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Exchange rates and wages in unionised labour markets

By

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GEP

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Abstract

We investigate the impact of exchange rate movements on wage determination in unionised labour markets. Using a simple model of international oligopoly, we show that organised labour has a rational incentive to accept lower wages in the face of a currency appreciation. This proposition is examined empirically using a matched worker-firm dataset for Portugal. We find results consistent with the predictions of the model, though the impact varies considerably with both worker characteristics and the regional unemployment rate.

JEL classification: Exchange rates, trade unions, wage bargaining, worker-firm data

Keywords: F31, J3, J5

Outline

Non-Technical Summary

There has been a long and passionate debate on the effect of collective bargaining institutions on wage flexibility. OECD (2004) reviews an extensive body of evidence and concludes that no robust associations emerge between several indicators of wage bargaining and either the growth rate of aggregate real wages or unemployment rates. Researchers and policymakers alike have therefore called for further micro-level analyses of the role of different collective bargaining arrangements in shaping wage adjustment to external shocks. Progress towards this aim has met with two important difficulties, however. First, in many countries sector-wide union agreements are supplemented with idiosyncratic adjustments at the level of the firm, and hence these two forms of wage adjustment need to be distinguished in the analysis. This requires detailed institutional information at the individual level, which is unavailable in most datasets. Second, the comparison of wage adjustments across micro-level studies requires identifying an important source of external shocks which can be plausibly regarded as exogenous to the wage setting process.

This paper adds to the literature by examining the impact of exchange rate fluctuations on wage determination in the Portuguese manufacturing sector. For a number of reasons Portugal provides a remarkable case study in this context. First, it has a uniquely rich administrative worker-firm dataset which enables us to distinguish between sector-wide collective agreements and adjustments subsequently made at the level of the firm. Hence we are able to explicitly identify the response of collective bargaining outcomes to external shocks. Second, the labour market is characterized by both a high level of union coverage and a great degree of uniformity in the institutional arrangements for bargaining. Third, Portugal is a small open economy and hence fluctuations of import-weighted exchange rates constitute an important source of industry-specific external shocks to firms and workers.

To guide the empirical analysis we develop a simple model of international oligopoly in which domestic workers are represented by an industry-level trade union. The main insight of this model is that an appreciation of the domestic currency, by increasing the elasticity of labour demand, and hence the trade-off between wages and employment, leads the union to lower its wage demands. We then examine the predictions of the model for Portuguese manufacturing econometrically. The results confirm the predicted negative wage response to a currency appreciation and suggest that the bulk of it reflects adjustment in industry-wide bargained wages. The estimated real-wage elasticity to the real exchange rate is of similar magnitude to that obtained in previous studies for the U.S. manufacturing sector, where only a small fraction of workers are covered by union agreements. The results also reveal, however, that wage responses vary both with worker attributes and the local unemployment rate.

1 Introduction

There has been a long and heated debate on the effect of collective bargaining institutions on wage flexibility. OECD (2004) reviews an extensive body of evidence and concludes that no robust associations emerge between several indicators of wage bargaining and either the growth rate of aggregate real wages or unemployment rates. Researchers and policymakers alike have therefore called for further micro-level analyses of the role of different collective bargaining arrangements in shaping wage adjustment to external shocks (OECD (2004), Blanchard (2006), Freeman (2010)). Progress towards this aim has met with two important difficulties, however. First, in many countries sector-wide union agreements are supplemented with idiosyncratic adjustments at the level of the firm, and hence these two forms of wage adjustment need to be distinguished in the analysis (Flanagan 1999). This requires detailed institutional information at the individual level, which is unavailable in most datasets. Second, the comparison of wage adjustments across micro-level studies requires identifying an important source of external shocks which can be plausibly regarded as exogenous to the wage setting process.

This paper adds to the literature by examining the impact of exchange rate fluctuations on unionised wages in the Portuguese manufacturing sector. For a number of reasons Portugal provides a remarkable case study in this context. First, it has a uniquely rich administrative worker-firm dataset which enables us to distinguish between sector-wide collective agreements and adjustments subsequently made at the level of the firm (Cardoso and Portugal 2005). Hence we are able to explicitly identify the response of collective bargaining outcomes to external shocks. Second, the labour market is characterized by both a high level of union coverage and a great degree of uniformity in the institutional arrangements for bargaining. Third, Portugal is a small open economy and hence fluctuations of import-weighted exchange rates constitute an important source of industry-specific external shocks to firms and workers.

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A number of previous studies have examined the response of actual paid wages

to exchange rate fluctuations in the US manufacturing sector, where only a small fraction of workers are covered by union agreements. Revenga (1992) instruments import penetration with source-weighted real exchange rates in a study that examines the impact of increased import competition on wages. She finds a negative impact of increased international competition, though one that is relatively small in magnitude. Bertrand (2004) employs a similar instrumental variable strategy using a panel of US workers and finds that, besides lowering average wages, increased foreign competition also increases the sensitivity of wages to the local unemployment rate. Campa and Goldberg (2001), using industry-level data for the US, explicitly focus on the effect of real exchange rate fluctuations on wages. Their estimates point to a wage elasticity with respect to the real exchange rate of 0.06, in line with the estimates of Revenga (1992). As we will see below, our estimates point to an elasticity of actual paid wages of fairly similar magnitude.

