easily allow us to control for country and sector unobserved heterogeneity and compositional effects. Hence, all the analysis presented here will be free of confounding effects that remain fixed across countries and sectors and consequently less subject to possible omitted variable biases. Second, we extend previous analysis on the determinants of wage rigidity. We explore the role of compositional effects including worker characteristics such as the gender, age and skill composition, and firm characteristics such as the size distribution of sectors in the determination of downward nominal and real rigidities.[2] Moreover, we explore the impact of three crucial elements in the determination of wage rigidities such as the role of collective wage agreements, product market competition and flexible wage components in the remuneration policies of firms.

The rest of the paper is organized as follows. Section 2 describes the methodology used for the study and discusses some suggestive evidence of DNWR and DRWR from selected wage change histograms in our countries and sectors. Section 3 describes the main characteristics of the data used. Section 4 looks at the incidence of downward real and nominal rigidity in the data, disentangling the role of sectors and countries. Sections 5 discusses the relevance of worker and firm characteristics in explaining rigidities, while section 6 looks at structural determinants, like wage bargaining institutions, variable pay policies and product market competition. Section 7 concludes.

2. Methodology

The empirical literature on downward wage rigidity (DWR) is organized along two distinct lines of research. In the spirit of Layard et al. (1991), many authors have studied the reaction of wages to changes in relevant variables, i.e. unemployment and productivity, mainly using macroeconomic data. This paper adds to a second line of research, where measures of downward wage rigidity rest on the idea of an asymmetric behaviour of wage changes in response to notional wage increases versus notional wage cuts, using microeconomic data.

Estimates of DNWR based on individual micro data can be largely grouped into three broad families. Several studies draw inference about rigidities from asymmetries in the wage change

1 Holden and Wulfsberg (2008, 2009) also study DNWR and DRWR at the industry level, but their estimates are based on industry data, hence on average wages at the industry level.

2 See Du Caju et al. (2009) for a similar disaggregated approach for Belgium

distribution, assuming that the effects of rigidity are seen only below the median and that the distribution would be symmetric in the absence of rigidity (see Dickens et al. 2007 and Card and Hyslop, 1997). A second group of estimates are based on the assumption that, in the absence of changes in the extent of rigidity certain aspects of the wage change distribution are constant over time (see Kahn, 1997 and Christofides and Nearchou, 2008 for an extension to study DRWR). Lastly, estimates are based on the assumption that there is an ideal type of wage change distribution (often called notional) and departures from this ideal distribution are attributed to either DNWR or DRWR. An alternative is proposed by Altonji and Devereux (2000), who develop a model of wage changes where DNWR and measurement error parameters are jointly estimated using maximum likelihood. The IWFP engaged in extensive testing of each of these three methodologies. Measures based on symmetry are problematic when reasonable estimates of the expected rate of inflation lie above the median wage change (see Dickens et al. 2007). Extending Kahn to allow for both DNWR and DRWR is possible, but it requires sufficient variation in the median of the distribution to allow the different types of rigidity to be identified. This variation is not available in the relatively stable inflation environments that characterise our samples. Extending Altonji and Deveraux is also possible, but the IWFP analysis of measurement error data from Gottschalk (2005) shows that the distribution of measurement errors failed to pass the normality assumption.

The IWFP methodology, reviewed at length in Dickens and Goette (2006) is the one applied in this paper. Our method estimates DWR at the individual level (using employee wage data), but from the perspective of the firm (looking only at wage changes of workers that stayed with the same firm in two consecutive years). Hence, we abstract from wage flexibility associated with worker turnover.

The IWFP method first corrects the observed distribution of individual wage changes for measurement errors, assuming that an observed wage cut that is compensated the year after with a wage increase constitutes a measurement error. This assumption, that all auto correlation in wage changes is due to measurement error, is suggested by the findings of Abowd and Card (1989) and has been extensively verified using data from Gottschalk (2005). Controlling for measurement error is crucial, since studies correcting for measurement error consistently find more evidence of DWR, as reviewed in Dickens et al. (2007).

