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**LABOUR COST AND
EMPLOYMENT ACROSS
EURO AREA COUNTRIES
AND SECTORS**

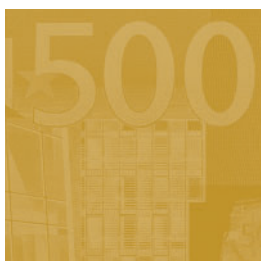
by Beatrice Pierluigi
and Moreno Roma





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Abstract: *This paper studies the role of wage moderation and labour and product market regulation for employment creation. To this end, labour demand estimates are presented for the five largest euro area countries at the aggregate level and for three macro sectors: manufacturing, construction and services. Estimates are carried out for individual countries as well as for the pooled group of countries. This paper shows that labour cost moderation generally helps employment creation, notwithstanding the fact that elasticities of employment to labour costs vary across the countries and sectors analysed. It also shows that some key institutional/structural variables add to the explanation of labour demand developments. In particular, in some countries and sectors, our results point to a negative link between employment growth, the unemployment benefit replacement rate and product market regulation.*

Keywords: labour demand, labour cost, panel estimates

JEL: E24, J23, J30, C22, C23

Non-technical Summary

This paper studies the role of wage moderation and labour and product market regulation for employment creation. It presents a set of estimates of labour demand in the five largest euro area countries (Germany, France, Italy, Spain and the Netherlands) from 1970 to 2006 at the total economy level and for three macro sectors: manufacturing, construction and services. Estimates are carried out for individual countries as well as for the pooled group of countries.

Three features of this paper, compared with other studies in this area, are worth mentioning. First, a uniform approach is applied across countries and sectors, which allows a straightforward comparison of elasticities. In particular, looking at the key sectors of the economy in conjunction with the total economy aggregate allows for a better understanding of the different labour demand dynamics across the euro area countries, which are easily captured in the common framework adopted. The second important feature consists in including in the specification of the labour demand some key structural variables capturing the extent of labour and product market regulation. Notably, this paper seeks to assess the impact of time-series rather than cross-sectional variations in structural/institutional variables both at a single country level and within a pooled estimation approach. Alternative methodologies are used to obtain the pooled estimates (mean group, pooled mean group and dynamic fixed effects). Third, as regards the data used, while the empirical version of the labour demand is common in the literature, this paper is one of the few with employment and real wages expressed in full time equivalent rather than per person. This concept is equivalent to that of hours worked and allows building a theory consistent measure of unitary labour cost that helps to take into account important employment developments, such as part-time work.

Our results show that labour cost moderation generally helps employment creation and that elasticities of employment to labour costs vary across countries and sectors. In particular, contained growth in real wages is found to be supportive for employment growth in Germany, Spain, Italy, the Netherlands and the pooled panel for the aggregate economy. In France, the long term employment elasticity to real wages is found significant only in the manufacturing and construction sector. The high share of public wages in the service sector in France might be one of the reasons for the fact that real wages are not statistically significant in explaining employment developments in this sector. As regards the other countries, the economy-wide results are also broadly confirmed at the sectoral level. For the manufacturing sector, finding a satisfactory specification for employment growth was particularly challenging in the case of Italy. In this country, the subdued pattern of employment in the manufacturing sector during a period of relatively moderate real labour costs might be related to “exogenous” factors, such as high competition from low costs countries in low-tech products, which have recently triggered an important industrial restructuring.

In some cases institutional/structural variables add to the explanation of labour demand developments. In particular, in some countries and sectors our results support the negative link between employment growth

and the unemployment benefit replacement rate, which can be considered a proxy for wage floors or reservation wages created by social transfers. Additionally, stricter regulation in product markets is found to hamper employment growth in some countries (notably Germany, France and Italy) and sectors (mainly in the construction sector). These results seem to support the view that the positive effect of wage-moderation on employment growth would be larger in countries and sectors where product markets are less strictly regulated. However, some caution is required in interpreting these results. Pooled estimates indicate that, in general, structural variables do not seem to add in explaining employment growth probably due to the rather heterogeneous role played by these variables across countries and sectors. This reflects institutional differences and the different degree of flexibility of each economy.

Finally, pooled estimates suggest that even if results are qualitatively broadly similar across methodologies, at the sectoral level the magnitude of the estimates may differ somewhat depending on the estimation techniques used.

1. Introduction

During the past eight years employment creation has been one of the most impressive achievements of the euro area countries. Employment growth appears to have suffered relatively little from the economic slowdown of the euro area countries between 2003 and 2005. Around this key stylized fact, both macroeconomic and institutional explanations have been put forward in the academic as well as in the policy debate. The macroeconomic explanations are mainly related to the high degree of wage moderation which has been witnessed by some euro area countries in recent years, the institutional explanations are related to a number of reforms in the labour and product markets which started to take place in the past two decades.

Against this background, this paper presents a set of estimates for the labour demand in the five largest euro area countries (Germany, France, Italy, Spain and the Netherlands) at the total economy level and for three macro sectors: manufacturing, construction and services. Estimates are carried out for individual countries as well as for the pooled group of countries. The time span used for the estimates is sufficiently large to comprise in the sample several business cycles, thus leading to estimates robust to business cycle fluctuations. Moreover, the end point of the estimates (2006) allows assessing the link between wage moderation and employment creation in recent years. This paper shows that labour cost moderation generally helps employment creation, notwithstanding the fact that elasticities of employment to labour costs vary across countries and sectors. It also shows that in some countries some key institutional/structural variables add to explain labour demand developments. This sectoral heterogeneity suggests that the degree of substitution between factors of productions, which varies across sectors, might be relevant in determining how labour demand is affected by changes in the relative price of labour. Thus, as a possible follow up of this paper, it might be interesting to investigate labour demand by using a more detailed sectoral and skill decomposition. Moreover and importantly, differences in the slope of labour demand might be associated to different degree of labour market flexibility.