2 Exchange rates and union wage demands

Although the theoretical literature examining the impact of globalisation on unionised labour markets has grown steadily in recent years[1], an examination of the impact of exchange rate fluctuations on unionised wages is absent. Below we develop a simple model of unionised international oligopoly which allows us to study the effect of exchange rate fluctuations on the wage demands of industry-level trade unions, in order to provide a framework for the empirical analysis that follows. The model builds on Dornbusch (1987), who analyses the effect of exchange rate movements on key industry variables in an international oligopoly model. The innovation we introduce is that home wages are set by a monopoly union model rather than being exogenously given. This approach to wage setting has been popular in papers examining the implications of other aspects of globalisation (e.g. Naylor(1998, 1999) and Lommerud, Meland and Sørgard (2003)).

2.1 Model setup

2.1.1 Product Market

We consider a two-country, single industry model with n identical domestic suppliers and n^* identical foreign firms. For simplicity, we assume that domestic and foreign firms sell all their output in the home country[2], where product demand is

[1] *inter alia* Brander and Spencer (1988), Mezzetti and Dinopoulos (1991), Huizinga (1993), Piperakis, Hine and Wright (2003), Straume (2003), Lommerud, Meland and Straume (2006), Bastos and Kreickemeier (2009) and Bastos, Kreickemeier and Wright (2009).

[2] The model could readily be extended to allow the firms to sell in both markets, as for instance in Brander (1981). This would add complexity without changing any of its qualitative results.

described by the following linear function:

$$p = a - bQ = a - b(nq + n^*q^*) \tag{1}$$

Where, $a, b > 0$, p is the home product price expressed in local currency, and Q denotes total sales by home (q) and foreign firms (q^*). The exchange rate (ε), is defined as the number of units of foreign currency that are needed to buy one unit of the home currency. Domestic suppliers face receive p, whilst foreign firms receive εp per unit of commodity sold.

The firms produce an homogeneous commodity under constant returns to scale, with labour as the only input and output per worker normalized to unity. Hence the profit function of the representative firm in each country is given by:

$$\pi = [p - w]\, q \tag{2}$$
$$\pi^* = [\varepsilon p - w^*]\, q^* \tag{3}$$

We will further assume that Cournot competition characterises the product market.

2.1.2 Labour market

In the labour market, there is a single trade union representing all workers employed by the domestic suppliers. The union cares about both wages and employment, which we capture using the following utility function:

$$U = (w - \overline{w})nq \tag{4}$$

Where, w is the wage rate and $\overline{w}$ is the wage that a union worker can earn in the non-union sector. To determine the bargained wage level, we adopt a formulation in which the monopoly union sets the wage and the firms subsequently have the *right to manage* in setting employment at the profit maximising level. Foreign firms recruit workers from a competitive labour market at the wage rate w^*, which is expressed in units of the foreign currency.

2.1.3 Solving the model

The model is solved as a two-stage game: in stage one, the union makes its wage demand, taking the exchange rate and the wage of the foreign competitor as given; in stage two, each firm chooses its profit maximising level of employment and output, taking as given the wage set by the union in the previous period. We solve for the sub-game perfect Nash equilibrium by backwards induction.

Product market equilibrium

Assuming that competition in the product market is Cournot, then solving the first order conditions for profit maximization, yields the following best-reply functions for each of the firms in each market:

$$q = \frac{a - w}{b(1 + n)} - \frac{n^*}{1 + n} q^* \tag{5}$$

$$q^* = \frac{a - w^*/\varepsilon}{b(1 + n^*)} - \frac{n}{1 + n^*} q \tag{6}$$

Solving (5) and (6) gives equilibrium sales of:

$$q = \frac{a - (1 + n^*)w + n^*(w^*/\varepsilon)}{b(1 + n + n^*)} \tag{7}$$

$$q^* = \frac{a + nw - (1 + n)(w^*/\varepsilon)}{b(1 + n + n^*)} \tag{8}$$

Union wage setting

The monopoly union will maximize (4) subject to (7). This gives the equilibrium wage rate in the home country of:

$$w = \frac{\overline{w}}{2} + \frac{[a + n^*(w^*/\varepsilon)]}{(2 + 2n^*)} \tag{9}$$

A number of things are worthy of note. Firstly, one can see from (9) that union wage demands are positively associated with the reservation income of union workers, as would be expected. Secondly, the wage demands of the monopoly union will be affected by the elasticity of labour demand with respect to the wage rate. The more elastic is labour demand, the higher the trade off the union will face between wages and employment, and the lower the wage that will be set. Thirdly, an appreciation in the exchange rate will lead to the union setting lower wages. This is because a rise in ε will make home firms less competitive with respect to their foreign rivals, and this will increase the elasticity of labour demand with respect to the wage rate. The home union therefore faces a higher trade off between wages and employment, and so has an incentive to set a lower wage rate. This result will be the main focus of the empirical analysis that follows.

3 Collective bargaining in Portugal

Portugal provides an interesting case for studying the impact of exchange rate movements on collectively bargained outcomes, firstly because of the high level of coverage and secondly because of the uniformity of institutional arrangements. The primary level of bargaining in Portugal is at the sectoral level[3], with the agreements published in legal documents, normally between January and April. These agreements typically establish the minimum working conditions for each category or group of workers, including the monthly base wage, the overtime pay and the normal hours of work. The wage clauses are ordinarily updated yearly and are valid, often retrospectively, for the whole of the calendar year.

