Sectoral labour market flexibility in a small open economy*

Fernando Alexandre[†] Pedro Bação[‡] João Cerejeira[§]
Miguel Portela[¶ ‖]

December 6, 2010

Abstract

We compute an index of sectoral labour market flexibility and use it to estimate the effect of exchange rate movements on employment in Portugal. Our sectoral index indicates that manufacturing labour markets have become more flexible in recent years, albeit at a different pace from what the OECD's EPL index suggests. Furthermore, our index shows that there is heterogeneity at the sector level. Our econometric application indicates that our measure of sectoral labour market flexibility, alongside the level of technology and trade openness, is relevant for understanding the reaction of employment to movements in exchange rates.

Keywords: employment, exchange rates, international trade, labour market flexibility, technology.
JEL-codes: J23, F16, F41

*We are grateful for insightful comments and suggestions from Nicolas Berman and other participants at NIPE's seminar, and at the conferences "International Workshop on Firm and Product Heterogeneity in International Trade", held in Brussels, Royal Economic Society Conference held at University of Surrey, the Portuguese Economic Journal Conference held at University of Algarve and the ETSG 2010 12th Annual Conference held at University of Lausanne. Fernando Alexandre and Pedro Bação are grateful for the hospitality enjoyed at Birkbeck College.

[†]Email: falex@eeg.uminho.pt.
[‡]University of Coimbra and GEMF. Email: pmab@fe.uc.pt.
[§]University of Minho and NIPE. Email: jccsilva@eeg.uminho.pt.
[¶]University of Minho, NIPE and IZA. Email: mangelo@eeg.uminho.pt.
[‖]Corresponding author: Escola de Economia e Gestão, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal.

1 Introduction

An index of labour market flexibility is, in the usual sense, a measure of the speed with which labour markets adjust to shocks.[1] In times of crisis, such as the sovereign debt crisis of 2010, labour market flexibility is frequently mentioned as a necessary requirement for exiting the crisis. For instance, in a paper on Greece's adjustment program, produced by the European Commission's Directorate-General for Economic and Financial Affairs (ECFIN), it is written that "Employment Protection Legislation has been hampering the functioning of the labour market. [...] Major labour market reforms are now advanced well ahead of the December 2010 deadline. [...] These initiatives will increase adjustment capacity of firms, ultimately boosting employment." (ECFIN, 2010a, pp.41-42). Even before the current sovereign debt crisis, the European Commission had recommended on several occasions the reform of labour markets as a necessary condition for making the European Union the world's most competitive economy, as stated in the Lisbon Strategy (see, for example, European Commission, 2003).

In what concerns public finance, productivity and balance of payments indicators, Portugal has been Greece's partner in crime and, as such, has been urged to reform its labour market with a view to reducing rigidity, within the "flexicurity" approach favoured by the European Commission – see, e.g., ECFIN (2010b).[2] Nevertheless, one widely used measure of labour market rigidity, the OECD's (with the collaboration of ILO experts) Employment Protection Legislation index (EPL) – discussed in section 2.1 below – indicates that labour market flexibility in Portugal has been converging to the average OECD level. Indeed, many, namely trade unionists, argue that the Portuguese labour market is already flexible enough. But there are also Portuguese corporate officials reported as saying that labour market regulations have not hindered their activities.[3]

In this paper we study the issue of labour market flexibility at the sector level. Our hypothesis is that actual labour market flexibility may differ from what one can infer from reading labour market legislation alone, and that this difference may be detected at the sector level by means of adequate indicators. A consequence of this hypothesis is that differences in sectoral labour market flexibility should also become visible when analysing the reaction of sectoral employment to shocks. To study this hypothesis we take advantage of the existence of a rich linked employer-employee dataset for Portugal: "Quadros de Pessoal", provided by the Portuguese Ministry of Labour and Social Solidarity (Portugal, MTSS, 1988-2006). This

[1] For a discussion of alternative meanings see, e.g., Solow (1998) and UK HM Treasury (2003).

[2] Along the same lines, Almeida *et al.* (2009), using a DSGE model for a small economy in a monetary union, calibrated to reproduce the main features of the Portuguese economy, conclude that increasing the flexibility of labour markets may be very beneficial for the competitiveness of the Portuguese economy.

[3] In November 2010, Paulo Azevedo, CEO of Sonae SGPS, one of the biggest employers in Portugal, with over 30 thousand employees, mentioned on a TV interview that labour market legislation has not been a constraint on his company's business.

dataset is based on a compulsory survey that matches all firms and establishments with at least one employee. Our study covers the period 1988-2006. In 1988, it included 122,774 firms and 1,996,933 workers, covering 44.6% of total employment. In 2006, it included 344,024 firms and 3,099,513 workers, covering 60.5% of total employment. With this dataset, we compute an index of sectoral labour market flexibility, which we then use to assess the relevance of labour market flexibility for the adjustment of sectoral employment to exchange rate movements.

We believe the focus on the impact of exchange rate movements is warranted because of the central role that currency management has played in shaping macroeconomic policy and outcomes in Portugal – a small open economy, specialized in low technology products – since the mid-1970s. In particular, the adherence to the Exchange Rate Mechanism (in 1992) and the participation in the Economic Monetary Union (in 1999) implied a regime change in the behaviour of the Portuguese nominal and real effective exchange rates, putting an end to the competitive devaluations which were a hallmark of the Portuguese economic policy in the first half of the 1980s[4] – see, for example, Blanchard and Giavazzi (2002), Fagan and Gaspar (2007), Lopes (2008) and Macedo (2008). As a result of these changes, between 1988 and 2006, the effective real exchange rate appreciated more than 20% (Alexandre *et al.*, 2009).

In the same period, manufacturing employment followed a declining trend: in 2006 manufacturing sectors accounted for 18.1% of total employment, down from 24.4% in 1988. Over this period, total employment in these sectors declined 15%, representing a loss of almost 160,000 jobs. This reduction of manufacturing sectors' share in the labour force partly reflects the deindustrialization trend that has affected advanced countries since the 1980s: for example, between 1988 and 2006 manufacturing employment decreased by approximately 40% and 20% in the UK and in the USA, respectively. In 2006, it represented approximately 10% of the workforce in those countries.[5]

One possible explanation for these trends is the impact of movements in exchange rates.[6] Economic theory suggests that changes in real exchange rates may have an impact on the reallocation of resources between sectors of the economy as they reflect changes in relative prices of domestic and foreign goods.[7] In fact, several authors have shown that exchange rate movements had a strong impact on manufacturing employment – see, for example, Branson and Love (1988), Revenga (1992), Gourinchas (1999), Campa and Goldberg (2001) and Klein *et al.* (2003). These papers conclude that sectors with a higher degree of openness to trade are more affected by exchange rate movements. The appreciation of the Portuguese real

[4] Between August 1977 and May 1990 a 'crawling peg' exchange rate regime was followed.

[5] Data from the OECD STAN database.

[6] Alternative views are discussed in Machin and Van Reenen (1998), Davis and Haltiwanger (2001) and Auer and Fischer (2008), among others.

[7] The effect on firms' competitiveness of an exchange rate movement may be likened to that of a change in tariffs – see Feenstra (1989).

effective exchange rate, mentioned above, is therefore expected to be part of the explanation for the declining trend in manufacturing employment, as these sectors are very exposed to international competition. In fact, the degree of openness has increased substantially since accession to the European Community – see Amador *et al.* (2009).