The labour demand equations derived in this paper, while being rather standard in the literature (Morgan, 2001, Mourre, 2006), contain some interesting features. First, a uniform estimation approach is applied to the five largest euro area countries, across sectors and pooling the countries. In particular, the focus made on the sectoral estimation allows for a better understanding of the different labour demand dynamics across the euro area countries, which are easily captured within the common framework adopted. The second important feature consists in including in the specification of the labour demand some key structural variables capturing the extent of labour and product market regulation. Due to the paucity of data for many structural/institutional variables, some of the previous analyses mainly focused on the cross-country

properties of the data¹. By contrast, this paper seeks to exploit the impact of time-series rather than cross-sectional variations in structural/institutional variables both at a single country level and within a pooled estimation approach. Alternative methodologies are used to obtain the pooled estimates (mean group, pooled mean group and dynamic fixed effects). Third, labour costs, which are measured as real unitary compensation, as well as employment, are expressed in full-time equivalent, which implies correcting the number of heads by the number of hours worked. By contrast, due to limited availability of series for hours worked in the euro area, most of the existing studies measure employment as the number of persons employed². In this paper the concept of employment in full-time equivalent is instead used in order to build a theory consistent measure of unitary labour cost and to give the correct weight to recent employment developments in part-time work (mostly relevant in countries such as Italy and Spain). Finally, given that in the most recent papers the time span of the estimates generally ends in early 2000s, our paper can also be considered an update of the existing literature. This is of relevance given the inclusion in our sample of 8 years of EMU.

The paper is structured as follows. Section 2 presents the theoretical and empirical framework of the labour demand equations. Section 3 reviews the employment and real labour cost data and presents the results together with some robustness tests as well as comparisons with other studies. Conclusions are reported in Section 4.

2. Labour cost and employment: the theoretical and empirical framework

Labour demand equations are widely studied in empirical economics. Most of the empirical studies derive the long-term specification of the labour demand from the first order conditions of a profit-maximising or, equivalently, a cost-minimising representative firm (Hammermesh, 1993; Layard, Nickell and Jackmann, 1991). Alternatively, one can use the employment level induced by the inverted production function (see for example Fagan et al., 2001).

Assuming only two factors of production, labour and capital, and constant returns to scale, the simplest specification of a production function is a Cobb-Douglas, characterised by unitary elasticity of substitution between factor inputs. By contrast, a Constant Elasticity of Substitution (CES) specification would allow for a non-unitary elasticity of substitution between labour and capital. With a CES specification one can also extend the analysis to the case of imperfect competition (see Morgan, 2001). Irrespective of the type of production function assumed, the solution of the profit maximisation problem would lead to a long-term labour demand specification where employment depends on a constant, which is directly or indirectly

¹ See for example Nickell (1997).

² See Mourre (2006).

related to the labour share, on output with a unitary elasticity, on real wages and, in the case of a CES specification, on trend technological progress which is usually approximated by a linear time trend.

The standard theoretical framework, derived from the optimization problem of a representative firm, leads to a labour demand equation in levels. However, empirically, the presence of non-stationary variables implies searching for a cointegrating vector or for stationarity around a linear trend in order to get not spurious estimates. Thus, most empirical studies search for, or even assume the existence of a long-term cointegrating relationship and use this long-term relationship within a short-term dynamics, which includes an error correction mechanism. From an economic point of view, the use of an error correction model is warranted by the existence of costs of adjustments, which induce a slow response of employment to shocks (Nickell, 1986; Hammermesh and Pfann, 1996).

In this paper we use the profit maximising first order condition to derive the long-run relationships between employment and labour costs. Let assume a CES specification, with two production factors, constant returns to scale and with labour augmenting technological progress:

$$(1) Y_t = \left[\alpha (a_t L_t)^{\frac{\sigma-1}{\sigma}} + (1-\alpha) K_t^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

where Y_t is output, L_t is labour and K_t is capital. a_t is an index of the level of technology and is assumed to be labour augmenting. $a_t L_t$ is often referred to as labour in efficiency unit. α is the labour intensity of the method of production and σ is the elasticity of substitution between labour in efficiency unit ($a_t L_t$) and capital. Assuming perfect competition, one derives the following first order condition from the firm's profit maximisation problem:

$$(2) \frac{w_t}{p_t} = \alpha a_t^{\frac{\sigma-1}{\sigma}} \left(\frac{Y_t}{L_t} \right)^{\frac{1}{\sigma}}$$

From (2), which equates real compensation per employee to the marginal productivity of labour, one can obtain the following log-linear relationship between employment, real wages, labour augmenting technical progress and output:

$$(3) \log L_t = \sigma \log \alpha + \log Y_t - \sigma \left(\log \frac{w_t}{p_t} \right) + (\sigma - 1) \log a_t$$

This relationship forms the basis of the long-term specification used for the estimation of the labour demand equations. In the empirical specification of equation (3) it is assumed that the labour augmenting technological progress follows a linear trend of the form:

$$(4) \log a_t = \varphi t + \xi_t, \text{ where } \xi_t \text{ is the error term.}$$

In addition, the long-term specification has been enriched to capture possible effects of globalisation via a competitiveness term (terms of trade and real effective exchange rate)³.

Finally, institutional/policy variables have been introduced in the long-run specification (see Blanchard and Wolfers, 2000 for a discussion). In principle, one should expect that labour demand is affected by all policy measures that have an effect on the cost of employment such as tax wedges, the design of the system of wage determination and the cost of employment protection. Labour demand is also affected by the strength of competition in product markets (Annet, 2007), which is partly determined by product market regulation.

High taxes reduce either labour supply or labour demand, depending on whether their burden falls onto wage earners – in the form of lower net wages – or employers – in the form of higher labour costs. The more employees succeed in obtaining compensation for higher personal income taxes, social security contributions and consumption taxes by pushing up their wages, the more labour demand decline and unemployment rises. This is especially the case if employers cannot compensate for higher labour taxes by reducing wages, as may happen for instance in the presence of binding minimum wages or wage floors created by social transfers. Job protection which can be captured by the index of employment protection legislation as well as by the degree of unionisation of a country constitutes, *inter alia*, a cost to firing, which may entail disincentives to hiring workers. Stronger competition in product markets increases employment in the long run (Blanchard and Giavazzi, 2003). Lower barrier to entry curb market power and monopoly profits and make entry of new firms possible. Both factors tend to expand activity levels and labour demand. Moreover, lower monopoly profits reduce the scope for incumbent workers to share in the rents generated by excessive prices. Reduced rent sharing between employers and employees would then tend to shorten the length of unemployment spells as it would become less attractive for the unemployed to limit their search for job opportunities in ‘high-wage’ sectors only.

Against this background, four institutional variables have been used: the replacement rate, the index of product market regulation, the index of employment protection legislation and the union density (see Appendix E for a description of the data).