A worker will be covered by a collective agreement if they are affiliated with a trade union that has signed an agreement with their employer or with the corresponding employers' association. However, voluntary extensions are widespread, whereby workers' or employers' associations voluntarily subscribe to an agreement to which they were not original signatories. For these reasons, most workers in Portuguese manufacturing are covered by some type of collective agreement, irrespective of their union membership status.[4]

A further interesting feature of the Portuguese industrial relations system is that, although sectoral agreements are not ordinarily supplemented by further local collective bargaining, a significant proportion of workers actually receive wages above the level that is set via the collective bargaining process (Cardoso and Portugal 2005). This occurs when firms adjust wages upwards to reflect their specific conditions, generating a *wage cushion*. This feature will allow us to examine how exchange rate fluctuations impact not just on the contractual wage, but also on the wage cushion and the actual wage paid. The existence of such firm-specific mark-ups on top of wage floors set via more centralised bargaining is a feature of other European countries. See Flanagan (1999) for a survey.

4 Data

The empirical analysis of this paper is based on the *Quadros de Pessoal (QP)*. This is a compulsory, annual, administrative census collected by the Portuguese Ministry of Employment, which covers all firms with employees in manufacturing and services. It contains unique, time-invariant identifiers which allow workers to

[3]In contrast to some other OECD countries, firm-level bargaining covers only a small proportion of workers in the private sector and is virtually non-existent in manufacturing (Cardoso and Portugal 2005).

[4]For a more detailed description of the institutional setting of collective bargaining in Portugal see Cardoso and Portugal (2005).

be matched to their employers and to be tracked over time. Since the data is used by the Ministry of Employment for checking compliance with labour law, stress is placed on the reliability of the information supplied by the employers. Portuguese law also makes it compulsory for firms to display this information publicly in the establishment. We restrict our analysis to full-time wage earners, aged between 16 and 65, who work at least 25 hours a week in a firm located in mainland Portugal. Firm-level information includes sales, number of employees, equity, industry code, geographical location and date of establishment. Information on workers includes base wage and other components of pay, gender, schooling, start date of employment, occupation and hours worked. The data also includes identifiers for the collective bargaining agreement covering the worker, as well as an indication of whether the contract is firm, multi-firm, or sector specific.[5]

Since our primary motivation is to investigate the effect of movements in ε, we supplement the information from the QP with source-weighted, industry-specific, real exchange rates for the years 1991 to 2000. The data is classified according to the Portuguese classification of economic activities (CAE) into 74 industries.[6] Finally, and as is standard in the literature (e.g. Card (1995), Bertrand (2004)), we use the regional unemployment rate as an inverse proxy for $\overline{w}$, the fall back position of the union workers in the bargain.[7]

Table 1 presents summary statistics from the QP for the main variables used in the analysis over the 1991-2000 period. The average wage cushion in Portuguese manufacturing over this period was 0.19 log points. This confirms the importance of firm-specific arrangements in addition to industry-level collective bargaining. The table also illustrates the high proportion of females (47 percent) and the low general level of education (5.65 years) in the workforce.

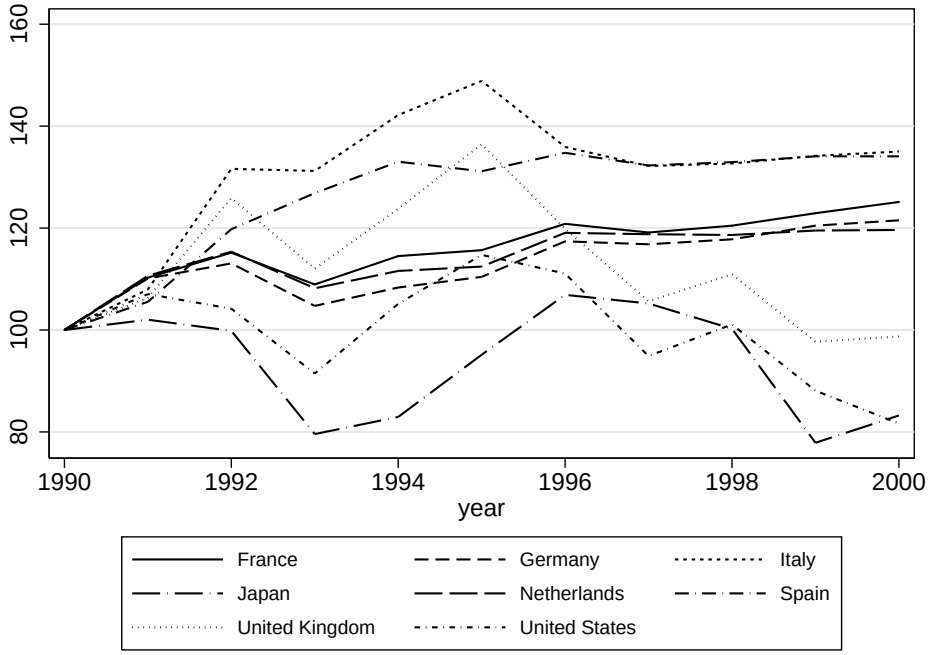
Figure 1 shows the movements in the exchange rate of the Portuguese Escudo against the currencies of a number of major trading partners from 1990 to 2000. As can be seen, real exchange rate movements exhibit substantial heterogeneity across trading partners. The cross-industry variation in the relative importance of each partner in each industries trade is reflected in the variation in the industry real exchange rate from 1990 to 2000 (Figure 2). Such heterogeneity will be critical for identifying the wage effects of real exchange rate movements in the econometric analysis that follows.

[5]For further information on the dataset and details on sample selection, please see the data appendix.

[6]For previous use of comparable measures see for example Revenga (1992), Gourinchas (1999), Campa and Goldberg (2001), Bertrand (2004) and Cuñat and Guadalupe (2009).