Following the new literature on international trade (Melitz, 2003), Berman *et al.* (2009) and Alexandre *et al.* (2010a) have highlighted the importance of productivity in the determination of the reaction of firms to the exchange rate. Berman *et al.* (2009) show that high productivity firms use their markups to adjust to exchange rate shocks; on the other hand, low productivity firms adjust to exchange rate movements by changing quantities. Alexandre *et al.* (2010a) show how this effect is felt on employment. Their results suggest that shocks in real exchange rates may have had sizable effects on Portuguese manufacturing employment, given that the Portuguese economy is specialized in low technology sectors, which tend to be less productive.

In view of the above, in our econometric application the effects of exchange rate movements on employment will be mediated by not only our index of sectoral labour market flexibility, but also the degree of openness and productivity.[8] Our estimates, using data on employment in 20 manufacturing sectors, in the period 1988-2006, are consistent with the predictions derived from the models of Alexandre *et al.* (2010a) and Alexandre *et al.* (2010b).[9] Namely, they suggest that employment in low technology sectors with a high degree of openness to trade and less labour market rigidities is more sensitive to exchange rate changes.

The remainder of the paper is organized as follows. Section 2 discusses the main trends in labour market flexibility and proposes a sectoral index. Section 3 estimates a set of models to evaluate how the degree of openness to trade, productivity and labour market flexibility have affected the impact of exchange rate shocks on Portuguese manufacturing employment. Section 4 concludes.

2 Measuring labour market flexibility

In this section we propose an index of labour market flexibility at the sector level, which will be used in our empirical analysis. This index is presented in subsection 2.2. Before that, in subsection 2.1, we will discuss the evolution of the Employment Protection Legislation index, to which we will compare our sectoral index.

[8]Recent papers have explored the importance of labour market institutions to the impact of openness to international trade on employment – see, for example, Helpman and Itskhoki (2010) and Felbermayr *et al.* (2008). More general references on the impact of labour adjustment costs on firms' decisions and job flows include Bertola (1990, 1992), Hopenhayn and Rogerson (1993), Blanchard and Wolfers (2000), Blanchard and Portugal (2001), Varejão (2003), Gómez-Salvador *et al.* (2004) and Haltiwanger *et al.* (2006).

[9]For evidence on the role of trade openness and labour market institutions in times of crisis see Gamberoni *et al.* (2010).

2.1 The Employment Protection Legislation index

One feature of labour market rigidity is employment protection, that is, the legislation on individual and collective bargaining agreements that regulate the hiring and firing – for a survey of the literature on employment protection see Addison and Teixeira (2003). This employment protection represents an additional labour cost for employers. The current version of the OECD measure of employment protection, EPL, gathers three different types of indicators: indicators on the protection of regular workers against individual dismissal; indicators of specific requirements for collective dismissals;[10] and indicators of the regulation of temporary forms of employment (OECD, 1999 and 2004; Venn, 2009).[11] This measure of labour market rigidity allows us to describe the evolution of rigidity in the Portuguese labour market over time and to compare it with other countries.

As shown in Figure 1, in the last 20 years there was a downward trend in the EPL index for OECD countries as a group: it decreased from 2.49, in 1988, to 1.91, in 2006, indicating an easing of hiring and/or firing conditions. The United States has the lowest value among OECD countries for the EPL index, and it has remained unchanged throughout the whole period. Although converging to the average EPL levels, Portugal has been one of the countries with more stringent labour markets regulations according to this index. The reduction from 4.19, in 1988, to 3.46, in 2006, was achieved through a reduction of the components of the index related to individual dismissals and temporary contracts.

Whereas the EPL index is computed on a country basis, in this paper we wish to analyse employment at the sector level. In the next subsection we present an index of labour market flexibility computed at the sector level, using Portuguese data.

2.2 An index of sectoral labour market flexibility

While the EPL index is based on the analysis of labour market legislation, which should affect all sectors, our index will be based on the behaviour observed in the actual data available at the firm level, enabling the construction of a sectoral flexibility index. In the construction of our sectoral labour market flexibility index we tried to mimic the indicators included in the EPL index, under the constraint given by the information available in "Quadros de Pessoal". The indicators we have included in our index have been widely used in the related literature, but at the country level. A notable exception is Anderson *et al.* (2006), who also use indicators similars to the ones presented next to compare labour market flexibility across UK sectors, although they do not combine them to compute a composite sectoral index.

As a measure of flexibility concerning collective bargaining we chose the share of workers

[10] This component is available only since 1998. In order to benefit from a longer time series, we will not use the version of EPL that incorporates this indicator.

[11] See also Bertola *et al.* (2000). For alternative measures of labour market flexibility at the country level see, e.g., Fabiani and Rodriguez-Palenzuela (2001) and Lawson and Bierhanzl (2004).

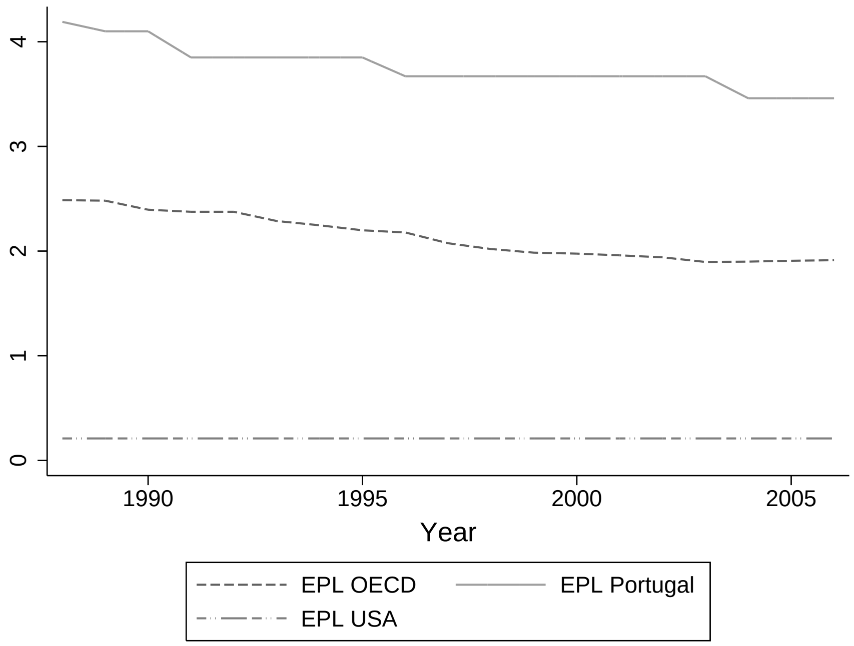

Figure 1: Employment Protection Legislation index (OECD, 2009)

not covered by a collective agreement. The intuition is simple: the greater the share of contracts not regulated by a collective agreement the lower is the bargaining power accrued to unions, which implies a higher vulnerability of workers towards dismissals – see Cazes and Tonin (2010). Thus, firms should find it easier to implement labour adjustments. As a measure of flexibility concerning the hiring of temporary workers we used the share of workers not working full time, as the dismissal costs associated with this type of workers are lower. Finally, as "Quadros de Pessoal" does not provide an adequate measure of protection against individual dismissals, we chose to include an alternative indicator of labour market flexibility: the share of workers earning above minimum wage. This "wage cushion" (Cardoso and Portugal, 2005) may, in the face of adverse shocks and as long as there is some inflation, provide leeway for firms to adjust their real wages. Additionally, firms with this wedge may be able to replace current workers by cheaper workers. Babecký *et al.* (2009) show that this is the dominant strategy for reducing labour costs in Portugal (this is also true for manufacturing within Europe). This strategy can be followed until the wage reaches the minimum wage, which should take longer when the firm employs a high proportion of workers earning above minimum wage.