For each country analysed, the empirical specification of equation (3) is therefore the following:

$$(5) \log L_{it} = \sigma_i \log \alpha_i + \beta_i \log Y_{it} + \gamma_i \left(\log \frac{w_{it}}{P_{it}} \right) + \nu_i t + \delta_i macro_t + \varphi_i inst_t + \varepsilon_{it}$$

where the subscript i denotes the sectors analysed, i.e. i = total economy, manufacturing, construction, services, and the parameters β , γ , ν , δ , φ denote the elasticities of labour demand to output, real wages, the time trend, macroeconomic and institutional variables, respectively. Macroeconomic and institutional variables are common across sectors. Given the long-term nature of equation (5) output is replaced by trend

³ Moreover, in the short-run specification, the cost of an important factor input, the oil price, has been added.

GDP. The macroeconomic variables included in the long-run specification are the terms of trade and the real effective exchange rate. The institutional variables comprise the replacement rate, the index of product market regulation, the employment protection legislation and the union density.

ε_{it} represents the “equilibrium” errors term. Results of an Augmented Dickey-Fuller test with 1 lag point to the stationarity of the error term. The presence of a cointegrating relationship has also been tested by the Johansen cointegrating rank (see Appendix D). The larger the elasticities in absolute values, the higher is the response of employment to macroeconomic conditions and institutional variables. As far as the macroeconomic variables are concerned, higher elasticities would imply a higher degree of labour market flexibility, as far as the institutional variables are concerned, higher elasticities might imply higher distortions coming from highly regulated markets or high “wage floors”.

The unitary elasticity of output which is implied by equation (3) is not imposed in equation (5) but verified by the data, as for example in Hahn, 2004. Estimation results for the total economy of specifications where the employment elasticity to output has been imposed equal to 1 are however reported in Appendix C2 to test robustness of the results.

Due to market imperfections such as institutional or cost restrictions⁴, adjustment to changing economic conditions might not be instantaneous and actual employment only partially adjusts to the optimal level desired by firms:

$$(6) \Delta \log L_{it} = \lambda (\log L_{t-li}^* - \log L_{t-li})$$

where $\log L_{t-li}^*$ represents the optimal level of employment desired by firms. The higher the degree of persistence λ , the lower the employment response in the short run. By substituting the labour demand function (5) into (6) it is possible to obtain an error correction mechanism. However, the long-run equilibrium ($\Delta \log L_{it} = 0$) can be already inferred from the analysis of equation (5).

For the panel of countries equation (5) can be written as:

$$(7) \log L_{itc} = \sigma_{ic} \log \alpha_{ic} + \beta_{ic} \log Y_{itc} + \gamma_{ic} \left(\log \frac{w_{itc}}{p_{itc}} \right) + \nu_{ic} t + \delta_{ic} macro_{itc} + \varphi_{ic} inst_{itc} + \varepsilon_{itc}$$

where the subscript c denotes countries (Germany, Spain, France, Italy and the Netherlands).

Given that this paper is focused on labour demand, in principle there is no problem of identification in terms of labour demand or supply. Furthermore, one could argue that equation (5) allows identifying a labour demand equation as the deflator used for real wages (i.e. the value added deflator) is indeed the relevant one for firms. The additional macro variables, which aim at capturing the cost of globalisation and

⁴ See for instance Hamermesh and Pfann (1996).



of other input prices on employment decisions, are also relevant for the profit maximisation problem of firms. Finally, the institutional variables chosen, as argued above, should affect labour demand decisions.

As regards the estimation strategy, in order to capture both the long-term equilibrium relationship of labour demand and the short-term dynamics we have followed the traditional two-step estimation procedure of Engel and Granger, 1987.

The long-run specification of labour demand was estimated for each country according to equation (5) above, substituting the residual $\hat{\varepsilon}_{t-li}$ into equation (5) to get the ECM representation of labour demand:

$$(8) \quad \Delta \log L_{t_i} = \tilde{\beta}_i \Delta \log Y_{t_i} + \tilde{\gamma}_i \left(\Delta \log \frac{w_{t_i}}{p_{t_i}} \right) + \tilde{\delta}_i \Delta macro_{t_i} + \tilde{\varphi}_i \Delta inst_{t_i} \\ - \gamma (\log L_{t-li} - \sigma_i \log \alpha_i - \beta \log Y_{t-li} - \gamma_i \log \frac{w_{t-li}}{p_{t-li}} - \nu_i t - \delta_i macro_{t-li} - \varphi_i inst_{t-li}) + \xi_{t_i}$$

where the parameters $\tilde{\beta}$, $\tilde{\gamma}$, $\tilde{\delta}$, $\tilde{\varphi}$ are the short-run elasticities of labour demand to the output gap, real wages, macroeconomic variables and institutional variables, respectively. The last term in square brackets of equation (8) is the error-correction term which can be interpreted as reflecting disequilibrium responses of labour demand to the explanatory variables. γ is the loading factor, capturing the speed of adjustment to disequilibrium. Equation (8) is estimated separately for Germany, Spain, Italy, France and the Netherlands, using OLS techniques⁵.

Dynamic panel estimation techniques are used to estimate the following equation for the panel of five countries examined:

$$(9) \quad \Delta \log L_{t_{ic}} = \tilde{\beta}_{ic} \Delta \log Y_{t_{ic}} + \tilde{\gamma}_{ic} \left(\Delta \log \frac{w_{t_{ic}}}{p_{t_{ic}}} \right) + \tilde{\delta}_{ic} \Delta macro_{t_{ic}} + \tilde{\varphi}_{ic} \Delta inst_{t_{ic}} \\ - \gamma (\log L_{t-lic} - \sigma_{ic} \log \alpha_{ic} - \beta \log Y_{t-lic} - \gamma_{ic} \log \frac{w_{t-lic}}{p_{t-lic}} - \nu_{ic} t - \delta_{ic} macro_{t-lic} - \varphi_{ic} inst_{t-lic}) + \xi_{t_{ic}}$$

where the sub-script c refers to countries and the rest of the notation is the same as in equation (8). To estimate equation (9) we have used three econometric techniques (see Pesaran et al., 1999, and Hahn, 2004, for an application to the labour market): the mean group (MG), the pooled mean group (PMG) and the dynamic fixed effects (DFE). The MG estimator imposes no restrictions of the coefficients across groups, its estimates being the averages of the coefficients across countries. On the contrary, the DFE constrains the coefficients and the error variance to be the same across groups and only the intercepts are allowed to differ across groups. The PMG is between these two cases, given that the short-run dynamics are allowed to differ freely across groups whilst the long-run coefficients are imposed to be the same across countries. The latter is justified by the fact that the long-run equilibrium between employment growth and the key

⁵ Newey-West standard errors have been computed, to correct for autocorrelation and heteroskedasticity of unknown forms.

macroeconomic variables investigated should be similar across countries enjoying similar levels of economic and technological developments such as the five euro area countries considered. Presenting alternative estimates was considered more informative than assuming a priori certain restrictions on the short and long-term coefficients across countries, which would lead to the selection of one estimation technique.