Once an error free wage change distribution is available, the IWFP procedure applied here fits a model of wage changes using GMM techniques. This model jointly estimates the parameters of the so-called notional distribution, the extent of DNWR and DRWR, and the average reference point for real wage rigidity (expected inflation or bargaining focal point). It is assumed that the notional distribution of wage changes under flexibility follows a symmetric two-sided Weibull,

with parameters that may change year by year and sector by sector and are estimated by the IWFP protocol. However, a fraction of the population is potentially subject to DWR, and if their notional wage change falls below their reference point (zero in case of DNWR and expected inflation or a bargaining focal point in case of DRWR), they will receive a wage change equal to this reference point, instead of the notional wage change.

It is important to highlight that the focal point relevant for the estimation of DRWR is estimated by the model, rather than assumed at a given rate (e.g. expected inflation). The estimation is based on a grid search for asymmetries in the wage change distribution around the expected inflation rate. As will be shown below, in highly centralized countries the focal point of wage changes might differ from expected inflation, being either below or above depending on the conditions for negotiating wages in each year. Note also that the measures of DWR presented here attempt to capture the fraction of workers who would not receive a nominal or real wage cut when they were scheduled for one, no matter what the reason for the expected wage cut is. Hence, these measures are designed to be largely independent of macroeconomic conditions, in order to reflect structural features in the functioning of the labour market.

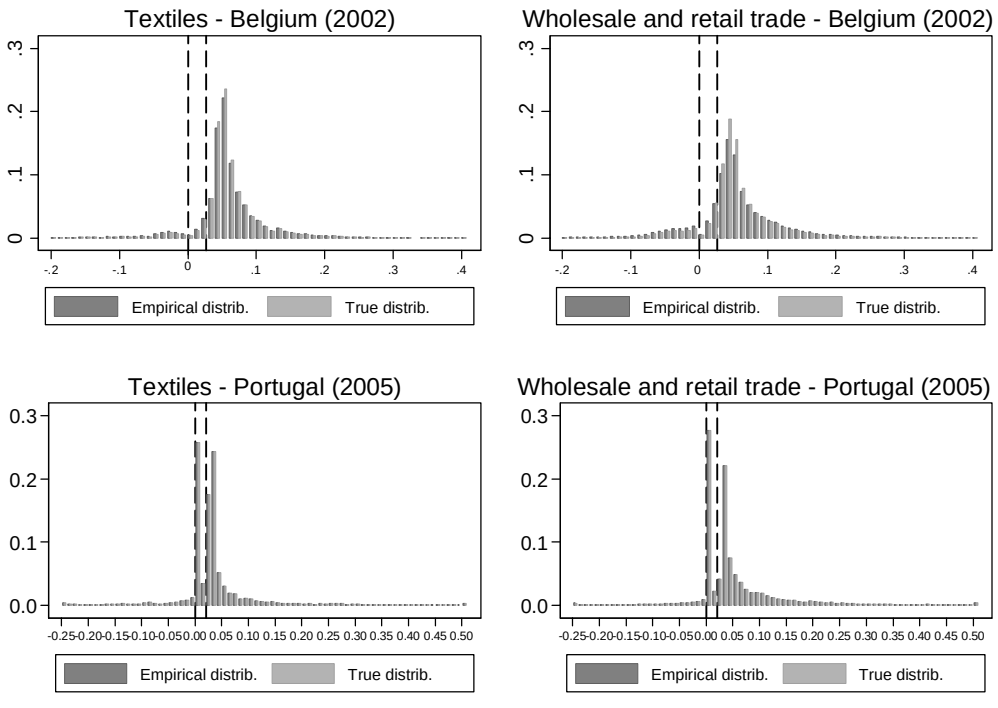
A simple illustration following two selected cases from the individual wage change distributions in each sector, country and year can help illustrate our methodology. Figure 1 presents the wage change distribution of workers staying for two consecutive years in the same job in the Textiles and Wholesale and retail sectors in Belgium and Portugal. The Belgian graph refers to the wage changes in 2001-2002, and the Portuguese shows wage changes for the period 2004-2005. The black bars refer to the observed wage change distribution, while the grey bars present the true wage change distribution, once measurement errors in the data have been corrected. The vertical line to the left shows the zero wage change, while the vertical line to the right of each graph denotes expected (national) inflation in each year. Several features are worth noting from the graphs. There is virtually no distinction between the observed wage change distributions and the estimated true wage change distributions. This is not surprising; given the high quality administrative data used in this study (see more details about the data in the next section).