Our index of labour market flexibility at the sector level is a composite measure of these three dimensions of labour market flexibility.[12] The three dimensions are aggregated in the

[12]Note that these three measures correspond broadly to those that, in the list of labour market indicators given in Lawson and Bierhanzl (2004), are more likely to vary across sectors within the same country.

same way as in the skill index proposed by Portela (2001):

$$flex_{jt} = \left(0.5 + \frac{\exp(f_{1,jt})}{1+\exp(f_{1,jt})}\right) \cdot \left(0.5 + \frac{\exp(f_{2,jt})}{1+\exp(f_{2,jt})}\right) \cdot \left(0.5 + \frac{\exp(f_{3,jt})}{1+\exp(f_{3,jt})}\right) \qquad (1)$$

In our labour market flexibility index, $f_{1,jt}$ is the share of workers in sector j and period t not covered by some form of collective agreement; $f_{2,jt}$ is the share of workers not working full time; and $f_{3,jt}$ is the share of workers earning above minimum wage within those working full time. We standardise each measure by subtracting the mean and dividing by the standard deviation over its entire distribution.[13]

In our formulation the dimensions of flexibility are interacted using the logistic formulation, corrected by the factor 0.5. This is done in order to guarantee that each index is bounded between 0.5, in case a specific standardized index goes to minus infinity, and 1.5, when the same index goes to infinity.[14] By using the logistic distribution we ensure that the main changes occur around the mean of each index, while changes far from the mean have smaller impacts on the index.

In Figure 2 we show the aggregate behaviour of our index, measured as a weighted average of our sectoral indexes, using as weights the share of employment in each sector, and which we call $flex$ – the data is available in Table 4 in the Appendix. The same figure also displays the aggregate behaviour of the three components of the index described above. The aggregate flexibility index exhibits an increasing trend that becomes more pronounced after 1999. This trend is common to the three components of the index. Nevertheless, the sharp increase in the aggregate index is driven by the evolution of the first two components, f_1 and f_2. In particular, the jump in the aggregate index around 2000 is essentially explained by the rise in the share of workers not working full time.

In order to assess the reasonableness of our measure of labour market flexibility, we compare the aggregate behaviour of our index, $flex$, to the OECD's EPL index – see Figure 3. Both measures show an increase in labour market flexibility over time. Since EPL is a rigidity measure and $flex$ is a flexibility measure, we expect their correlation to be negative. In fact, the overall correlation between $flex$ and EPL is -0.73. All the sectors display the trend towards increased flexibility described above for the aggregate flexibility index and the EPL. In fact, the correlation between the flexibility index at the sector level and the EPL index varies between -0.83, in "Office, accounting and computing machinery", and -0.49, in "Chemicals excluding pharmaceuticals".[15]

A noticeable aspect of Figure 3 is that changes in our index appear to lag changes in

[13] As we do not have data in "Quadros de Pessoal" for the years 1990 and 2001 we impute the values of f_1, f_2 and f_3 using a linear interpolation between the previous and the following year.

[14] Our proposed measure, $flex$, is bounded between 0.125 ($= 0.5^3$) and 3.375($= 1.5^3$).

[15] The working paper version (Alexandre *et al.*, 2010c) presents additional evidence, from regression analysis, of the strong relation between our index and the EPL index.

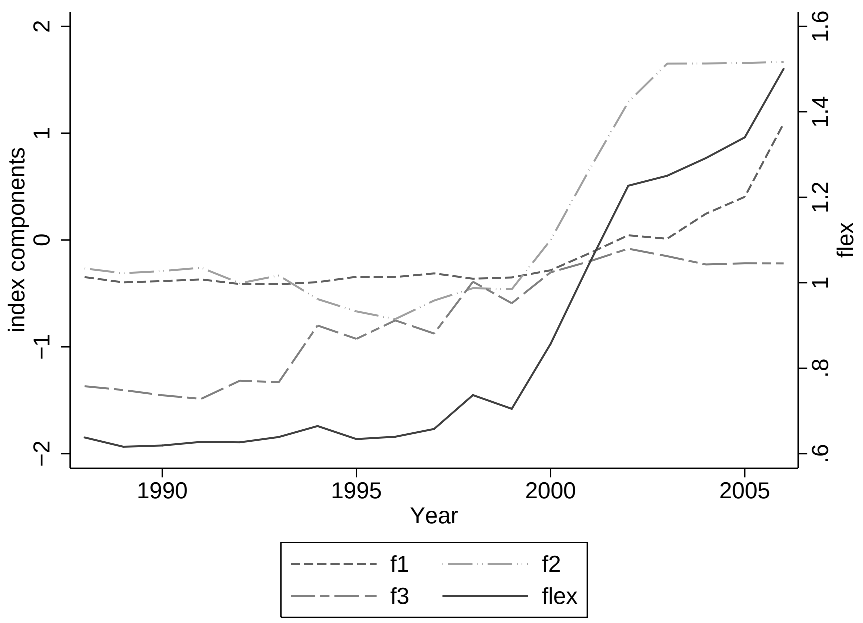

Figure 2: Aggregate flexibility index and its components

EPL. This may be a reflection of the time that legislative measures take to make an impact on the behaviour of agents. Alternatively, it may reflect the different impact of the measures taken over the years on actual flexibility. Note that it was the increase in the share of workers not covered by collective agreements and in temporary workers that made our index show evidence of increased flexibility after 2000. In the case of temporary contracts, note also that this new contractual arrangement became a very important contractual form in the Portuguese labour market, leading to its increasing segmentation.[16] The introduction of this type of contract also coincided with much higher job flows (Centeno *et al.*, 2009).

Since our econometric application, presented in the next section, will also take into consideration the role of the technology level, it is of interest to see how our flexibility index varies across technology levels. In our analysis we divide the 20 manufacturing sectors considered into low and high technology sectors. Low technology sectors correspond to low and medium-low technology sectors in the OECD technology classification, whereas high technology sectors include medium-high and high technology sectors according to the OECD classification.[17] We will use this division as a proxy for productivity in our econometric analysis.[18]

[16]According to OECD (2004), the regulation of temporary employment is crucial for understanding differences across countries.

[17]The OECD classification system divides sectors into four classes of technology – low, medium-low, medium-high and high – ranked according to indicators of technology intensity based on R&D expenditures (OECD, 2005). For a list of the sectors used in our study, grouped by technology level, see Table 3 in the Appendix.

[18]This is supported by evidence provided in Alexandre *et al.* (2010b).