The specification search in the estimation of long-run labour demand follows three steps for each country and sector: (i) a basic specification with real wages, trend GDP and a time trend is used as a starting point and trend GDP is retained if statistically significant (ii) macroeconomic variables are added (real effective exchange rate and terms of trade) to the basic specification and retained if statistically significant (iii) structural variables are added (the replacement rate, the index of product market regulation, the index of employment protection legislation and the union density⁶) and retained if statistically significant. The presence of indirect effects of the structural variables on labour demand via wages was also tested, multiplying each structural variable by real wages (following for example Annett, 2007). However, no statistically significant indirect effects of the structural variables considered have been found. For each country and sector analyzed, the same procedure is followed for the specification search of the short-term labour demand.

3. Labour demand across the euro area countries and across the key sectors of the economies

3.1 Some key features of the data

Before discussing the empirical results, a few features of the dataset are worth mentioning. For a detailed description of the variables used in the estimation see Appendix E.

Due to the fact that institutional variables are available at low frequency, the data used for the estimates are annual and run from 1970 to 2006 both for the total economy and for the three macro sectors: manufacturing, construction and services⁷. The choice of the sectors analysed is fully consistent with national account definitions, with the advantage of avoiding arbitrary classifications of sub-sectors into, for example, tradable and non tradable. At the total economy level two specifications have been estimated, making use of two employment concepts: total employment in full-time equivalent and the employment rate. Using the employment series in full-time equivalent allows controlling for institutional changes in working hours as well as for labour market reforms focused on enhancing the flexibility of temporary and part-time jobs. By using the employment rate one can control for the effects of special phenomena which have affected the labour force, such as immigration. Results in terms of employment rates are presented in

⁶ The union coverage could be a more appropriate indicator, given that workers not directly joining trade unions could nevertheless be benefiting from the outcome of collective agreements. Long time series data for union coverage for the countries of interest are however unavailable.

⁷ Data for construction and services for France end in 2005. Data for construction and services for Spain start in 1980. Data for Germany prior to 1991 are constructed backward by using the growth rates of West Germany.

Appendix C1 and can be considered as a robustness check against results in terms of employment in full time equivalent.

Charts 1-4 show the dynamics of employment in full time equivalent between 1980 and 2006⁸. At the total economy level Chart 1 shows a very strong employment dynamics in Spain and the Netherlands from the mid 1980s. Italy and France saw a relatively good employment dynamics from the mid 1990s, while in Germany employment shows a limited but persistent deterioration and a stabilisation occurring during the past five years. At the sectoral level, in the manufacturing sector (Chart 2) employment in full time equivalent has been on a declining trend in all countries up to 1995. During the past 10 years countries have witnessed a rather diverse path. The decline in employment has continued in Germany and France, but it stopped in the Netherlands and Italy. In Spain, employment dynamics has been very strong between 1995 and 2002, while it has stabilised since then. In the construction sector (Chart 3), employment in full time equivalent has been broadly stable or declining in all countries, with the exception of Spain where it showed an exponential increasing path since 1995. Finally, in the services sector (Chart 4) all countries have witnessed a relatively good employment performance, with Spain outperforming since the mid 1990s.

⁸ To facilitate the comparisons the data in the charts start in 1980, as sectoral data for Spain are not available before 1980.

Chart 1 – Employment in full time equivalent – total economy (1980=100)

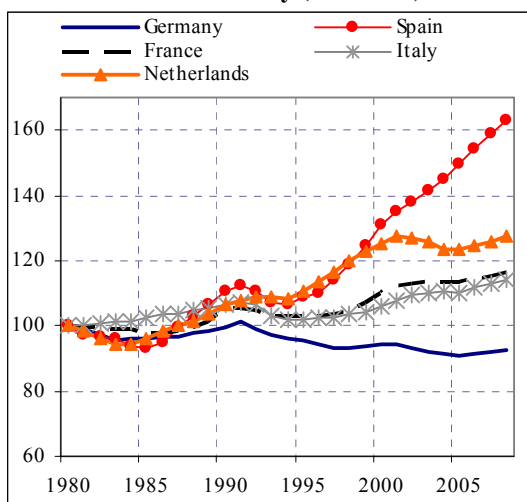


Chart 2 – Employment in full time equivalent – Manufacturing (1980=100)

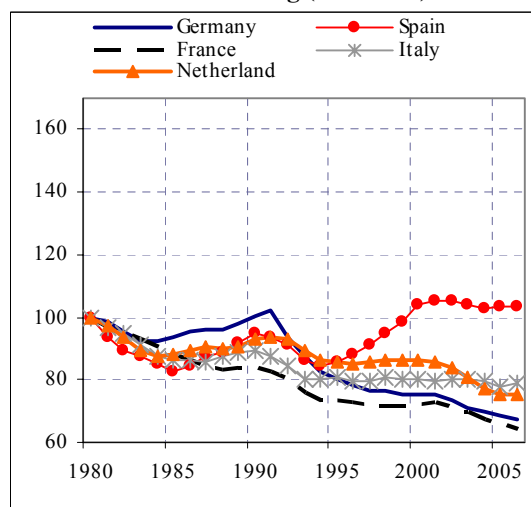


Chart 3 – Employment in full time equivalent - construction (1980=100)

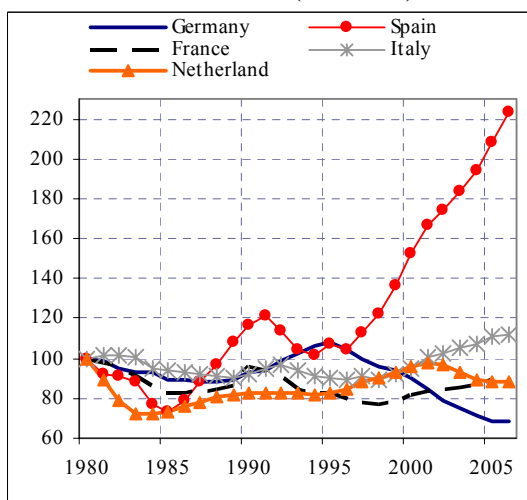
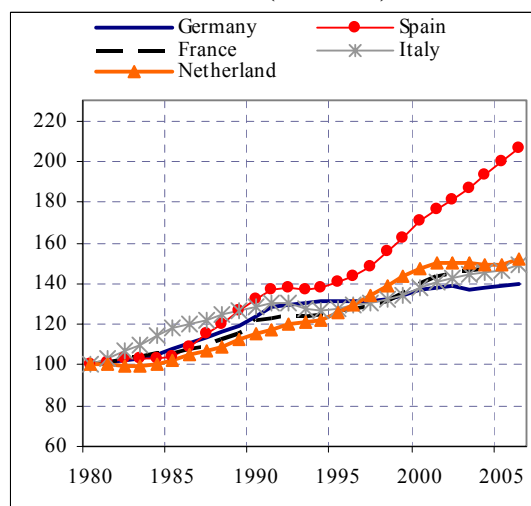