[7]This data is classified by NUTS-II regions, which divides mainland Portugal into: North, Centre, Lisbon and Vale do Tejo, Alentejo and the Algarve.

Figure 1: Portuguese Real Exchange Rate by Major Trading Partners 1990-2000



5 Econometric specification and results

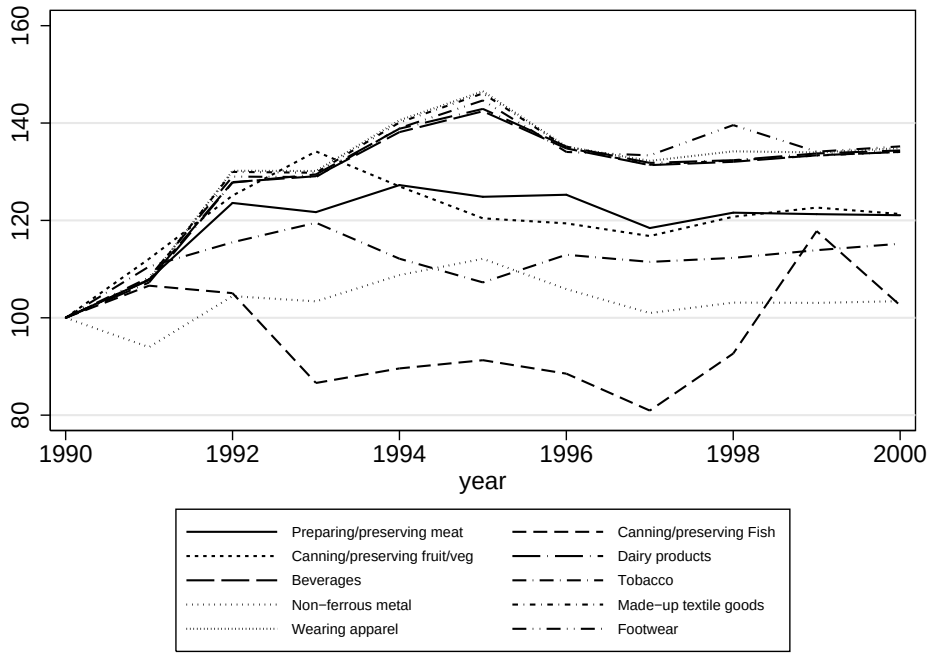
To investigate the impact of exchange rate fluctuations on wage determination, we use the following baseline specification:

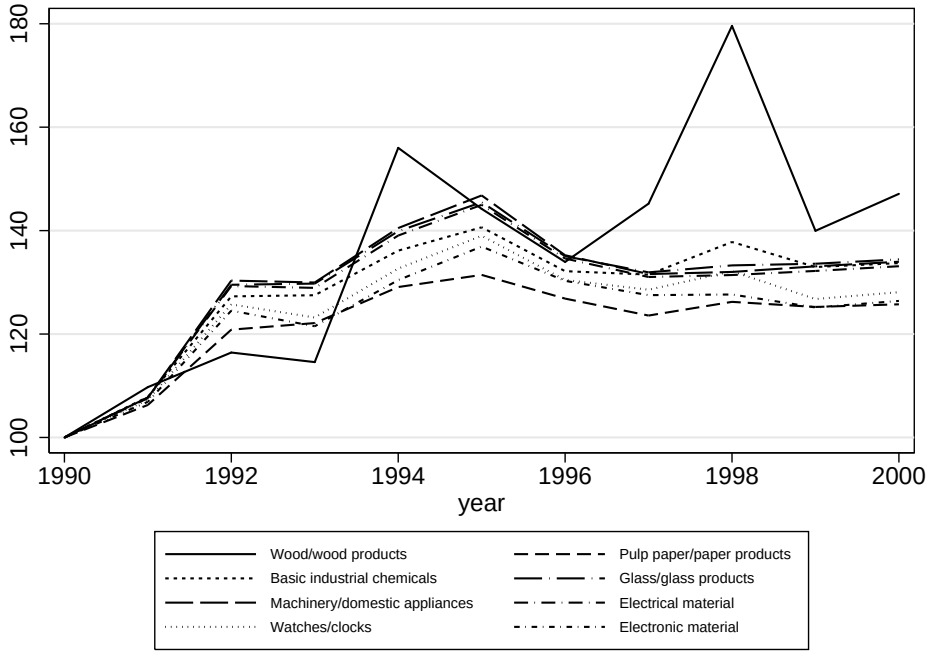
$$\begin{aligned} \ln w_{it} = {} & \alpha.\mathbf{x}_{it} + \beta.\mathbf{y}_{jt} + \gamma.\mathbf{z}_{at} + \delta.\ln \text{exch}_{k(t-1)} + \eta.\text{unemp}_{r(t-1)} \\ & + \phi_i + \theta_j + \lambda_k + \psi_r + \rho_t + \mu_{it} \end{aligned} \tag{10}$$

where: w_{it} is the wage for worker i in year t; $\mathbf{x}_{it}$ is a vector of individual characteristics; $\mathbf{y}_{jt}$ is a vector of characteristics for firm j at which worker i is employed in year t; $\mathbf{z}_{at}$ is a vector of characteristics of the collective agreement a that covers worker i in year t; ϕ_i is a person fixed effect; θ_j is a firm fixed effect; λ_k an industry fixed effect; ψ_r is a region fixed effect; ρ_t is a time period fixed effect; and μ_{it} is an exogenous disturbance. In order to obviate from possible simultaneity problems, we lag the source-weighted real exchange rate index of industry k ($exch_{k(t-1)}$) and the unemployment rate in the region ($unemp_{r(t-1)}$).