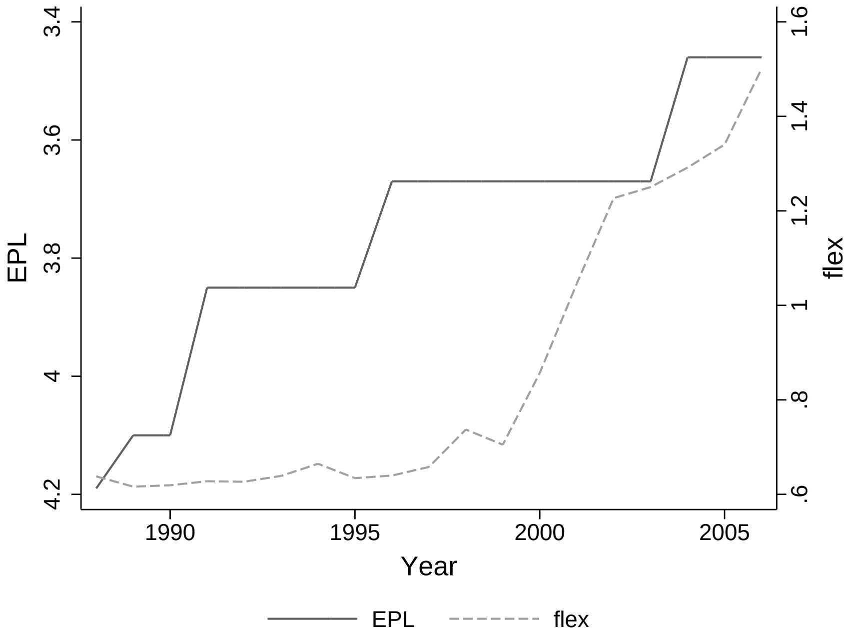

Figure 3: EPL vs. flex

The values of the index aggregated by technology level are also available in Table 4 in the Appendix and are represented in Figure 4. Both series present an increasing trend towards more flexibility and, according to our index, there is greater flexibility in high technology sectors. This is due to the fact that a smaller part of the labour force is under collective work agreements and also to the fact that the wage cushion is larger in these sectors. Nevertheless, there has been a convergence between the flexibility indexes of high and low technology sectors, especially since the year 2000. In fact, in the final year of our sample, 2006, the difference between the high and low technology sectors is negligible. However, this trend masks important differences in flexibility that still exist between sectors. In 2006, the most flexible sectors are actually low technology sectors: “building and repairing of ships and boats” and “rubber and plastics products”. In these two sectors, since the end of the 1990s, there has been a steady increase of the flexibility index due to increases in the components of the index related to collective agreement coverage and temporary work, following the general trend described above.

These results suggest that our index may be useful for characterising labour market flexibility. We will use it as a measure of sectoral labour market flexibility in the empirical analysis presented in the next section.

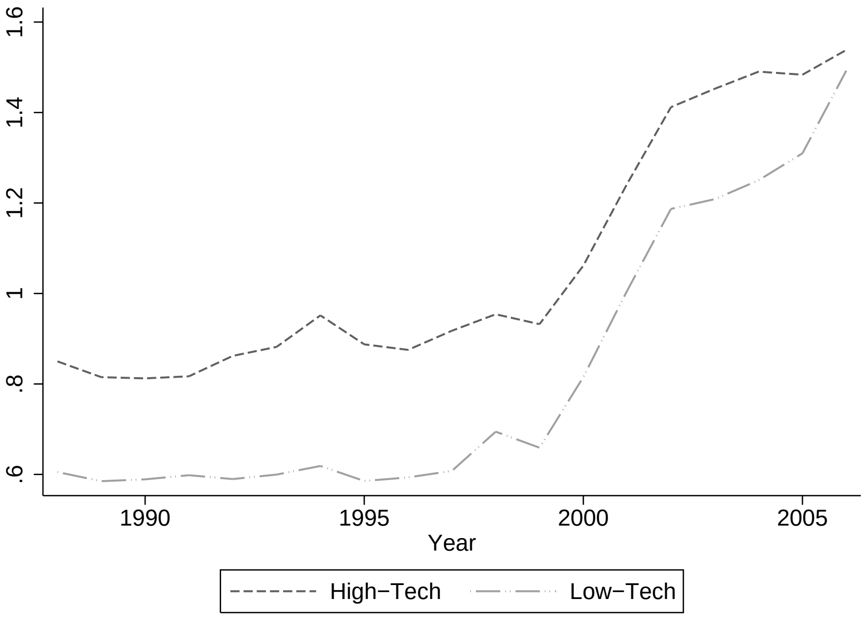

Figure 4: Aggregate flexibility index for high and low technology sectors

3 Employment and exchange rates

3.1 Econometric model

The previous sections mentioned five major facts concerning the evolution of the Portuguese economy during the period 1988-2006:[19] *(i)* manufacturing employment decreased significantly; *(ii)* low and medium-low technology sectors, though declining in importance, were dominant; *(iii)* the degree of openness has increased; *(iv)* labour market flexibility has increased; and, *(v)*, the real effective exchange rate has appreciated significantly. Alexandre *et al.* (2010b) argue that these five facts are related. In fact, the timing of those changes suggests that the analysis of the Portuguese experience may improve the understanding of the role that differences in labour market flexibility, trade openness and technology level across sectors have in the determination of the effects of exchange rate movements on economic activity.

According to the model presented in Alexandre *et al.* (2010b), the sensitivity of employment to exchange rate changes is expected to decrease with productivity and to increase with both the degree of openness to trade and labour market flexibility. To assess how important these mechanisms have been to employment dynamics in Portugal we use the following empirical

[19]For more details, see Alexandre *et al.* (2010c).

model:

$$
\begin{aligned}
\Delta y_{jt} \;=\;& \beta_0 + \beta_1 \Delta ExRate_{j,t-1} + \beta_2 \Delta ExRate_{j,t-1} \times Open_{j,t-1} \\
& + \beta_{1L} \Delta ExRate_{j,t-1} \times Low_j + \beta_{2L} \Delta ExRate_{j,t-1} \times Open_{j,t-1} \times Low_j \\
& + \beta_3 \Delta ExRate_{j,t-1} \times flex_{j,t-1} + \beta_{3L} \Delta ExRate_{j,t-1} \times flex_{j,t-1} \times Low_j \\
& + \beta_4 \Delta ShareImp_{j,t-1} + \beta_5 Open_{j,t-1} + \beta_6 flex_{j,t-1} + \lambda_t + \theta_j + \varepsilon_{jt}, \qquad (2)
\end{aligned}
$$

where Δ denotes first-difference, j refers to sectors and t indexes years. The dependent variable y_{jt} is log-employment, measured as total workers. $ExRate_{j,t-1}$ is the lagged real effective exchange rate (in logs) for sector j, where the bilateral weights are given by total trade (exports plus imports) shares.[20] The exchange rate index is defined such that an increase in the index is a depreciation of the currency. This exchange rate is smoothed by the Hodrick-Prescott filter, which filters out the transitory component of the exchange rate.[21] This is the usual procedure in the literature – see, for example, Campa and Goldberg (2001) – as firms, in the presence of hiring and firing costs, are expected to react only to permanent exchange rate variations. As a control variable, to account for competitors from emerging countries,[22] we include in our regressions the variable $ShareImp_{j,t-1}$, which is the share of these countries in sector j OECD countries' imports.[23]

As discussed in Alexandre *et al.* (2010a and 2010b), the effects of exchange rates on employment should differ according to the degree of trade openness. Therefore, we include in equation (2) an interaction term for the exchange rate and our measure of trade openness, $Open_{j,t-1}$, given by exports plus imports divided by exports plus imports plus gross output. Similarly, we include the interaction of the exchange rate with a dummy variable indicating low technology sectors, Low_j.

To evaluate the role of labour market rigidity, we add to the model the variable $flex_{j,t-1}$, which stands for the flexibility of sector j, measured by our sectoral labour market flexibility index. This index makes three appearances in our empirical model: alone, interacting with the exchange rate, and interacting with both the exchange rate and the dummy variable indicating low technology sectors.

[20] Sector-specific exchange rates may be more informative than aggregate exchange rate indexes as indicators of industries' competitiveness when the importance of trading partners varies across sectors – see, for example, Goldberg (2004), Gourinchas (1999) and Alexandre *et al.* (2009). Data for exchange rates were computed in Alexandre *et al.* (2009) and are available at http://www3.eeg.uminho.pt/economia/nipe/docs/2009/DATA_NIPE_WP_13_2009.xls.

[21] Following Ravn and Uhlig (2002), the smoothing parameter was set equal to 6.25.