Concentrate on the bottom-left graph, displaying wage changes in the textile sector in Portugal. This figure shows clear signs of DNWR. There is a large spike at zero wage changes, and a missing mass of observations below this point. Note also that there is missing mass just above the zero wage change. This might be an indication of symmetric (e.g. menu costs), rather than downward nominal wage rigidity. Our GMM model will jointly estimate symmetric wage rigidities, since failing to take into account this feature of the data might bias upwards the estimates of downward wage rigidities. The graph also clearly displays an indication of DRWR. A large mass of wage changes are clustered around the expected inflation rate, and again, we

observe missing mass below this point when compared with the bin that lies just above expected inflation. The IWFP will measure the departures highlighted above of this true wage change distribution from an estimated symmetric two sided Weibull distribution as indications of DNWR and DRWR respectively. Let us now consider the bottom right graph, which measures wage changes in the Wholesale and Retail trade sector in the same country. The evidence regarding DNWR is very similar. As in the previous graph, there is a large spike at zero and missing mass below it. With regards to DRWR however, there is a slight difference. There is a large spike in the positive wage change histogram, and missing mass below it, but this new spike lies slightly above the expected inflation rate. This concentration of observations could be related to a bargaining focal point in the sector during that year, and highlights the importance of estimating, rather than imposing, the focal point of asymmetries in the positive wage change range.

Let us turn now to the first row in Figure 1, which displays wage change histograms for the two sectors in the Belgium case. In contrast with the Portuguese case, there is no evidence of DNWR. We virtually observe no wage freezes. There is however a clear sign of DRWR, and similarly to the Wholesale and Retail trade sector in Portugal, the focal point seems to lie slightly above the expected inflation rate. A final observation worth doing from these graphs is that country differences seem much more relevant than sectoral patterns in the determination of rigidities. This issue will be further explored below.

Figure 1. Wage Change Distributions in Belgium and Portugal. Selected Sectors



3. The data

In this paper we analyze individual wage changes for four countries: Belgium, Denmark, Portugal and Spain. In all four cases the sources are administrative databases covering most sectors in the economy. There are several advantages in using administrative sources. Since we derive summary measures of wage rigidity in each sector from individual wage change histograms we need relatively large sample sizes. The sample sizes typically encountered in household survey databases might be appropriate for measuring wage rigidities at the country level, but would not allow for the sectoral analysis we are aiming at. Additionally, administrative instead of household and/or employer surveys are often seen as more reliable than survey data, being less prone to misperception, misreporting and rounding errors (Biscourp et al. 2005).

Even if our four databases are relatively error free and extremely well suited for the analysis, it is important to bear in mind that building a cross-country database is quite challenging. Despite our efforts towards harmonization, the final dataset is bound to include intrinsic concept differences, which reflect the diversity of data sources considered. We provide next with a brief description of the main characteristics of each data set.

