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 of 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 rigidity. Our estimates of wage rigidities are set against structural features of the labour markets studied, including the wage bargaining level and the degree of product market competition.

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1.Introduction

The moderate levels of inflation experienced in the industrialised countries during the last decade have re-awakened interest in an old dispute: 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. Following his reasoning, moderate levels of inflation help the adjustment of relative wages if workers (or firms) are reluctant to see 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)

This renewed interest and the increasing availability of individual and firm level data with relatively accurate information on individual wages saw a flourishing of empirical literature assessing the extent of downward nominal wage rigidities in different countries and periods. The International Wage Flexibility Project (IWFP), a large network studying wage rigidities from individual data in 17 OECD countries, showed that in many (mostly European) wage change distributions 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 to inflation.

This paper applies the methodology from the IWFP to study the incidence 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 spans the period from 1990-2007, although the years available vary from country to country. To our knowledge, this is the first paper to exploit sectoral measures of wage rigidity based on individual data.[2] The use of sectoral data allows us to control for country and sector unobserved heterogeneity and compositional effects, being less subject to possible omitted variable biases. We extend previous analysis on the determinants of wage rigidity, examining the role of the collective bargaining level, product market competition and the use of flexible wage components in firms' remuneration policies.

The rest of the paper is organised as follows. Section 2 describes the data and methodology used for the study and discusses suggestive evidence of DNWR and DRWR from selected wage change histograms. Section 3 disentangles the role of sectors and countries in the determination of rigidities, while section 4 discusses the correlates of each type of rigidity. Section 5 concludes.

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[2] Holden and Wulfsberg (2008, 2009) also study DNWR and DRWR at the industry level, but their estimates are based on industry data, and hence on average wages at the industry level. Du Caju et al. (2009) follow a similar approach to that presented here, focusing on Belgium.

2. Methodology and data

There are different approaches in the literature to estimate the extent of rigidities from individual data.[3] Several studies draw inference about rigidities from asymmetries in the wage change distribution (see Card and Hyslop, 1997 and Dickens et al., 2007). A second group of estimates are based on the assumption that, in the absence of changes in the extent of rigidity, the shape of the wage change distribution is constant over time (see Kahn, 1997 and Christofides and Leung, 2007 for an extension to study 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 method, reviewed at length in Dickens and Goette (2006), 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. Estimates are based on the assumption that there is an ideal type of wage change distribution (called notional) and departures from this ideal distribution are attributed to wage rigidities (either DNWR, DRWR or menu costs) . We proceed in two steps. First, we correct 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 autocorrelation in wage changes is due to measurement error, 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 obtained, we fit a model of wage changes using GMM techniques. This model jointly estimates the parameters of the notional distribution, the extent of DNWR and DRWR, and the average reference point for real wage rigidity. It is assumed that the so-called 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. However, a fraction of the population is potentially subject to DWR, and if their notional wage change falls below their reference point (zero in the case of DNWR and expected inflation or a bargaining focal point in the case of DRWR), they will receive a wage change equal to this reference point, instead

[3] This section is not meant to be a thorough overview of the empirical literature, seeking merely to illustrate some of the approaches that the IWFP evaluated to estimate downward rigidities.

of the notional wage change. It is important to highlight that the focal point of relevance 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. 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, reflecting structural features in the functioning of the labour market.

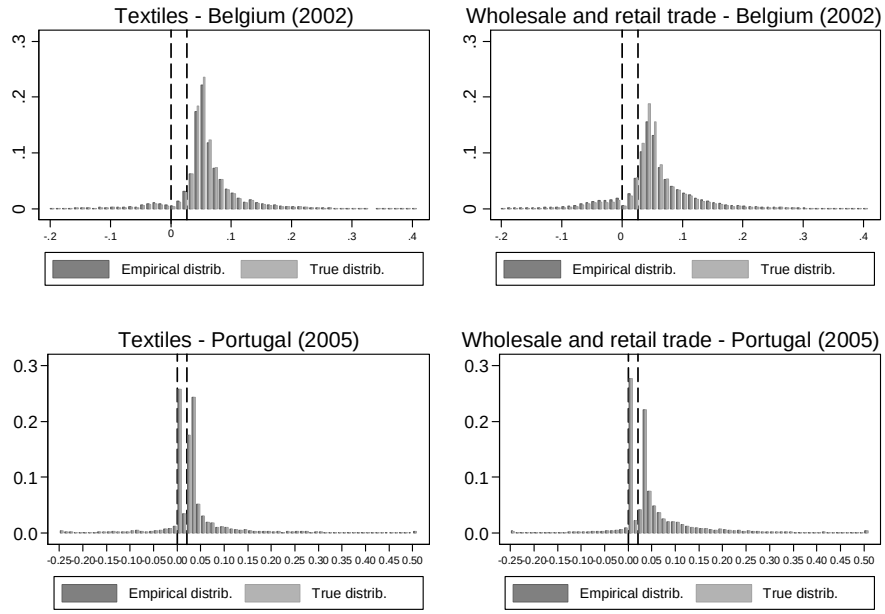
In this paper we analyse individual wage changes for four countries: Belgium, Denmark, Portugal and Spain. In all four cases the sources are administrative databases covering most sectors in the economy, which offers several advantages. First, sample sizes are large, allowing us to construct reasonable wage change distributions at the sectoral level. Second, administrative data on wages are typically more reliable than survey data, being less prone to misperception, misreporting and rounding errors. Full details on the data coverage and definitions are provided in Messina et al. (2009).