Chart 4 – Employment in full time equivalent - services (1980=100)



Source: European Commission (Ameco database)

Charts 5 to 8 show the dynamics of real labour cost between 1980 and 2006. The real labour cost measure is obtained by deflating nominal wages with the output deflator. The concept of nominal wage used is that of compensation per employee (in full time equivalent), i.e. the overall compensation paid by employers. The overall compensation is a gross concept, not only it includes gross wages but also the impact of employers' social security contributions as well as the wage drift.

As can be seen in Charts 5-8, real labour cost (real compensation per employee) behaved rather differently across the five euro area countries examined during the past 25 years. It emerges quite clearly that the two extreme countries in terms of employment performance, Spain and Germany (Chart 5) have also witnessed very different real wage dynamics since the mid 1990s.

Chart 5 – Real labour cost – total economy (1980=100)

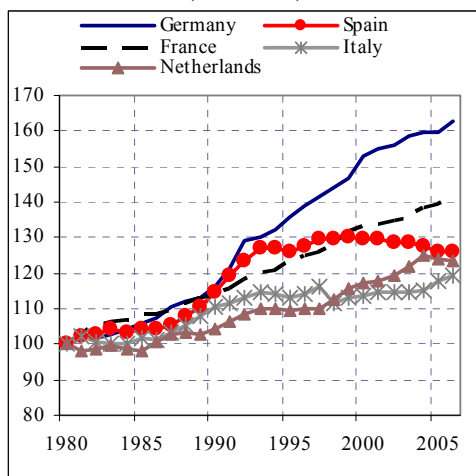


Chart 6 – Real labour cost - manufacturing (1980=100)

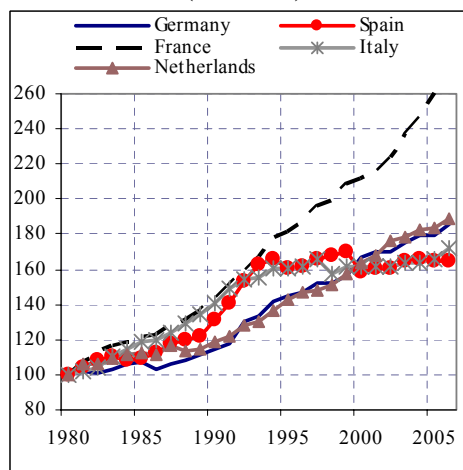


Chart 7 – Real labour cost – construction (1980=100)

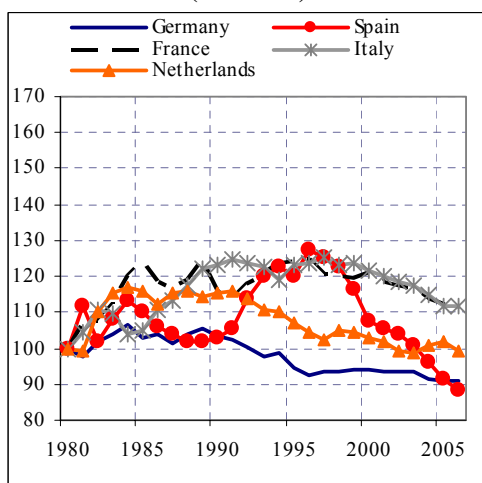
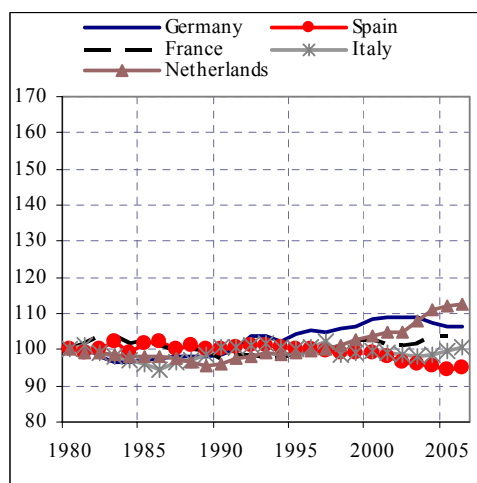


Chart 8– Real labour cost - services (1980=100)



Source: European Commission (Ameco database)

Four key institutional/policy variables are used in the long and short-term specifications: an index of product market regulation, which is increasing with the degree of regulation in product markets, an index of employment protection legislation, which is increasing with the degree of protection in the labour market, the union density, which is an increasing function of the power of unions in a country and the replacement rate, defined as the benefit entitlement before tax as a percentage of previous earnings before tax. As explained before, this variable is meant to capture the “wage floor” or reservation wage of the employees. Given that labour taxes are already included in the labour cost measure used, there was no need to add the tax wedge as additional explanatory variable in the right hand side of the labour demand equation.

As some of the structural variables capture structural changes which may take place at low frequency, in some instances they may appear like step variables. Therefore, by construction the dynamics of some

structural variables may result poorly correlated with that of employment. It might therefore be difficult to capture their effects in the estimates of labour demand.

3.2 Cross-country results – The long-run relationship

The long-run relationship between employment and real wages is significant in almost all countries, a result which is confirmed by the pooled approach (see section 3.4). However, long-run employment elasticities to real wages differ somewhat across countries and sectors (Tables A1 – A4 in Appendix A). In particular, for the total economy, the elasticity is strongest in the Netherlands (0.7), Spain and Germany (0.6) and weakest in Italy (0.2). France is the only country where such elasticity was found not significant (see Table A1 in Appendix A).