[22] The set of emerging countries includes Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia, China, Chinese Taipei, Hong Kong, India, Indonesia, Malaysia, Philippines, Singapore, Thailand.

[23] Alternatively, we have included the share of non-OECD imports in Portuguese manufacturing sectors. However, this was not statistically significant in explaining employment variations. Results are available from the authors upon request.

Endogeneity concerns may arise within the model formulated in equation (2), i.e., one may question whether the explanatory variables, namely industry-level exchange rates, are exogenous with respect to the employment movements we want to explain. We account for this possibility by using first-differences as well as lagged values of the explanatory variables. The model also includes a set of time dummies, λ_t, in order to control for any common aggregate time varying shocks that are potentially correlated with exchange rates,[24] and a set of sectoral dummies θ_j. Since we specify a model in first-differences, these dummies represent sector-specific trends. Finally, ε_{jt} is a white noise error term.

All variables are in real terms. The model is estimated by OLS, with robust standard errors allowing for within-sector correlation.[25]

3.2 Results

Table 1 summarizes the results for the model specified in equation (2). Our estimation strategy is the following. We start by estimating equation (2) without taking into account the sectors' technology level. These results are presented in columns (1) and (2) under ALL. Next we extend this specification by including the level of technology. These results are presented in columns (3) and (4), under $FULL$. Finally, we estimate equation (2) separately for high ($HighTech$) and low technology sectors ($LowTech$) – these results are shown, respectively, in columns (5) and (6) and in columns (7) and (8). Even-numbered columns include sectoral dummies.

Looking at Table 1, the results concerning the control variable $ShareImp_{j,t-1}$ show that competition from emerging countries has had a negative and statistically significant impact on employment growth. The statistical significance of this effect is independent of the technology level. However, the impact of the competition with emerging countries' imports seems to be stronger for high technology sectors (estimated coefficients -2.5 and -2.7 in columns (5) and (6)) than for low technology sectors (estimated coefficients -1.5 and -1.6 in columns (7) and (8)). Nevertheless, a more insightful analysis might attempt to assess the effect of subsets of this group of countries based on their specialization. For example, Amador *et al.* (2009) show that Eastern European countries competition has mainly affected medium-high and high technology sectors, whereas competition from China has had a strong effect on low technology sectors. Although these results deserve further research, in this paper we focus instead on the effects of exchange rate movements on manufacturing employment.

Looking at the benchmark regressions (ALL), which do not control for the technology

[24] Since we use time dummies to account for aggregate shocks, our identification strategy relies mainly on the inclusion of the sectoral exchange rates. Other sources of heterogeneity are variations in overall level of trade exposure, $Open_{j,t-1}$, and the labour market flexibility, $flex_{j,t-1}$.

[25] An obvious alternative would be to estimate a dynamic panel data model, using adequate instrumental variables estimators. However, the inclusion of the lagged dependent variable as an additional regressor produced a statistically non-significant coefficient.

level, we observe that the interaction term for the exchange rate and openness is statistically significant and positive. This result seems to corroborate the results of Klein *et al.* (2003), that is, the effect of the exchange rate on employment is magnified by trade openness. To account for the role of technology, the specification $FULL$ (columns (3) and (4) in Table 1) introduces the dummy variable *Low* in the model via additional interactions with the exchange rate, the degree of openness and the measure of labour market flexibility. Again, the results presented in columns (3) and (4) show that the degree of openness has a positive effect on employment and that it magnifies the effect of exchange rate movements, though not every coefficient is statistically significant. The coefficient associated with the interaction between the exchange rate and openness is positive and clearly significant when we estimate separate regressions for low and high technology sectors (columns (5) to (8)).

Let us now turn our attention to the role of labour market flexibility. The results in columns (1) and (2) do not show a significant effect of labour market flexibility on employment, i.e., the effect does not exist through its interaction with the exchange rate, nor on its own. Once we account for the level of technology, in column (3), we conclude that the effect of exchange rates is magnified in low technology sectors with high labour market flexibility. Our results indicate that the employment sensitivity to exchange rate movements is not affected by the degree of labour market flexibility in the case of high technology sectors. Additionally, flexibility on its own does not explain changes in employment (the estimated coefficient is -0.009, with a standard error of 0.025). Controlling for sector-specific effects, column (4), we lose the statistical significance on $\hat{\beta}_{3L}$, even though the point estimate is actually larger.

Performing the regressions separately by level of technology – columns (5) to (8) –, the conclusion reached with $FULL$ regressions is reinforced, i.e., labour market flexibility is relevant for low technology industries through its impact on employment exchange rate elasticity. The quality of the adjustment of our model improves significantly when we use only the set of low technology industries. The root mean squared error is about 0.07, while the R^2 is about 0.2, compared to 0.13 and to $0.05 - 0.09$, respectively, for high technology sectors.

Since our goal is to evaluate how labour market flexibility, the openness to trade and technology mediate the effect of exchange rate movements on employment, we computed the elasticity of employment with respect to the exchange rate implied by the different specifications of our empirical model. The elasticity was evaluated at different degrees of labour market flexibility and trade openness, using the results presented in Table 1. In the analysis we consider a low, a median and a high level of labour market flexibility and of trade openness, which correspond to the 10^{th}, the 50^{th} and the 90^{th} percentiles, respectively. The employment exchange rate elasticities for the 10^{th}, 50^{th} and the 90^{th} percentiles of openness are shown separately in the three panels of Table 2.

The results shown in Table 2, columns (3) and (4) (specification $FULL$), indicate that, regardless of labour market flexibility and the degree of openness, employment in high technology sectors does not seem to be sensitive to exchange rate movements. However, for low technology sectors a 1% depreciation of the exchange rate is associated with an increase in employment that varies between 1.96% and 7.7%, though the lower values, associated with less labour market flexibility, are not all statistically significant. The elasticities estimated for low technology sectors by estimating the model on this data alone are very similar to these (cf. columns (7) and (8)). Moreover, the F-statistics shown in this table indicate that exchange rate elasticities are different for low and high technology sectors, except perhaps for less open sectors.

What stands out in columns (5) and (6), concerning high technology sectors, is the negative exchange rate elasticity of employment, which is statistically significant for the less open sectors (percentile 10). For higher degrees of openness the absolute magnitude of the elasticity decreases and becomes statistically insignificant. From a theoretical perspective, this result may be explained by the effect of the exchange rate variation on the price of imported inputs, that is, firms that rely heavily on imported inputs may have their competitiveness negatively affected by a depreciation of the exchange rate. Empirically we cannot test this hypothesis as we do not have data on firms foreign trade.[26]

Overall, our results show that the magnitude of the elasticity increases with both the level of labour market flexibility and the degree of openness, and is larger for low technology sectors than for high technology sectors.

We should highlight that the estimated elasticities for the Portuguese economy are larger than those reported in the literature for other countries, namely for the US (Revenga, 1992, Campa and Goldberg, 2001) and France (Gourinchas, 1998). Although Alexandre *et al.* (2010b), analysing 23 OECD countries, also using sectoral data and an identical estimation procedure, found similar patterns regarding the importance of openness, technology and labour market flexibility (measured at the country level using EPL), the magnitude of the elasticities therein is much smaller than the ones we found. In this paper, an elasticity of 7.1 for low technology sectors, highly open and highly flexible (Table 2, column 8, percentile 90), compares to the cross-country elasticity of 0.62 found in Alexandre *et al.* (2010b). The within country figure for Portugal is considerably larger than the cross-country counterpart. This difference may be explained by differences in the composition of low technology sectors and by specific characteristics of the sectors that belong to that category, which are not captured by the OECD technology classification. This is an issue that deserves further research.