In the case of Belgium, we use an administrative database on labour earnings, which covers about one third of the workers in the private sector, referring to all individuals born between the 5th and the 15th day of any month, for the period from 1990 to 2002. This database contains information on annual gross earnings, annual working days, and worker characteristics, such as age, sex and occupation category (blue- or white-collar), covering all sectors of activity (including services). The annual gross earnings are the base wage plus bonuses, premia, overtime hours paid, and so on. Adding to the exclusion of natural persons and firms with less than 5 employees, for confidentiality reasons, the sample is further restricted to the following: full-time permanent job-stayers, who work in firms classified with NACE codes from C to K; workers aged between 18 and 64 for men and 59 for women; workers who have not more than one month of sick leave (or other "abnormal" days off) per year, and who worked at least 2 years for the same employer. Furthermore, we exclude individuals whose earnings are below the legal minimum wage and we drop the same number of observations from the upper tail of the distribution.

Regarding Portugal, the dataset used was made available by the Instituto de Informática e Estatítica da Solidariedade (Social Security's Statistical Office) and refers to all individuals that paid contributions to the general social security system, in the period from 2001 to 2007. This database covers all activity sectors and contains information on monthly declared earnings reported in October of each year, number of working days in that month, worker characteristics,

such as age, sex, worker status (dependent worker, self-employed or other) and tenure, and firm characteristics, like region and size. The monthly declared earnings encompass the base wage and other types of remuneration (variable or other). The database is restricted to a 10 per cent random sample of the dependent workers registered at least once in the period considered, who declared a base wage not inferior to the minimum wage. We further restricted the sample to job-stayers working at least for two consecutive years in the same company, who worked a full month. In this case, due to dataset restrictions, it is not possible to distinguish between full-time and part-time workers.

The Spanish data come from the "Muestra Continua de Vidas Laborales 2005" which is a novel dataset containing a sample of 4 per cent of individuals with any type of relationship with the Social Security System in 2005. This dataset provides information about the whole labour market career of these individuals including personal characteristics (sex, age, and a proxy for educational attainment), job characteristics (sector of activity, firm size, type of contract) and earnings. In particular, we have information about monthly and yearly earnings including (almost) any type of bonuses and/or overtime payments. This sample is restricted to include only full-time job-stayers working at least for two consecutive years for the same employer in manufacturing firms, construction and private services sectors of the economy, for the period 1990 to 2005. In addition, the earnings variable is top censored for individuals with earnings above the maximum level of contribution, so we exclude these individuals from the sample. We also exclude earnings below the legal minimum wage, which coincides with the minimum level of contribution.

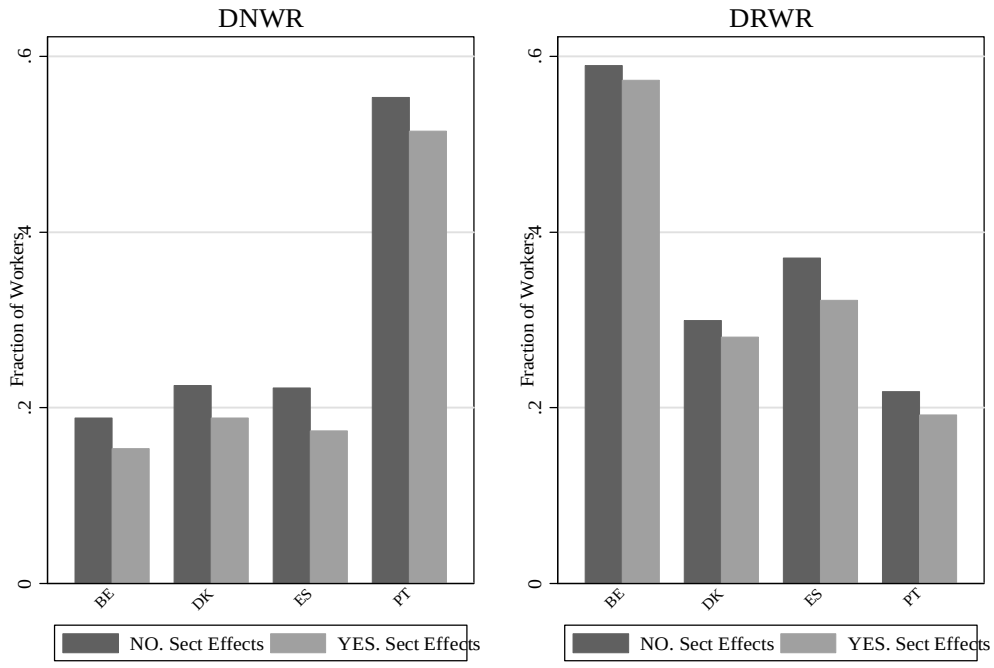
Finally, the Danish dataset comprises annual observations on individual earnings, i.e. base wages per hours worked including pension contributions, as well as information on a number of background variables, like age, sex, education, occupational experience, work function, and sector. The data are collected electronically directly from the administrative earnings registers at the firms and are part of the Integrated Database for Labour Market Research (IDA). It comprises all workers who are employed in a firm with at least 10 full time employees, i.e. around 90 per cent of all employees in the private sector. Here we only look at job stayers employed at a full-year basis in the age group 20-65 years. This leaves us with 4.1 million individual wage observations, and the average wage trajectory is around 3 years.