As the dependent variable, we consider in turn the contractual wage, the wage cushion and actual wage. In order to split the actual wage into the contractual wage and the wage cushion, we follow the methodology of Cardoso and Portugal

Figure 2: Industry Real Exchange Rate 1990-2000





(2005). They argue that the mode of the distribution of the base wage for each job category, within each collective agreement, corresponds with remarkable accuracy to the contractual wage that is set through collective bargaining.[8] The wage cushion is then defined as the ratio of overall monthly earnings actually received by the individual (including the base wage, tenure-related and other regularly paid components) to the contractual wage for the worker's professional category in the collective agreement that covers the worker.[9]

The vector of worker attributes includes age, age squared, gender, years of schooling and tenure. The 1988 International Standard Classification of Occupations (ISCO-88) allows us to define four skilled levels, based on the level of general education and the job-related formal training required to perform a job (International Labour Office 1990).

The vector of firm characteristics includes firm size (number of employees), age since establishment, labour productivity (ratio of firm sales to the number of employees), capital intensity (equity relative to number of employees), and market share (firm sales relative to total industry sales). The vector of agreement characteristics includes the number of workers and the number of regions covered by the collective agreement.

Table 2 reports the baseline results for the contractual wage, the wage cushion and the actual wage. In all cases results are presented when worker fixed effects and worker-firm (spell) fixed effects are included, with the results being largely comparable across the two specifications. The table reports standard errors clustered at the individual level to allow for correlation across time. For comparison we also present standard errors clustered at the industry-year level in square brackets.

The results show consistent impacts of worker attributes on the actual level of wages. Older workers, those with higher education and those in higher skill groups earn more. The characteristics of the firm are also important: those in larger and more productive firms earn more than otherwise, and gain an additional premium if their firm has a larger market share. Workers also appear to be able to obtain higher wages if the number of workers covered by the collective agreement is higher.

Turning to the components of the actual wage, in general the results confirm the earlier cross sectional evidence of Cardoso and Portugal (2005) that the wage cushion magnifies the returns to personal and workplace characteristics. Older, more educated workers in larger, more productive firms have both higher contrac-

[8]To support this claim, they examine the relationship between the contractual wage for each worker category, obtained directly from published collective agreements, and the corresponding modal base wage in some pre-selected industries.

[9]Only categories consisting of at least 50 workers and agreements with at least 1,000 workers were included in the analysis. The final panel comprises information on 938,060 workers, 54,481 firms and 168 sectoral agreements for the years 1991 to 2000. This amounts to about 3.6 million worker-year observations.

tual wages and higher wage cushions.

The impact of agreement size and the geographical coverage of the agreement has opposite effects on the contractual wage and the wage cushion. Again this is similar to the findings of Cardoso and Portugal (2005), who argue that this reflects the fact that firms use the wage cushion to partly undo the impact of collective bargaining on wage setting.

As might be expected, actual wages paid are negatively associated with the regional unemployment rate, a result that is standard elsewhere in the literature. Interestingly, however, our results suggest that this result is largely driven by the negative response of contractual wages, which offsets a small positive response of the wage cushion as some firms seek some flexibility in their wage policy, despite poor economic conditions.

Turning to the primary focus of this paper, we see that a higher real exchange rate leads to a statistically significant fall in actual wages, as predicted by the theoretical framework presented earlier. Specifically, the estimates point to an average real wage elasticity with respect to the exchange rate of about 0.07. This is very much in line with the estimated elasticity obtained by Campa and Goldberg (2001) for US manufacturing (0.06). Interestingly, although the impact of the exchange rate emerges via both a change in the contractual wage and the wage cushion, the majority of the adjustment is via the former. This conforms with the theoretical prediction of the earlier model, although it suggests that some of the adjustment is made idiosyncratically by firms via the wage cushion. Further, notice that the magnitude of the effects remains very similar when spell fixed-effects models are used to simultaneously control for worker and firm unobserved heterogeneity. The results suggest that, overall, strong union presence is not necessarily associated with lower wage flexibility.

Heterogeneity of effects

We investigate further the impact of the real exchange rate on wages by augmenting the baseline model in a number of ways. Firstly, in Table 3, the impact of regional influences is examined by interacting the exchange rate with the regional unemployment rate. This shows that the sensitivity of wages to higher regional unemployment decreases following a real currency appreciation, a result that contrasts with related estimates obtained by Bertrand (2004) for the US labour market. This might be explained by the stricter employment protection for tenured workers in Portugal, who are more likely to remain employed and less likely to suffer downward pressure on their wages when the local labour market is depressed.

Secondly, Guadalupe (2007) for the US and Falvey, Greenaway and Silva (2008) for Portugal find that harsher international competition (as measured by a real

currency appreciation) leads to higher returns to skill. We investigate this proposition in Tables 4 and 5 by interacting the exchange rate with our measure of job tenure. We find that the negative wage impact of appreciation is higher for those with tenure of less than one year and for those with low levels of schooling. Perhaps more importantly, in both of these cases, the negative relationship is exclusively driven by adjustments in the wage cushion, which offset contrary movements in contractual wages. This finding is consistent with the theoretical explanation proposed by Guadalupe (2007), who emphasizes the role of firm-specific incentives and market forces, as opposed to collective bargaining, in determining the causal effect of international competition on returns to skill.