At the sectoral level the country-ranking changes somewhat. In the manufacturing sector (Table A2 in Appendix A), the elasticity is strongest in Germany (0.7), the Netherlands (0.6) and France (0.5) and it is weakest in Spain (0.3). In Italy, the coefficient was found not significant. The relatively similar long run elasticities found in Germany, the Netherlands and France might be associated to a similarly high degree of substitution between labour and capital in the manufacturing sector in these three countries. If the degree of substitution between the two factors of production is elevated, then one might expect that the labour demand responds more strongly to changes in the relative price of the labour input. A higher substitution between labour and capital can be expected for low skilled workers, whilst high-skilled workers are likely to be complement rather than substitute of capital (see EC, 2007). Differences in the skill composition of the labour force across countries and sectors may thus also affect the magnitude of the elasticity of labour demand to real wages. Moreover and importantly, one can interpret the relatively high slope of the labour demand as a signal of high labour market flexibility (or relatively low employment protection) in the manufacturing sector (see EC, 2005).

In Italy the subdued pattern of employment in the manufacturing sector during a period of relatively moderate real labour costs, might be related to “exogenous” factors, such as high competition from low costs countries in low-tech products which has recently triggered an important industrial restructuring⁹.

In the construction sector, the long-run employment elasticity to real wages is strongest in the Netherlands and Spain (0.7), followed by France and Germany (0.5) and Italy (0.3). In the case of Spain, the strong immigration inflow in recent years might help explaining the higher slope of the labour demand as immigrants have boosted the labour supply and this is likely to have reduced workers bargaining power in the construction sector. In the service sector, the elasticity is strongest in Spain (0.8) and the Netherlands (0.6) followed by Italy (0.4) and Germany (0.2). In France the coefficient is not significant. Again, in the case of Spain, the downward shift in labour supply due to immigration might explain the higher elasticity in the service sector. Given the high share of the service sector in the total economy, it appears that in the case

⁹ See Daveri and Jona-Lasinio, 2005.

of France the result for services affect that of the total economy. It should be also pointed out that services include some not market services, such as education, health care and public administration, whose share in France is particularly high (see ECB, 2006¹⁰). More generally, employment decisions in non-market services are likely to be less dependent from the relative remuneration of labour as well as from productivity considerations. Thus, in light of this fact, labour demand results for the service sector may be expected to be weaker than for the other sectors.

As regards the employment elasticity to output, the total economy results indicate clearly that the restriction of unitary elasticity emerging from equation (3) can only be accepted in Germany and Italy, while in Spain, France and the Netherlands this elasticity appears to be greater than one. In Table C2 in Appendix C, estimation results for the total economy of specifications where the employment elasticity to output has been imposed equal to 1 are however reported. These results are remarkably similar to those reported in Table A1, pointing to the robustness of the estimates across countries with respect to this specification choice.

At the sectoral level, in all countries (except in the Netherlands) the unitary restriction can be broadly accepted in the case of services. While the response of employment to output appears rather uniform in the service sector, different cross-country responses occur in the manufacturing and construction sector, with the employment elasticity to output ranging from 0.3 to 3.6 in the former and from 0.7 to 3.8 in the latter.

Moving to the competitiveness indicators, they were found significant only in Italy and France in the manufacturing sector. As to the institutional variables, a prominent role appears to be played by the index of product market regulation, which was found significant in Germany, Italy and France at the total economy level. The rationale behind this result is that in more regulated product markets, weaker competition and barriers to entry allow incumbent firms to appropriate part of the improved labour supply conditions in the form of higher rents (see for example Estevao, 2005). The positive effect of wage-moderation on employment growth would therefore be larger in countries and/or sectors where product markets are less strictly regulated. In a few countries the replacement rate and the union density were found significant (Spain, France and the Netherlands), while the index of employment protection legislation was found significant only in the Netherlands. The other institutional variables were found not significant.

At the sectoral level, the importance of the degree of product market regulation for labour demand is not confirmed in manufacturing, is only confirmed for France in the service and construction sector and for Italy in the construction sector. Interestingly, although to a rather limited extent, the results seem to suggest that the effects of product market regulation on employment would be stronger in sectors which are more regulated than manufacturing. As to the replacement rate, this variable enters significantly in the manufacturing and construction sector of Spain and in the service sector of Italy. Higher union density appears to be associated with lower employment growth in France in the manufacturing sector and for the

¹⁰ “Community, social and personal services” accounted for 25% of value added in France in 2002 compared to an average close to 22% in the euro area in the same year.

Netherlands in the construction sector. Finally, stricter employment protection legislation hampers employment growth in the three macro sectors of the Netherlands.

In summary, the long-run relationships reveal the prominent role of the real labour cost across most countries in affecting labour demand. They also show a significant degree of diversity as regards the size of the employment elasticities to real wages (with Germany, the Netherlands and Spain generally exhibiting higher elasticities) and also as regards the other determinants of the labour demand: trend output, competitiveness and institutions. Differences in the slope of the labour demand across countries might be related to a different degree of substitution between factor inputs also due to heterogeneous skills in labour supply across countries and sectors; however, digging into this issue would require a more detailed micro analysis. Importantly, these differences might also be related to a different degree of labour market flexibility across countries. The role of institutional/structural variables in the labour demand appears rather heterogeneous across countries, probably reflecting institutional differences and the different degree of flexibility of these economies.

3.3 Cross-country results – The short-run dynamics

Moving to the short-run dynamics, higher real wage growth dampens employment growth in almost all the countries and sectors examined. Starting with the total economy results, across countries, the short-run elasticity is strongest in Spain (0.7), followed by Germany (0.4), the Netherlands (0.3) and Italy (0.2). In France the coefficient on real wage growth is negative but the uncertainty surrounding this estimate is too large for the elasticity to be considered significant (See table A1 in Appendix A). The results confirm that the recent good employment performance can be related, to a different extent, to the relative high degree of wage moderation observed in the recent past. This is particularly the case of Spain, but also of Germany, the Netherlands and Italy. At the sectoral level the ranking across countries changes somewhat. In particular, in the manufacturing sector the elasticity is highest in Germany (0.5), followed by Spain (0.3) and the Netherlands (0.2). In France and Italy the coefficient is not significant. In the construction sector, in all countries the coefficient on real wage growth is significant and rather high. This might be related to the fact that the relatively low-skill nature of the labour supply in the construction sector implies a relatively high degree of substitutability between insiders and outsiders, leading to a steeper labour demand curve. In particular, this elasticity is the highest in Spain (1.1) and the smallest in Germany and Italy (0.3). In the service sector, the coefficient on real wages is highest in the Netherlands (0.5), followed by Germany (0.3), Spain and Italy (0.2). In general, as in the long-run, the short-run elasticities of employment to real wages appear higher in Spain, Germany and the Netherlands compared to Italy and France. This country grouping tend to suggest that the first group has a higher degree of labour market flexibility as measured by the reaction of the labour demand to changes in the real labour cost.