A simple illustration following two selected cases from the individual wage change distributions 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 one shows wage changes for the period 2004-2005. The black bars depict the observed wage change distribution, while the grey bars present the true wage change distribution, once measurement error in the data has 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 in the graphs are worth noting. There is virtually no distinction between the observed wage change distributions and the estimated true wage change distributions. This is perhaps not surprising given the high-quality administrative data used in this study. Concentrating on the bottom-left graph, we observe 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 and asymmetric wage rigidities, since failing to take into account this feature of the data might bias upwards the estimates of DNWR. 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. We 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 in Figure 1, which shows also data for Portugal but in the Wholesale and retail trade sector. The evidence regarding DNWR is very similar, but there is a noticeable difference in the case of DRWR. As before, 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.

Figure 1. Wage Change Distributions in Belgium and Portugal



Let us turn now to the first row in Figure 1, which displays wage change histograms for the two sectors in Belgium. 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, perhaps more noticeable in the Textiles sector. Similarly to the Wholesale and Retail trade sector in Portugal, the focal point seems to lie slightly above the expected inflation rate. We estimate DNWR and DRWR in 422 sector/year wage change distributions. In some cases, our estimates fail to converge, or converge to the boundaries resulting in very imprecise estimates. After dropping these observations, we obtain 412 point estimates of the probability of being subject to DRWR and 333 estimates of the probability of being subject to DNWR, which constitute the basis of our analysis.

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

We start the analysis 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. 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). Significantly, despite 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.

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.

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.

4. The structural determinants of wage rigidities

In this section, 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. We go one step further here, investigating the impact of decentralisation of wage-setting on downward wage rigidity within a set of highly unionised countries. Wage bargaining institutions are captured by the share of workers in the sector that are 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. The incidence of additional firm-level bargaining is therefore a sign of decentralised wage-setting in the sector relative to the national average.

It is commonly argued that firms might use flexible compensation elements such as bonuses and some fringe benefits in order to 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 also have the ability to limit flexible compensation schemes, if wage rigidity is demanded as an

insurance device. Hence, wage rigidity might complement or substitute for 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 and other forms of flexible pay in total earnings in the sector. Competition in product markets might also be related to wage rigidities. Rent-sharing considerations suggest that firms in less competitive environments might be more favourable to avoid 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.

Moving to the regression analysis, 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. We follow Papke and Wooldridge (1996), who suggest using fractional logit models, whereby E(y|x) is modelled as a logistic function and the effects of interest are presented as marginal effects. All the regressions include time, country and sectoral fixed effects and a limited set of controls for compositional effects including the gender mix in the sector, two dummies capturing the age distribution, median firm size and its square. See Messina et al. (2009) for a thorough description of all the variables in the analysis and a discussion of the role of compositional effects in the incidence of wage rigidities.

The first and fourth columns in Table 1 exclude indicator variables for competition, since the Herfindahl index is not available for Spain. Perhaps not surprisingly, firm level bargaining coverage has no impact on DNWR (column 1), while it has a clear negative effect on DRWR. According to column 4, a medium level of firm-level bargaining coverage (variable labelled as "firm coverage: medium") in the sector reduces DRWR by 0.14 percentage points, while the predominance of firm-level bargaining in the sector (covering more than 75% of workers) is associated with a reduction of 0.24 points. Both effects are significant at the 1% level, and hold in column 6, after controlling for product market competition. This suggests that in highly unionised economies, where the presence of unions is typically associated with resistance to real wage cuts, bargaining at the firm level provides firms with additional flexibility. Firms that set wages at a decentralised level very often pay higher wages than those agreed at a more centralised bargaining level, providing them with a wage cushion that might bring wage flexibility in bad times (see Cardoso and Portugal, 2005).

We move next to examine the association of flexible pay components with the rigidity of base wages. According to columns 1 and 4, medium or high levels of bonuses in total pay are negatively associated with both DNWR and DRWR. Results are also negative but somewhat weaker after controlling for product market competition in columns 3 and 6, especially in the case of DRWR, where we lose statistical significance. This apparent complementarity of flexibility in base wages and the use of flexible pay components casts 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.

Our results regarding product market competition 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 1. The structural determinants of wage rigidities

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	*DNWR*	*DNWR*	*DNWR*	*DRWR*	*DRWR*	*DRWR*
Firm coverage: medium	-0.06		-0.03	-0.14***		-0.21***
	(0.05)		(0.09)	(0.05)		(0.07)
Firm coverage: high	0.03		0.11	-0.24***		-0.28***
	(0.10)		(0.15)	(0.07)		(0.11)
Bonuses: medium	-0.14***		-0.10**	-0.09**		-0.05
	(0.03)		(0.04)	(0.04)		(0.04)
Bonuses: high	-0.07*		-0.05	-0.10**		-0.04
	(0.04)		(0.05)	(0.05)		(0.06)
Competition: medium		-0.17***	-0.12***		0.01	0.09
		(0.04)	(0.04)		(0.05)	(0.06)
Competition: high		-0.19***	-0.15***		0.02	0.11
		(0.04)	(0.05)		(0.07)	(0.08)
Observations	333	270	270	412	325	325

Note: Marginal effects from fractional logit models. All the specifications include country, sector and year fixed effects, the female employment share, two age category dummies, the median firm size and its square. Robust standard errors in brackets. *** p<0.001, ** p<0.05, * p<0.01

5. Conclusions

This paper discusses new estimates based on individual data of downward nominal and real wage rigidity, and examines its incidence across sectors in four European labour markets: 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 of the institutions of the labour market in their determination. In this context, we find that the use of firm-level collective agreements has a negative impact on real wage rigidity. Bearing in mind that in the four countries under study the dominant level of wage negotiations is outside the firm (at the sector, province or national level), this suggests that some degree of decentralisation within highly centralised 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 to, and not a substitute for, other forms of flexible pay such as the use of bonuses.

Hence, it may be harder than previously thought for firms to overcome rigidity in base wages using flexible pay components.

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