4. Downward nominal and real rigidity: a first look at the data

We start the analysis of the data searching for systematic patterns in the data. If technology is an important determinant of rigidities in the labour market, we would expect the sectoral

dimension in our dataset to be an important element at the time of explaining nominal and real rigidities. On the contrary, institutional features of the labour market are expected to be largely determined at the national level, although sector specific practices within countries could also play some role. If institutions are behind differences in estimated rigidity, we would expect the country dimension to explain the largest portion of the variance in the data. A simple analysis of variance provides the answer. Both regarding DRWR and DNWR, country effects clearly dominate the picture. One way ANOVA analyses show that country effects explain 36% (46%) of the variability in DRWR (DNWR) while sectoral effects explain only 5% (0.3%) of the variance respectively.[3] However, two-way ANOVA analyses featuring countries and sector explanatory variables reject the null of the sectoral effects equal to zero for both types of rigidities (although sectoral effects are only accepted at the 10% level in the case of DNWR). It is important to note that, in spite of the prevalence of country effects there is considerable variability in the rigidity estimates within countries. The largest average standard deviation corresponds to nominal and real rigidity in Spain (0.21 and 0.18 respectively) and the lowest to DNWR in Belgium (0.12). Moreover, ANOVA analysis shows that the interaction of countries and sectors is significant in regressions of DNWR and DRWR (F-values: 2.67 for DRWR and 4.38 for DNWR), suggesting the importance of sector specific features within countries.

Figure 2. Downward Nominal and Real Wage Rigidity. Country Summaries



[3] Based on adjusted R-squared values

Figure 2 shows country averages of DNWR and DRWR. The dark bars are simple averages, while the grey bars show country means after controlling for sectoral effects. As expected, sectoral effects have a limited impact on country averages, especially in the case of DRWR. Among the four countries studied, Portugal displays the highest level of DNWR, which affects 55% of workers across sectors and years, and the lowest ranking in DRWR, affecting 22% of the workforce. At the other extreme, Belgium displays the highest level of real rigidity (59%) and the lowest of DNWR (19%). Spain displays higher DRWR (37%) than DNWR (22%), and Denmark is the country that presents overall, lower levels of rigidity, with 29% in the case of DRWR and 22% in the case of DNWR. This country ranking is very similar to that found in Dickens et al. (2009), a reassuring fact given that the datasets used in the cases of Portugal and Denmark do not coincide with those used in the original IWFP.

Is there a relationship between nominal and real rigidity? Simple correlations suggest a negative association (the correlation coefficient is -0.22). Note that our measures of rigidity are designed to be independent of macroeconomic conditions. Hence, the negative relationship between DNWR and DRWR should reflect structural features of the labour markets, and not a mechanical association whereby lower inflation is translated into more rigid nominal wages and less real rigidity. However, partial correlations show that the negative association disappears once country effects are taken into account.