6 Conclusions

In this paper we have investigated the effect of real exchange rate fluctuations on unionised wages. Using uniquely rich worker-firm panel data for the Portuguese manufacturing sector, we were able to distinguish between changes in industry-wide collective wages and subsequent adjustments at the level of the firm. Our estimates point to an average real wage elasticity with respect to real exchange rate changes of about 0.07, most of which reflects adjustments in industry-level collective wages. Our results reveal however that wage responses vary considerably by worker characteristics. Specifically, the negative wage effects of exchange rate appreciations tend to be felt by newcomers to the firm and the low skilled. Finally, we have find that a currency appreciation tends to decrease the sensitivity of wages to the local unemployment rate, a result that contrasts with related estimates obtained by Bertrand (2004) for the US labour market.

Table 1: Summary Statistics

Variable	*Mean*	*Standard Deviation*
Actual wage (ln)	11.51	0.31
Contractual wage (ln)	11.31	0.31
Wage cushion	0.19	0.31
Age	35.53	11.00
Male	0.53	0.50
Schooling (years)	5.65	2.88
Tenure	9.54	8.90
Tenure $<$ 1 year	0.08	0.28
Firm size	4.60	1.60
Firm age	23.20	20.60
Firm average labour productivity (ln)	8.78	1.11
Firm capital intensity	2688.84	72599.37
Market share	0.02	0.08
No. of workers in agreement (ln)	10.74	1.15
No. of districts in agreement	24.68	5.54
Employment rate (ln)	4.85	0.11
Unemployment rate	5.40	1.87
Observations	3,664,006	
Workers	938,060	
Firms	54,481	
Collective agreements	168	

Table 2: Wage effects of real exchange rate movements: baseline model

	Contractual wage		Wage cushion		Actual wage	
	(1)	(2)	(3)	(4)	(5)	(6)
age	0.0109	0.0096	0.0130	0.0070	0.0239	0.0166
	(0.0002)**	(0.0002)**	(0.0003)**	(0.0003)**	(0.0002)**	(0.0003)**
	[0.0014]**	[0.0013]**	[0.0010]**	[0.0009]**	[0.0017]**	[0.0015]**
age squared	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
	[0.0000]**	[0.0000]**	[0.0000]**	[0.0000]**	[0.0000]**	[0.0000]**
schooling	0.0028	0.0019	0.0054	0.0046	0.0082	0.0065
	(0.0003)**	(0.0003)**	(0.0004)**	(0.0004)**	(0.0003)**	(0.0003)**
	[0.0003]**	[0.0004]**	[0.0004]**	[0.0005]**	[0.0004]**	[0.0005]**
tenure	0.0014	-0.0009	-0.0016	0.0003	-0.0002	-0.0005
	(0.0000)**	(0.0002)**	(0.0001)**	(0.0002)	(0.0001)*	(0.0002)**
	[0.0001]**	[0.0003]**	[0.0002]**	[0.0003]	[0.0002]	[0.0002]*
tenure < 1 year	-0.0057	-0.0073	-0.0044	-0.0116	-0.0101	-0.0189
	(0.0005)**	(0.0005)**	(0.0007)**	(0.0008)**	(0.0006)**	(0.0006)**
	[0.0013]**	[0.0015]**	[0.0014]**	[0.0016]**	[0.0013]**	[0.0016]**
first skill group	-0.1810	-0.1803	0.0372	0.0720	-0.1437	-0.1083
	(0.0055)**	(0.0058)**	(0.0064)**	(0.0066)**	(0.0034)**	(0.0032)**
	[0.0129]**	[0.0132]**	[0.0135]**	[0.0135]**	[0.0056]**	[0.0050]**
second skill group	-0.0867	-0.0896	-0.0174	0.0145	-0.1041	-0.0751
	(0.0055)**	(0.0058)**	(0.0064)**	(0.0066)*	(0.0034)**	(0.0032)**
	[0.0112]**	[0.0118]**	[0.0124]	[0.0123]	[0.0052]**	[0.0046]**
third skill group	0.0413	0.0273	-0.0975	-0.0663	-0.0562	-0.0390
	(0.0055)**	(0.0057)**	(0.0064)**	(0.0065)**	(0.0032)**	(0.0031)**
	[0.0122]**	[0.0123]*	[0.0128]**	[0.0127]**	[0.0042]**	[0.0040]**
firm size	0.0102	0.0110	0.0223	0.0270	0.0326	0.0380
	(0.0003)**	(0.0006)**	(0.0004)**	(0.0008)**	(0.0004)**	(0.0006)**
	[0.0008]**	[0.0018]**	[0.0012]**	[0.0028]**	[0.0013]**	[0.0026]**
firm age	-0.0003	0.0051	0.0002	0.0100	-0.0001	0.0152
	(0.0000)**	(0.0002)**	(0.0000)**	(0.0004)**	(0.0000)*	(0.0003)**
	[0.0001]**	[0.0012]**	[0.0001]	[0.0012]**	[0.0001]	[0.0011]**
firm labour productivity (ln)	0.0010	0.0007	0.0042	0.0034	0.0052	0.0041
	(0.0010)**	(0.0002)**	(0.0002)**	(0.0002)**	(0.0002)**	(0.0002)**
	[0.0006]	[0.0006]	[0.0008]**	[0.0009]**	[0.0010]**	[0.0041]**
firm capital intensity	0.0039	0.0022	-0.0105	-0.0102	-0.0067	-0.0080
	(0.0015)*	(0.0014)	(0.0022)**	(0.0022)**	(0.0014)	(0.0014)
	[0.0031]	[0.0024]	[0.0055]	[0.0051]*	[0.0037]	[0.0038]
firm market share	0.0554	0.0166	-0.0326	-0.0062	0.0229	0.0105
	(0.0050)**	(0.0050)**	(0.0065)**	(0.0062)**	(0.0048)**	(0.0050)*
	[0.0212]**	[0.0280]	[0.0303]	[0.0380]	[0.0262]	[0.0306]
no. workers in agreement (ln)	-0.0152	-0.0152	0.0174	0.0221	0.0021	0.0070
	(0.0007)**	(0.0008)**	(0.0008)**	(0.0009)**	(0.0005)**	(0.0005)**
	[0.0043]**	[0.0051]**	[0.0035]**	[0.0044]**	[0.0020]	[0.0023]**
no. districts agreement	-0.0003	-0.0003	0.0002	0.0001	-0.0001	-0.0002
	(0.0000)**	(0.0000)**	(0.0001)**	(1.09)	(0.0001)*	(0.0001)*
	[0.0005]	[0.0006]	[0.0004]	[0.0004]	[0.0004]	[0.0005]
regional unemp. rate	-0.0080	-0.0083	0.0023	0.0020	-0.0057	-0.0063
	(0.0002)**	(0.0002)**	(0.0003)**	(0.0003)**	(0.0003)**	(0.0003)**
	[0.0012]**	[0.0013]**	[0.0014]	[0.0013]	[0.0014]**	[0.0013]**
exchange rate (ln)	-0.0487	-0.0501	-0.0169	-0.0165	-0.0657	-0.0667
	(0.0035)**	(0.0035)**	(0.0055)**	(0.0055)**	(0.0045)**	(0.0045)**
	[0.0369]	[0.0365]	[0.0326]	[0.0333]	[0.0283]*	[0.0282]*
worker fixed-effects	yes		yes		yes	
spell fixed-effects		yes		yes		yes
R-squared	0.48	0.15	0.05	0.02	0.37	0.09
Observations	3,654,006		3,654,006		3,654,006	