As a further robustness check, equation (2) was estimated using hours worked, job

[26]For an empirical analysis of the effect of exchange rate movements on employment, through its effect on the cost of imported inputs, see Ekholm *et al.* (2008).

creation, job destruction and job reallocation as the dependent variable instead of total workers. The results are presented in Alexandre *et al.* (2010c). Using hours as a measure of employment confirms the results described above. In what concerns job flows we found the following results. The degree of market flexibility seems to mediate the effect of exchange rate innovations on job creation in low technology sectors, but it does not seem to have a role for high technology sectors. This suggests that for low technology sectors a rigid labour market insulates the job creation process from external shocks. When we look at job destruction, our estimates suggest that a higher degree of flexibility in the labour market magnifies the negative impact of an exchange rate appreciation. When we focus on job reallocation our results show that its elasticity with respect to the exchange rate increases with the degree of labour market flexibility, both for low technology sectors and high technology sectors. Summing up, our results suggest that higher labour market flexibility makes job flows more responsive to exchange rate movements.

4 Conclusions

In this paper the degree of labour market flexibility is measured at the sector level by means of a novel index, based on the actual behaviour of firms. Our index shows that labour market flexibility in Portugal has displayed an increasing trend that became more pronounced after 1999. This increasing trend was shared by all manufacturing sectors included in our analysis and reflected the reduction of the share of workers covered by collective agreements and working full time. The trend towards more flexibility is shared with the OECD's employment protection legislation index, which reflects changes in legislation. However, the two indexes move at different paces, with our index lagging EPL. One possible explanation for this is that it takes time for legislation to affect firm behaviour. Alternatively, it may reflect the different impact of the measures taken over the years on actual flexibility.

Our sectoral index allows us to compare the flexibility of different sectors. For example, if we divide the sectors into high and low technology sectors, we see that high technology sectors tend to face more flexible labour markets, although there are low technology sectors among the most flexible labour markets. The sectoral index also shows that the level of flexibility in high and low technology sectors has been converging.

As an application of our index, we introduced it in an econometric model of sectoral employment changes. The results of this application show that labour market flexibility, together with the degree of openness to trade and technology, affect the impact of exchange rate movements on Portuguese manufacturing employment. In particular, we estimate that employment in low technology sectors, with a high degree of trade openness and facing more flexibility in the labour market has been the most affected by the evolution of the exchange rate since the late 1980s.

References

Addison, J. and P. Teixeira (2003). The economics of employment protection. Journal of Labour Research, 24(1), 85-129.

Alexandre, F., P. Bação, J. Cerejeira and M. Portela (2009). Aggregate and sector-specific exchange rates for the Portuguese economy. Notas Económicas, 30, 6-28.

Alexandre, F., P. Bação, J. Cerejeira and M. Portela (2010a). Employment and exchange rates: the role of openness and technology. Open Economies Review, forthcoming, DOI: 10.1007/s11079-010-9191-z.

Alexandre, F., P. Bação, J. Cerejeira and M. Portela (2010b). Employment, exchange rates and labour market rigidities. IZA Discussion Paper No. 4891.

Alexandre, F., P. Bação, J. Cerejeira and M. Portela (2010c). Manufacturing employment and exchange rates in the Portuguese economy: the role of openness, technology and labour market rigidity. NIPE Working Paper No. 22/2010, Universidade do Minho.

Almeida, V., G. Castro and R. Félix (2009). The Portuguese economy in the European context: structure, shocks and policy. In Banco de Portugal. The Portuguese Economy in the Context of Economic, Financial and Monetary Integration. Economics and Research Department, Banco de Portugal.

Amador, J., S. Cabral and J.R. Maria (2007). International trade patterns over the last four decades: how does Portugal compare with other cohesion countries? Working Papers, 14/2007, Banco de Portugal.

Amador, J., S. Cabral and L. D. Opromolla (2009). A portrait of Portuguese international trade. In Banco de Portugal. The Portuguese Economy in the Context of Economic, Financial and Monetary Integration. Economics and Research Department, Banco de Portugal.

Anderson, J., J. Grahl, S. Jefferys and A. Tasiran (2006). Labour market flexibility and sectoral productivity: a comparative study. Department of Trade and Industry, Employment Relations Research Series no.66.

Auer, R. and A. Fischer (2008). The effect of trade with low-income countries on U.S. industry. CEPR Discussion Paper Series # 6819. Centre for Economic Policy Research.

Babecký, Jan, P. Du Caju, T. Kosma, M. Lawless, J. Messina and T. Rõõm, (2009). The Margins of Labour Cost Adjustment: Survey Evidence from European Firms. Research Technical Paper 12/RT/09, Central Bank and Financial Services Authority of Ireland, Dublin.

Berman, N., P. Martin and T. Mayer (2009). How do different exporters react to exchange rate changes? Theory, empirics and aggregate implications. CEPR Discussion Paper Series No. 7493. Centre for Economic Policy Research.

Bertola, G. (1990). Job security, employment and wages. European Economic Review, 34(4), June, 851-86.

Bertola, G. (1992). Labor turnover costs and average labor demand. Journal of Labor Economics, 10(4), 389-411.

Bertola, G., T. Boeri and S. Cazes (2000). Employment protection in industrialized countries: The case for new indicators. International Labour Review, 139(1), 57-72.

Blanchard, O. and F. Giavazzi (2002). Current account deficits in the Euro Area: The end of the Feldstein-Horioka puzzle? Brooking Papers on Economic Activity, 2, 147-209.

Blanchard, O. and J. Wolfers (2000). The role of shocks and institutions in the rise of European unemployment: the aggregate evidence. The Economic Journal, 110(462), March, C1-C33.

Blanchard, O. and P. Portugal (2001). What hides behind an unemployment rate: Comparing Portuguese and U.S. labor markets, American Economic Review 91(1), 187-207.

Branson, W. and J. Love (1988). U.S. manufacturing and the real exchange rate. In R. Marston, ed., Misalignments of exchange rates: effects on trade and industry. Chicago University Press.

Campa, J. and L. Goldberg (2001). Employment versus wage adjustment and the US dollar. Review of Economics and Statistics, 83(3), 477-489.

Cardoso, A.R. e P. Portugal (2005). Contractual Wages and the Wage Cushion under Different Bargaining Settings. Journal of Labor Economics, 23(4), 875-902.

Cazes, S. and M. Tonin (2010). Employment protection legislation and job stability: A European cross-country analysis. International Labour Review, 149(3), 261-285.

Centeno, M., J. Maria and A. Novo (2009). Unemployment: supply, demand and institutions. In Banco de Portugal. The Portuguese Economy in the Context of Economic, Financial and Monetary Integration. Economics and Research Department, Banco de Portugal.

Davis, S. and J.C. Haltiwanger (2001). Sectoral job creation and destruction: responses to oil price changes. Journal of Monetary Economics, 48(3), 465-512.

Directorate-General for Economic and Financial Affairs (2010a). The Economic Adjustment Programme for Greece. First review – summer 2010. Occasional Papers, 68. European Commission, Brussels.

Directorate-General for Economic and Financial Affairs (2010b). Labour market and wage developments in 2009. European Commission, Brussels.

Ekholm, K., A. Moxnes and K.H. Ulltveit-Moe (2008). Manufacturing restructuring and the role of real exchange rate shocks: a firm level analysis. CEPR Discussion paper no. 6904.

European Commission (2003). 2003 Adopted employment guidelines. Available at http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_197/l_19720030805en00130021.pdf.

Fabiani, S. and A. Rodriguez-Palenzuela (2001). Model-based indicators of labour market rigidity. ECB working paper no.57.