5. The relevance of composition effects in explaining real and nominal wage rigidity.

In this subsection we focus on the relevance of workers and job characteristics to explain differences in real and nominal wage rigidity. The literature has related downward wage rigidity to workforce composition (Campbell (1997) and Du Caju et al. (2007)) and structural features at the sector level (see e.g. Du Caju et al., 2009). However, none of these papers had an international dimension. In this section we confront our sector estimates of DRWR and DNWR for four countries to compositional effects and structural characteristics of the sectors. Alongside information on the composition of the workforce (shares of female workers, share of blue-collar, the age distribution of workers), our data include information on wage bargaining institutions, firms' variable-pay policy and competition in the sector. The appendix provides a brief description of each of these variables.

First, we start investigating the role of worker and firm characteristics and explore the role of structural features below. Our data contains information about the sectoral distribution of worker characteristics such as age and gender and firms' characteristics such as the size distribution or the share of blue and white collar workers. The role of each of these dimensions

in determining wage rigidity can provide us some guidance regarding the relative relevance of different theories of pay determination. The gender and age distribution would affect wage rigidity in a model of insiders-outsiders, where a wage cut is less likely for the insiders, given their higher wage bargaining power. Accordingly, prime-aged male workers would present more rigid wages.

Also, job characteristics can be related to wage rigidity according to different theories about the functioning of the labour market. The share of white collar workers is positively related to wage rigidity in a model of efficiency wages that assumes that the effort of white-collar workers is more difficult to monitor, or where the quits of high skilled workers are more costly, given the costs of retraining. Similarly, monitoring might be more difficult in larger than in smaller firms, leading to more rigid wages.

Our next set of regressions aims at determining the effect of worker and job characteristics in DWR. The dependent variables are the share of workers subject to DNWR or DRWR. Since both variables lie within the interval [0,1] OLS is not appropriate inasmuch the predicted values could lie outside this range. Papke and Wooldridge (1996) suggest using fractional logit models, whereby E(y|x) is modelled as a logistic function:

$$E(y|x) = \exp(X\beta)/[1+ \exp(X\beta)]$$

This ensures that the predicted values for y are in the interval [0,1] and the effects of interest can be easily presented as marginal effects. Table 1 shows marginal effects from fractional logit models investigating the relationship between real and nominal wage rigidity, and firm and worker characteristics. The regressions always include time, country and sectoral fixed effects. Columns 1 and 3 exclude the share of high and low blue and white collar workers, since this information is not available for Portugal. The skill groups are included in the specifications presented in Columns 2 and 4.

Our results deliver few robust associations. Most importantly, they indicate that low skilled blue collar workers have more flexible wages, both in real and nominal terms, a finding consistent with most efficiency wage hypotheses. The probability of being subject to DNWR declines by 0.2% when the share of low skilled blue collar workers increases by 1%, and by 0.4% for DRWR. The relationship between DNWR and firm size is non-linear, suggesting the highest levels of wage rigidity for medium sized firms. Rigidity increases with size, but the relationship turns negative for firms with more than 40 employees. On the contrary, DRWR appear not to be related with firm's size.