a. Robust standard errors clustered by individual in parentheses. Robust standard errors clustered by industry-year in square brackets.
b. ** Significant at 1%. * Significant at 5%.
c. The period of analysis is 1991-2000. Year and industry dummies included.

Table 3: Wage effects of real exchange rate movements: regional influences

	Contractual wage		Wage cushion		Actual wage	
	(1)	(2)	(3)	(4)	(5)	(6)
exchange rate (ln)	-0.1344	-0.1384	-0.0971	-0.0968	-0.2315	-0.2352
	(0.0050)**	(0.0051)**	(0.0075)**	(0.0076)**	(0.0061)**	(0.0061)**
	[0.0516]**	[0.0511]**	[0.0353]**	[0.0363]**	[0.041]**	[0.0415]**
regional unemp. rate	-0.0847	-0.0872	-0.0696	-0.0697	-0.1543	-0.1568
	(0.0033)**	(0.0033)**	(0.0048)**	(0.0049)**	(0.0038)**	(0.0038)**
	[0.0210]**	[0.0211]**	[0.0159]**	[0.0169]**	[0.0213]**	[0.0215]**
exchange rate (ln) * reg. unemp. rate	0.0160	0.0164	0.0150	0.0149	0.0309	0.0313
	(0.0007)**	(0.0007)**	(0.0010)**	(0.0010)**	(0.0008)**	(0.0008)**
	[0.0043]**	[0.0043]**	[0.0033]**	[0.0035]**	[0.0043]**	[0.0044]**
worker fixed effects	yes		yes		yes	
spell fixed-effects		yes		yes		yes
R-squared	0.48	0.14	0.05	0.02	0.37	0.08
Observations	3,654,006		3,654,006		3,654,006	

a. Robust standard errors clustered by individual in parentheses. Robust standard errors clustered by industry-year in square brackets.
b. ** Significant at 1%. * Significant at 5%.
c. The period of analysis is 1991-2000. Year and industry dummies included.

Table 4: Wage effects of real exchange rate movements: the role of tenure

	Contractual wage		Wage cushion		Actual wage	
	(1)	(2)	(3)	(4)	(5)	(6)
tenure	-0.0006	-0.0021	0.0007	0.0026	0.0001	0.0006
	(0.0006)**	(0.0006)**	(0.0009)	(0.0010)**	(0.0008)	(0.0008)
	[0.0044]	[0.0045]	[0.0031]	[0.0032]	[0.0044]	[0.0041]
tenure < 1 year	-0.3671	-0.1789	0.4485	0.3525	0.0814	0.1736
	(0.0169)**	(0.0182)**	(0.0027)**	(0.0298)**	(0.0231)**	(0.0250)**
	[0.0759]**	[0.0634]**	[0.0499]**	[0.0492]**	[0.0641]	[0.1736]**
exchange rate (ln)	-0.0576	-0.0552	-0.0063	-0.0064	-0.0639	-0.0616
	(0.0038)**	(0.0039)**	(0.0060)	(0.0060)	(0.0048)**	(0.0049)**
	[0.0417]	[0.0412]	[0.0339]	[0.0346]	[0.0324]	[0.0316]
exchange rate (ln) * tenure	0.0004	0.0003	-0.0005	-0.0006	-0.0001	-0.0003
	(0.0001)**	(0.0001)*	(0.0002)*	(0.0002)*	(0.0002)	(0.0002)
	[0.0009]	[0.0009]	[0.0006]	[0.0007]	[0.0009]	[0.0008]
exchange rate (ln) * tenure < 1 year	0.0746	0.0354	-0.0935	-0.0751	-0.0189	-0.0397
	(0.0035)**	(0.0038)**	(0.0056)**	(0.0061)**	(0.0048)**	(0.0051)**
	[0.0156]**	[0.0130]**	[0.0103]**	[0.0102]**	[0.0132]	[0.0110]**
worker fixed-effects	yes		yes		yes	
spell fixed-effects		yes		yes		yes
R-squared	0.47	0.16	0.05	0.02	0.37	0.09
Observations	3,654,006		3,654,006		3,654,006	