Fagan, G. and V. Gaspar (2007). Adjusting to the euro, Working paper 2007-03, Banco de Portugal.

Feenstra, R. (1989). Symmetric pass-through of tariffs and exchange rates under imperfect competition: an empirical test. Journal of International Economics. February, 27(1-2), 25-45.

Felbermayr, G., J. Prat and H. Schmerer (2008). Globalization and Labor Market Outcomes: Wage Bargaining, Search Frictions, and Firm Heterogeneity, IZA Discussion Paper No. 3363.

Gamberoni, E., E. von Uexkull and S. Weber (2010). The role of openness and labour market institutions for employment dynamics during economic crisis. Unpublished ILO/World Bank manuscript.

Goldberg, L. (2004). Industry-specific exchange rates for the United States. Federal Reserve Bank of New York Economic Policy Review, May.

Gómez-Salvador, R., J. Messina and G. Vallanti (2004). Gross job flows and institutions in Europe. Labour Economics, 11(4), 469-485.

Gourinchas, P. (1998). Exchange Rates and Jobs: What do we Learn from Job Flows? In NBER Macroeconomics Annual, B. Bernanke and J. Rotemberg eds. The MIT Press.

Gourinchas, P. (1999). Exchange rates do matter: French job reallocation and exchange rate turbulence, 1984-1992. European Economic Review, 43(7), 1279-1316.

Haltiwanger, J., S. Scarpeta and H. Schweiger (2006). Assessing job flows across countries: the role of industry, firm size and regulations. IZA Discussion Paper No. 2450.

Helpman, E. and O. Itskhoki (2010). Labour market rigidities, trade and unemployment. Review of Economic Studies, 77(3), 1100-1137.

Hopenhayn, H. and R. Rogerson (1993). Job turnover and policy evaluation: A general equilibrium analysis. Journal of Political Economy, 101(5), 915-938.

Klein, M.K., S. Schuh and R. Triest (2003). Job creation, job destruction, and the real exchange rate. Journal of International Economics, 59(2), 239-265.

Lawson, R.A., E. Bierhanzl (2004). Labor market flexibility: An index approach to cross-country comparisons. Journal of Labor Research, 25(1), 117-126.

Lopes, Silva (2008). Introduction, In Franco, Francesco, org., Challenges Ahead for the Portuguese Economy. Imprensa de Ciências Sociais, Lisboa.

Macedo, Jorge Braga de (2008). Economic advice and regime change in Portugal, In Franco, Francesco, org., Challenges Ahead for the Portuguese Economy. Imprensa de Ciências Sociais, Lisboa.

Machin, S. and J. Van Reenen (1998). Technology and changes in the skill structure: evidence from seven OECD countries. Quarterly Journal of Economics, 113(4), 1215-1244.

Melitz, M.J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica. 71(6), 1695-1725.

OECD (1999). Employment Outlook. OECD, Paris.

OECD (2004). Employment Outlook. OECD, Paris.

OECD (2005). OECD Science, Technology and Industry Scoreboard, Annex 1. OECD, Paris.

OECD (2008). STAN Bilateral Trade Database. OECD, Paris.

OECD (2009). Employment Protection Indicators. OECD, Paris.

Portela, M. (2001). Measuring skill: a multi-dimensional index. Economics Letters, 72(1), 27-32.

Portugal. Ministério do Trabalho e da Solidariedade Social (MTSS) (1988-2006). Quadros de Pessoal. Data in magnetic media.

Revenga, A.L. (1992). The impact of import competition on employment and wages in U.S. manufacturing. Quarterly Journal of Economics. 107(1), 255-284.

Ravn, Morten O. and H. Uhlig (2002). On adjusting the Hodrick-Prescott filter for the frequency of observations. Review of Economic and Statistics, 84(2), 371-380.

Solow, R. M. (1998). What is Labour-Market Flexibility? What is it Good For?. Proceedings of the British Academy, 97, pp. 189-211.

UK HM Treasury (2003). EMU and Labour Market Flexibility. EMU Study.

Varejão, J. (2003). Job and worker flows in high adjustment cost settings. Portuguese Economic Journal, 2(1), 37-51.

Venn, D. (2009), Legislation, collective bargaining and enforcement: Updating the OECD employment protection indicators. OECD Social, Employment and Migration Working Papers 89.

Table 1: Employment regressions

Model	ALL		FULL		HighTech		LowTech	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta ExRate_{t-1}$	-2.345	-1.472	-.354	-2.858	-5.457*	-2.859	-3.074*	-2.869
	(2.686)	(2.995)	(2.365)	(2.537)	(2.976)	(4.909)	(1.790)	(2.161)
$\Delta ExRate_{t-1} \times Low$			-4.202**	-.635				
			(1.771)	(1.914)				
$\Delta ExRate_{t-1} \times Open$	2.645**	3.518**	2.057	7.201***	7.949***	8.065***	8.291***	7.227***
	(1.301)	(1.621)	(2.257)	(2.695)	(2.564)	(2.682)	(2.370)	(2.739)
$\Delta ExRate_{t-1} \times Open \times Low$			8.071**	.506				
			(3.478)	(4.121)				
$Open_{t-1}$	.105**	.205	.099**	.299*	.333***	.362*	.034	.148
	(.041)	(.164)	(.039)	(.159)	(.064)	(.214)	(.028)	(.150)
$\Delta ExRate_{t-1} \times Flex$	1.386	.901	-.050	-.784	-2.300	-4.001	2.349***	2.407**
	(1.567)	(1.926)	(1.478)	(2.107)	(2.328)	(2.706)	(.904)	(1.048)
$\Delta ExRate_{t-1} \times Flex \times Low$			2.564*	3.212				
			(1.457)	(2.240)				
$Flex_{t-1}$	-.0005	.021	-.009	.016	-.014	-.037	-.033	-.020
	(.024)	(.050)	(.025)	(.052)	(.054)	(.061)	(.029)	(.048)
$\Delta ShareImp_{t-1}$	-1.482***	-1.839***	-1.723***	-1.969***	-2.502**	-2.722	-1.509***	-1.621***
	(.434)	(.620)	(.490)	(.661)	(1.058)	(1.732)	(.556)	(.493)
Sectoral dummies	no	yes	no	yes	no	yes	no	yes
Observations	360	360	360	360	162	162	198	198
$Adj.R^2$	.068	.069	.084	.078	.092	.051	.196	.201
LogLikelihood	318.472	329.223	323.135	332.566	118.795	120.073	251.423	257.926
RMSE	.103	.103	.103	.103	.126	.129	.073	.072

Notes: Robust standard errors in parentheses. Significance levels: $*$: 10% $**$: 5% $***$: 1%. The dependent variable is the difference in the log employment. All regressions are estimated by OLS, and include time dummies. Additionally, even columns include sector dummies. RMSE is root mean squared error. The exchange rate is the average import/export exchange rate.