Table 1. The role of worker and firm characteristics in explaining wage rigidity
(marginal effects)

	(1)	(2)	(3)	(4)
Dependent variables:	*DNWR*	*DNWR*	*DRWR*	*DRWR*
Female employment share	-0.34	-0.20	0.34	0.58
	(0.21)	(0.26)	(0.28)	(0.36)
Age: 16-24	1.67**	0.84	0.54	2.40
	(0.78)	(1.05)	(1.06)	(1.59)
Age: 25-54	2.08**	1.22	0.23	2.81
	(1.00)	(1.32)	(1.26)	(1.85)
Firm size	0.15**	0.11**	0.07	0.07
	(0.06)	(0.05)	(0.06)	(0.06)
Firm size squared	-0.04***	-0.03***	-0.01	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Share of high skilled blue collars		0.14		-0.06
		(0.10)		(0.15)
Share of low skilled blue collars		-0.20*		-0.41***
		(0.11)		(0.13)
Share of high skilled white collars		-0.14		0.10
		(0.17)		(0.23)
Observations	333	262	412	343

Note: All the specifications include country, sector and year fixed effects. Robust standard errors in parentheses. *** p<0.001, ** p<0.05, * p<0.01

6. The structural determinants of real and nominal wage rigidity.

Next, we explore the impact of structural labour market features in the determination of nominal and real wage rigidities. Dickens et al. (2007) find that union coverage is positively related to DRWR across countries, with no impact on DNWR. According to their interpretation, in highly unionized economies workers might give more attention to real, as opposed to nominal, compensation because the participants may be more likely to understand the difference, hold expectations for the future inflation, and be more likely to be familiar with inflation forecasts. We go one step further here, investigating the impact of decentralization of wage setting on downward wage rigidity within a set of highly unionized countries. Wage bargaining institutions are captured by the share of workers in the sector that is covered by a collective wage agreement signed at the firm level. In the four countries we examine, the sector is a dominant level for collective bargaining (Du Caju et al. 2008).[4] The incidence of additional firm-level bargaining is therefore a sign of decentralized wage setting in the sector relative to the national average.

[4] Denmark has seen an increasing decentralization of wage formation since the mid 1990's and hence stands out as an exception in this respect.

It is commonly argued that firms might use flexible compensation elements such as bonuses and some fringe benefits in order increase wage flexibility in the presence of rigid base wage structures. On the other hand, it might well be that workers who are able to enforce downward rigidity in base wages have also the ability to limit flexible compensation schemes, if wage rigidity is demanded as an insurance device. Hence, wage rigidity might complement or substitute flexible compensation. We have collected information on the availability of such flexible payment schemes. The variable flexible pay is defined as the share of variable bonus payments in total earnings in the sector. This variable presents an extremely skewed distribution. Around 25 percent of sector-year observations have no flexible compensation whatsoever, and the median share of bonuses on basic pay is 2.8%. However, there is an important variance in the data (the standard deviation is 0.08), and in the 25% of sectors with the largest share of bonuses in pay, these flexible wage components represent more than 8% of the basic earnings.

Competition in product markets might also be related to wage rigidities. Rent-sharing considerations suggest that firms in less competitive environments might be more prone to avoid nominal or real wage cuts which could result in a loss of worker morale. We have constructed Herfindahl indices for all sectors in three countries: Belgium, Denmark and Portugal.

We do not expect a linear impact of these structural features on wage rigidities. In order to capture possible non-linearities, we have grouped each of these variables in three intervals: low, when the sector/year observation lies in the lowest quartile of the variable's distribution, medium, when the sector/year observation is in the 25-75 percentile bracket, and high, when the sector/year observation exceeds the 75 percentile of the variable in question.

Table 2 reports the results of fractional logit regressions for DNWR (columns 1 to 3) and DRWR (columns 4 to 6). As before, all specifications include country, year and sectoral dummies, the female employment share, two age category and firm size dummies as controls. The first and fourth columns in Table 2 exclude indicator variables for competition, since the Herfindahl index is not available for Spain. Perhaps not surprisingly, firm level bargaining has no impact on DNWR, while it has a clear negative effect on DRWR. According to results in column 4, a medium level of firm level bargaining in the sector reduces DRWR in 0.14 percentage points (p.p.), while the predominance of firm level bargaining in the sector (covering more than 75% of workers) is associated with a reduction of 0.24 p.p.. Both effects are significant at the 1% level, and hold after controlling for product market competition (column 6). This suggests that in economies with highly centralized wage formation, where the presence of unions is typically associated with resistance to real wage cuts, bargaining at the firm level

provides firms with additional flexibility. A possible interpretation of these results is that since most sectors studied have binding wage agreements at a level above the firm, firms that set wages at a decentralized level very often pay higher wages than those agreed at a more centralized bargaining level, providing them with a wage cushion that might bring flexibility in bad times (see Cardoso and Portugal, 2005).