a. Robust standard errors clustered by individual in parentheses. Robust standard errors clustered by industry-year in square brackets.
b. ** Significant at 1%. * Significant at 5%.
c. The period of analysis is 1991-2000. Year and industry dummies included.

Table 5: Wage effects of real exchange rate movements: the role of schooling

	Contractual wage		Wage cushion		Actual wage	
	(1)	(2)	(3)	(4)	(5)	(6)
schooling	0.0425	0.0399	-0.1697	-0.1664	-0.1272	-0.1266
	(0.0036)**	(0.0036)**	(0.0044)**	(0.0044)**	(0.0027)**	(0.0027)**
	[0.0141]**	[0.0140]**	[0.0143]**	[0.0147]**	[0.0092]**	[0.0092]**
exchange rate (ln)	-0.0069	-0.0101	-0.2014	-0.1968	-0.2083	-0.2069
	(0.0048)	(0.0049)	(0.0070)**	(0.0070)**	(0.0053)**	(0.0053)**
	[0.0394]	[0.03837]	[0.0321]**	[0.0331]**	[0.0305]**	[0.0303]**
exchange rate (ln) * schooling	-0.0082	-0.0078	0.0361	0.0352	0.0279	0.0274
	(0.0007)**	(0.0007)**	(0.0003)**	(0.0009)**	(0.0006)**	(0.0006)**
	[0.0029]**	[0.0029]**	[0.0030]**	[0.0031]**	[0.0019]**	[0.0019]**
worker fixed-effects	yes		yes		yes	
spell fixed-effects		yes		yes		yes
R-squared	0.48	0.15	0.05	0.02	0.37	0.09
Observations	3,654,006		3,654,006		3,654,006	

a. Robust standard errors clustered by individual in parentheses. Robust standard errors clustered by industry-year in square brackets.
b. ** Significant at 1%. * Significant at 5%.
c. The period of analysis is 1991-2000. Year and industry dummies included.

Data Appendix

Longitudinal linked employer-employee dataset

The primary source of data in the paper is the *Quadros de Pessoal (QP)*. Our sample consists of full time workers in manufacturing, aged between 16 and 65 years old, earning at least the national minimum wage. Records with inconsistencies in worker gender, date of birth and the highest level of schooling are removed.[10]

Because we compute the contractual wage as the mode of the distribution of base wages for each job category within each collective agreement for each year (as in Cardoso and Portugal (2005)), we only keep job categories with at least 50 workers and agreements with at least 1,000 workers. The final worker-firm panel contains information on 938,060 workers, 54,481 firms and 168 sectoral agreements for the years 1991 to 2000, yielding a total of 3,654,006 observations.

Exchange rate data

The real exchange rates are the product of the nominal exchange rates (expressed in units of foreign currency per unit of local currency) and the ratio between the Portuguese Consumer Price Index (CPI) and foreign CPI. The weights used are the shares of each trade partner in Portuguese imports in 1990-1991. For each industry, we have normalised the real exchange rate index to 100 in 1990. The nominal exchange rates and CPI come from the International Financial Statistics of the International Monetary Fund.

Industry level data

The Industry-level data is classified according to the Portuguese classification of economic activities (CAE). However, since the CAE classification was revised in 1994, the resulting dataset comprises 74 industries. Of the 99 manufacturing industries in CAE-Rev. 1, 56 had direct equivalents in CAE-Rev.2. The remaining 46 industries were aggregated into 18 sectors to provide an equivalence. The concordance used is available from the authors on request.

Definition of skill groups

Amongst the vector of individual attributes we include a group of dummy variables to control for the skill level associated with the worker's occupation, as defined in

[10]Details of procedures used to correct inconsistencies follow Cardoso (2006), and are available from the authors on request.

Table A.1: The ISCO classification system

Occupational Group	% of total	Description		ISCO Major group
First skill level	16.66	Competence associated with general education usually acquired by completion of compulsory education.	(9)	Elementary occupations
Second skill level	76.41	Requires knowledge as for first skill level, but in addition typically have a longer period of worker-related training or work experience.	(4)	Clerks
			(5)	Service workers and shop and market sales
			(6)	Skilled agriculture and fishery
			(7)	Craft and related workers
			(8)	Plant and machine operators and assemblers
Third skill level	4.89	Requires a body of knowledge associated with a period of post-compulsory education but not to degree level.	(3)	Technicians and associate professionals
Fourth skill level	2.05	Normally requires a degree or an equivalent period of relevant work experience.	(1)	Legislators, senior officials and managers
			(2)	Professionals
Observations	3,664,006			

Source: International Labour Office (1990, pp.23) and Elias, McKnight and Kingshott (1999).

the ISCO-88 classification. Table A.1 presents the definition of skill groups and sample proportions.

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