Table 2: Exchange rate elasticity of employment

Sectors	Flexibility, percentile	ALL (1)	ALL (2)	FULL (3)	FULL (4)	HighTech (5)	HighTech (6)	LowTech (7)	LowTech (8)
				Openness, percentile 10					
ALL	10	.355	.830						
	50	.569	.970						
	90	1.203	1.382						
HighTech	10			.201	-1.746	-6.192*	-5.888		
	50			.194	-1.867	-6.548*	-6.507		
	90			.171	-2.225	-7.600	-8.336*		
LowTech	10			1.959	2.169			2.658*	2.619
	50			2.348*	2.545			3.021**	2.991**
	90			3.497**	3.655**			4.095***	4.092**
F-test	10			1.707	2.947				
	50			1.946	2.867				
	90			2.366	2.683				
				Openness, percentile 50					
ALL	10	.951	1.623						
	50	1.165	1.763						
	90	1.799	2.175						
HighTech	10			.665	-.122	-4.400	-4.070		
	50			.658	-.243	-4.756	-4.688		
	90			.634	-.602	-5.808	-6.518		
LowTech	10			4.243**	3.907*			4.527**	4.249*
	50			4.631**	4.283*			4.890**	4.621*
	90			5.781***	5.393**			5.965***	5.722**
F-test	10			5.563**	3.630*				
	50			5.383**	3.459*				
	90			4.903**	3.095*				
				Openness, percentile 90					
ExRate	10	1.449	2.285						
	50	1.663	2.425						
	90	2.297	2.837						
HighTech	10			1.052	1.232	-2.905	-2.552		
	50			1.044	1.111	-3.260	-3.171		
	90			1.021	.753	-4.312	-5.001		
LowTech	10			6.148**	5.357*			6.087**	5.608*
	50			6.536***	5.732**			6.450**	5.980**
	90			7.686***	6.843**			7.524***	7.081**
F-test	10			7.112**	3.281*				
	50			10.398***	4.500**				
	90			6.394**	3.126*				

Notes: see notes to Table 1. F-test null: equal elasticities for HighTech and LowTech sectors.

Appendix

Table 3: List of sectors

Sector	ISIC Rev. 3
Low and medium-low technology sectors	
food products, beverages and tobacco	15 - 16
textiles, textile products, leather and footwear	17 - 19
wood and products of wood and cork	20
pulp, paper, paper products, printing and publishing	21 - 22
rubber and plastics products	25
other non-metallic mineral products	26
iron and steel	271 + 2731
non-ferrous metals	272 + 2732
fabricated metal products, except machinery and equipment	28
building and repairing of ships and boats	351
manufacturing nec	36 - 37
High and medium-high technology sectors	
chemicals excluding pharmaceuticals	24, excl. 2423
pharmaceuticals	2423
machinery and equipment, nec	29
office, accounting and computing machinery	30
electrical machinery and apparatus, nec	31
radio, television and communication equipment	32
medical, precision and optical instruments, watches and clocks	33
motor vehicles, trailers and semi-trailers	34
railroad equipment and transport equipment nec	352 + 359

Table 4: Values of the flex index

Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	0.94	0.99	0.90	0.82	0.77	0.75	0.80	0.77	0.72	0.74	0.75	0.83	0.86	1.10	1.38	1.24	1.33	1.30	1.58
2	0.78	0.80	0.85	0.91	1.15	1.05	1.14	1.08	1.10	1.19	1.32	0.88	0.92	1.26	1.54	1.51	1.61	1.51	1.52
3	0.83	0.65	0.69	0.72	0.72	0.85	0.91	0.78	0.80	0.80	0.89	0.84	0.96	1.13	1.31	1.43	1.47	1.45	1.51
4	0.82	0.77	0.73	0.69	0.82	0.90	0.83	0.80	0.73	0.78	0.71	0.78	0.98	1.46	1.80	2.15	2.21	2.00	1.91
5	0.72	0.73	0.74	0.76	0.70	0.75	0.70	0.82	0.81	0.85	0.94	1.25	1.29	1.34	1.39	1.47	1.42	1.50	1.47
6	0.76	0.73	0.68	0.63	0.74	0.78	0.74	0.72	0.83	1.14	1.19	1.09	0.96	1.15	1.33	1.26	1.43	1.51	1.47
7	0.87	0.80	0.83	0.86	0.88	0.76	0.75	0.84	0.84	0.90	1.03	0.92	0.80	1.02	1.30	1.22	1.29	1.30	1.54
8	0.99	0.93	0.94	0.95	1.01	1.06	1.12	1.04	1.03	0.95	0.80	0.81	1.47	1.49	1.52	1.42	1.46	1.57	1.53
9	0.74	0.71	0.70	0.69	0.72	0.73	1.25	1.00	0.75	1.16	0.76	0.65	0.83	1.02	1.26	1.66	1.76	1.69	1.82
High-Tech	0.85	0.82	0.81	0.82	0.86	0.88	0.95	0.89	0.88	0.92	0.95	0.93	1.06	1.24	1.41	1.45	1.49	1.48	1.54
10	0.77	0.71	0.81	0.91	0.85	0.82	0.85	0.82	0.75	0.79	0.79	0.73	0.93	1.12	1.32	1.28	1.39	1.49	1.58
11	0.49	0.47	0.46	0.44	0.43	0.45	0.49	0.46	0.49	0.51	0.61	0.57	0.74	0.96	1.13	1.07	1.04	1.00	1.43
12	0.48	0.49	0.51	0.52	0.51	0.50	0.52	0.51	0.53	0.50	0.62	0.57	0.68	0.82	0.97	1.09	1.14	1.17	1.20
13	0.61	0.60	0.61	0.61	0.68	0.69	0.75	0.73	0.74	0.75	0.81	0.79	0.89	1.07	1.27	1.39	1.39	1.60	1.62
14	0.86	0.98	0.91	0.85	0.88	0.81	0.72	0.67	0.72	0.71	0.80	0.74	1.01	1.12	1.23	1.43	1.46	2.01	2.05
15	0.75	0.76	0.80	0.83	0.86	0.84	0.82	0.79	0.79	0.80	0.86	0.87	1.06	1.21	1.37	1.48	1.60	1.61	1.69
16	0.70	0.72	0.75	0.77	0.72	0.74	0.91	0.84	0.78	0.81	0.80	0.80	0.83	1.11	1.38	1.35	1.38	1.35	1.42
17	0.63	0.62	0.66	0.70	0.62	0.64	0.70	0.64	0.64	0.65	0.77	0.68	0.77	0.96	1.19	1.43	1.26	1.65	1.39
18	0.62	0.62	0.58	0.54	0.55	0.61	0.62	0.55	0.58	0.62	0.72	0.68	0.75	0.93	1.13	1.17	1.28	1.36	1.39
19	1.27	0.99	1.20	1.31	1.34	1.28	0.99	0.91	0.82	0.83	1.06	1.10	1.39	1.49	1.58	1.95	2.14	2.04	2.22
20	0.60	0.58	0.56	0.54	0.52	0.52	0.51	0.48	0.48	0.49	0.64	0.63	0.73	0.92	1.12	1.22	1.27	1.31	1.35
Low-Tech	0.61	0.59	0.59	0.60	0.59	0.60	0.62	0.59	0.59	0.61	0.69	0.66	0.82	1.01	1.19	1.21	1.25	1.31	1.49
Aggregate	0.64	0.62	0.62	0.63	0.63	0.64	0.66	0.63	0.64	0.66	0.74	0.71	0.86	1.05	1.23	1.25	1.29	1.34	1.50

Sectors: 1 - chemicals, ex. pharm.; 2 - electrical mach.; 3 - machinery & equip.; 4 - medical & opt. inst.; 5 - motor vehicles; 6 - office, account. & comp.; 7 - pharmaceuticals; 8 - radio, tv & com.; 9 - railroad equip. & trans.; 10 - food, bev. & tobacco; 11 - text., leather & foot.; 12 - wood & cork; 13 - pulp, paper, print.; 14 - rubber and plast. prod.; 15 - other non-met. min. prod.; 16 - iron and steel; 17 - non-ferrous metals; 18 - fab. metal prod., ex. mach.; 19 - build & rep. of ships; 20 - manufacturing nec.