Next, we proceed into examining the association of flexible pay components with the rigidity of base wages. According to results in columns 1 and 4, medium or high levels of bonuses in total pay are negatively associated with both DNWR and DRWR. This negative relationship is also conserved, though somewhat weaker after controlling for product market competition (columns 3 and 6), especially in the case of DRWR, where we lose statistical significance. The apparent complementarity between flexibility in base wages and flexible pay components casts serious doubts on the notion that rigidity in base wages might be circumvented using bonuses and other flexible components of pay. On the contrary, our results suggest that those elements that limit the flexibility of base wages are also behind a limited use of flexible elements in total pay.

Lastly, we examine the role of product market competition in the determination of rigidities. Our results clearly indicate a negative and significant impact of medium or high competition in the sector on DNWR, consistent with rent-sharing models. This effect does not carry through in the case of DRWR, perhaps because real rigidities are more important in centralised wage-setting environments, where the extent of competition in the sector is less relevant for wage-setting.

Table 2. The structural determinants of wage rigidity
(marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	*DNWR*	*DNWR*	*DNWR*	*DRWR*	*DRWR*	*DRWR*
Medium share of firm-	-0.06		-0.03	-0.14***		-0.21***
level wage agreements	(0.05)		(0.09)	(0.05)		(0.07)
High share of firm-	0.03		0.11	-0.24***		-0.28***
level wage agreements	(0.10)		(0.15)	(0.07)		(0.11)
Medium use of bonuses	-0.14***		-0.10**	-0.09**		-0.05
	(0.03)		(0.04)	(0.04)		(0.04)
High use of bonuses	-0.07*		-0.05	-0.10**		-0.04
	(0.04)		(0.05)	(0.05)		(0.06)
Medium competition		-0.17***	-0.12***		0.01	0.09
		(0.04)	(0.04)		(0.05)	(0.06)
High competition		-0.19***	-0.15***		0.02	0.11
		(0.04)	(0.05)		(0.07)	(0.08)
Observations	333	270	270	412	325	325

Note: All the specifications include country, sector and year fixed effects, the female employment share, two age category dummies, and two firm size dummies. Robust standard errors in parentheses. *** p<0.001, ** p<0.05, * p<0.01

7. Conclusions

This paper discusses new estimates based on individual data of downward nominal and real wage rigidity, and examines its incidence across sectors, firm and worker characteristics and some structural features of the four labour markets under study: Belgium, Denmark, Spain and Portugal.

Our results show that differences across countries are clearly more important than differences across sectors when it comes to the incidence of different types of wage rigidity, suggesting a prominent role to the institutions of the labour market in their determination. However, it is important to note that, in spite of the prevalence of country effects there is considerable variability in the rigidity estimates within countries. In this respect, wage rigidity appears to be higher in medium-sized firms and negatively associated with the percentage of low-skilled blue collars in the firm.

Regarding structural factors affecting wage rigidities, we find that the use of firm-level collective agreements is associated with a lower degree of real wage rigidity. Bearing in mind that in the countries under study the dominant level of wage negotiations is outside the firm (at the sector, province or national level), this finding suggests that some degree of decentralization within highly centralized countries allows firms to adjust wages downwards, when business conditions turn bad. Our results also indicate that downward flexibility in base wages is a complement, and not a substitute, of other forms of flexible pay such as the use of bonuses. This suggests that it may be harder than expected for firms to overcome rigidity in base wages using flexible pay components.

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