The output gap enters significantly in all equations with only a few sectoral exceptions suggesting that employment follows a pro-cyclical pattern. The short-run elasticities of labour demand to the output gap is however generally fairly low, in line with the observed employment resilience since the early 2000s accompanied by a business cycle downturn witnessed by most euro area economies.

As regards the other macroeconomic variables, the short-run dynamics appears little affected by movements in oil prices or in competitiveness. In particular, at the total economy level only in the Netherlands the oil price and the terms of trade were found significant, where lower oil prices and higher competitiveness positively affect employment growth. At the sectoral level, the oil price affects the labour demand in a few countries: Spain and France in the manufacturing sector, Spain in the construction sector. The fact that competitiveness variables do not enter significantly in most of the countries analysed might be due to the fact that increased competitiveness has an impact on wages and thus affects labour demand only indirectly¹¹.

Among the institutional variables investigated, a lower growth in the replacement rate was found to positively affect employment growth in Spain and Italy at the aggregate level, suggesting that low unemployment benefits replacement rates (which can be considered a proxy for wage floors or reservation wages created by social transfers) could foster employment creation in some countries. At the sectoral level, the OECD indicator of product market regulation was found statistically significant in Italy in the construction sector. The indicator of union density is significant in France in the construction sector and the employment protection index in the Netherlands in the service sector.

With only a few exceptions (namely the construction sector in the Netherlands and Spain), the coefficient of the error-correction term is statistically significant and negative across countries and sectors, as one would expect, suggesting the importance of adjustments out of equilibrium dynamics in labour demand equations. The fit of the models is generally quite good especially in the case of Germany, Spain and the Netherlands.

As a robustness check, estimations of an economy-wide¹² labour demand equation using the employment rate rather than the employment growth are reported in Table C1 in Appendix C. Similar results to those reported for employment level and growth are obtained. In the case of the Netherlands, somewhat higher short and long-run employment elasticities to real wages are obtained. For France, the coefficient for real wages in the short-run is statistically significant.

3.4 Panel results - The long-run relationship

From the above description of the cross-country results it appears evident that there are significant differences across countries in terms of magnitude of the elasticities of employment with respect to real

¹¹ Other recent works have tested the role of the degree of openness in labour demand. See for example Bruno, G., A. M. Falzoni, R. Helg (2004) who show that the degree of openness affects the elasticity of labour demand indirectly via real wages.

¹² Only economy-wide estimates are reported given the unavailability of sectoral employment rates.

wages, the macroeconomic and institutional variables. Moreover, the specifications seem to differ considerably across countries and sectors. This notwithstanding, pooling the country data is a commonly used methodology to increase the number of available observations and the efficiency of the estimates (see Bassanini and Duval, 2006). For this purpose, three econometric estimation techniques are used (see Pesaran et al., 1999, and Hahn, 2004): the mean group (MG), the pooled mean group (PMG) and the dynamic fixed effects (DFE).

Results are reported in Tables B1 to B4 in Appendix B. For the total economy, the long-run elasticity of employment growth to real wages is relatively high, between 0.9 and 0.8, while it is slightly lower in the case of manufacturing and construction. In the case of the service sector it varies considerable across methodologies (from 1.8 to 0.4). For the total economy and across all sectors and specifications, the coefficient for real wages is correctly signed and always statistically significant (in almost all cases at the 1% confidence level). Apart from the relatively large range of elasticities found in the service sector, the panel estimates show rather similar results across methodologies. Thus the pooling of countries, irrespective of the method used, confirms the results that labour cost is a key determinant for the labour demand.

Trend GDP and trend value added are in most cases statistically significant and correctly signed. The elasticities are close to 1 in the case of PMG and DFE for the total economy and generally different from 1 in the other estimates.

The macroeconomic and structural variables discussed in the previous section are generally not statistically significant in the pooled estimates, with the exception of the replacement rate for the service sector in the case of the PMG and the DFE (see Table B4). This result may be related to the fact that the macroeconomic and structural variables appear to affect labour demand in specific countries and sectors but not across the board (see Section 3.2. and 3.3).

3.5 Panel results - The short-term relationship

Moving to the short-run dynamics, results differ somewhat compared to the country estimates. Higher real wage growth dampens employment growth in the construction sector (across methodologies) whilst for the total economy, the manufacturing and services sector this is the case only for the DFE estimation. The elasticity of labour demand to real wages (between 0.3 and 0.1) is generally smaller than for the country estimates.

As for the country results, the output gap enters significantly in all equations (and across methodologies) suggesting a pro-cyclical pattern. The short-run elasticities of labour demand to the output gap are however generally fairly low, confirming the results obtained for the individual countries.

The pooled short-run dynamics does not appear affected by the additional macroeconomic variables analysed.

Among the institutional variables investigated, the OECD indicator of product market regulation is statistically significant and correctly signed in the case of the construction sector (see Table B3). The result is robust across methodologies.

Finally and in line with the country results, the coefficients of the error-correction term are statistically significant and negative across sectors and methodologies, as one would expect, suggesting the importance of adjustments and out of equilibrium dynamics in labour demand equations.

3.6 Comparisons with other studies

Bearing in mind that comparisons with other studies should be taken with caution given differences in the sample periods analysed, in country coverage and methodologies applied, the summary table below shows a comparison of estimates of the long run elasticity of labour demand to real wages for the total economy.

Author	Sample period	Countries	Real wage coefficient
Annett (2007)*	1980-2003	Panel 14 EU countries	-0.1
EC (2005)#	1970-2003	EU12 Germany France Italy Spain Netherlands	-0.5 -1.2 -0.5 -0.1 -1.1 -1.2
Mourre (2006)	1970Q1-2002Q2	Euro area	-0.6 / -0.5
Pierluigi, Roma (2008)	1970-2006	Panel 5 largest EA countries Germany France Italy Spain Netherlands	-0.9 / -0.8 -0.6 -0.5 -0.2 -0.6 -0.7

* Non-government employment

Persons for EU12 and hours for euro area countries

The table shows that our panel estimates are slightly higher than the estimate in Mourre (2006), EC (2005) and Annett (2007). Country estimates for the total economy in EC (2005) point to the same country grouping as we have in terms of the magnitude of the elasticity of labour demand to real wages, namely Germany, Spain and Netherlands with a higher elasticity and Italy and France with lower elasticity. In the case of France, in EC, 2005, the long-run elasticity of real wages to employment is 0.5 and real wages are

statistically significant in explaining employment growth. In our case a similar coefficient was found but not significant (see Table A1).

4. Conclusions

This paper studies the role of wage moderation and labour and product market regulation for employment creation. It presents a set of estimates for the labour demand in the five largest euro area countries (Germany, France, Italy, Spain and the Netherlands) from 1970 to 2006 at the total economy level and for three macro sectors: manufacturing, construction and services. Estimates are carried out for individual countries as well as for the pooled group of countries.

The results show that labour cost moderation generally helps employment creation and that elasticities of employment to labour costs vary across countries and sectors. In general, both in the long and short-run, elasticities of employment to real wages appear higher in Spain, Germany and the Netherlands compared to Italy and France, suggesting a higher degree of labour market flexibility in the former three countries.

In particular, contained growth in real wages is found to be supportive for employment growth in Germany, Spain, Italy, the Netherlands and the pooled panel for the aggregate economy. The economy-wide results are also broadly confirmed at the sectoral level.

In France, the long term employment elasticity to real wages is found significant only in the manufacturing and construction sector. The high share of public wages in the service sector in France might be one of the reasons for the fact that real wages are not statistically significant in explaining employment developments in this sector.

We also find that in some cases institutional/structural variables are able to explain, to some extent, labour demand developments. In particular, in some countries and sectors our results support the negative link between employment growth and the unemployment benefit replacement rate, which can be considered a proxy for wage floors or reservation wages created by social transfers. Additionally, stricter regulation in product markets is found to hamper employment growth in some countries (notably Germany, France and Italy) and sectors (mainly in the construction sector). These results seem to support the view that the positive effect of wage-moderation on employment growth would be larger in countries and sectors where product markets are less strictly regulated. However, some caution is required in interpreting these results. Pooled estimates indicate that, in general, structural variables do not seem to add in explaining employment growth probably due to their heterogeneous effects across countries and sectors. This may reflect institutional differences and the different degree of flexibility of each economy.

Finally, pooled estimates also suggest that even if results are qualitatively broadly similar across methodologies, at the sectoral level the magnitude of the estimates differs somewhat depending on the estimation techniques used.

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Appendix A: Cross-country Results

Table A1: TOTAL ECONOMY – total employment in full time equivalent in the left-hand side

Error correction specifications

The dependent variable is the change in employment (emh_dl)

Employment growth (emh_dl)	Germany ⁽¹⁾	Spain ⁽¹⁾	Italy ⁽¹⁾	France ⁽¹⁾	Netherlands ⁽¹⁾
Output gap (gap)	0.005*** (0.00)	0.008*** (0.00)	0.003*** (0.00)	0.009*** (0.00)	0.006*** (0.00)
Changes in real wages (rw_dl)	-0.43*** (0.11)	-0.72*** (0.18)	-0.14** (0.07)	-0.20 (0.26)	-0.28*** (0.08)
Error correction coefficient (emh_ecm_lag1)	-0.56*** (0.10)	-0.40*** (0.07)	-0.44*** (0.12)	-0.53*** (0.18)	-0.44*** (0.05)
Replacement rate (rep_dl)		-0.16*** (0.04)	-0.005* (0.00)		
Oil price (oil_r_nc_l)					-0.01*** (0.00)
Terms of trade (tot)					0.28*** (0.06)
Real effective exchange rate (reer_ppi_l)			0.09*** (0.03)		
constant	0.005 (0.003)	0.03*** (0.00)	-0.42*** (0.15)	0.01 (0.01)	-0.26*** (0.06)
R-squared	0.57	0.66	0.69	0.40	0.76
Observations	36	36	35	36	36
Diagnostic Tests					
RESET original, p value	0.08	0.36	0.00	0.04	0.76
Normality, p value	0.32	0.83	0.87	0.00	0.79

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

(1) Newey-West standard error are reported, which are consistent with autocorrelation and heteroskedasticity of unknown form

Long-run specifications

The dependent variable is the employment level (emh_l)

Employment level (emh_l)	Germany	Spain	Italy	France	Netherlands
GDP level (trend_l)	1.05*** (0.24)	1.52*** (0.23)	0.95*** (0.17)	1.45*** (0.46)	1.97*** (0.20)
Real wages in level (rw_l)	-0.58*** (0.09)	-0.58*** (0.10)	-0.24** (0.12)	-0.45 (0.44)	-0.69*** (0.08)
time trend (ttrend_l)	-0.01* (0.00)	-0.02*** (0.01)	-0.01*** (0.00)	-0.03*** (0.01)	-0.03*** (0.00)
Product market regulation (regref_l)	-0.04** (0.02)		-0.12*** (0.03)	-0.36*** (0.08)	
Replacement rate (rep_l)		-0.20*** (0.05)			
constant	0.95 (1.92)	-1.2 (1.56)	3.07** (1.50)	-0.63 (4.46)	-4.44*** (1.20)
R-squared	0.89	0.94	0.93	0.77	0.96
Observations	37	37	37	37	37
Augmented Dickey-Fuller (p-value)	0.00	0.01	0.15	0.00	0.00

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Table A2: MANUFACTURING**ECM Specifications / Manufacturing sector****The dependent variable is the change in employment in the manufacturing sector (emh_m_dl)**

Employment growth (emh_m_dl)	Germany ⁽¹⁾	Spain ⁽¹⁾	Italy ⁽¹⁾	France ⁽¹⁾	Netherlands ⁽¹⁾
Manufacturing value added gap (va_m_gap)	0.005*** (0.001)	0.007*** (0.001)	0.004*** (0.00)	0.005*** (0.001)	0.003* (0.002)
Changes in real wages (rw_m_dl)	-0.49*** (0.14)	-0.26** (0.116)	-0.08 (0.08)	0.04 (0.126)	-0.222* (0.114)
Error correction coefficient (emh_m_ecm_lag1)	-0.32** (0.15)	-0.994*** (0.104)	-0.52*** (0.11)	-0.33** (0.17)	-0.52* (0.26)
Replacement rate (rep_dl)		-0.204*** (0.054)			
Oil price (oil_r_nc_l)		-0.029*** (0.005)		-0.009** (0.004)	
Real effective exchange rate (reer_ppi_l)					
constant	0.001 (0.006)	0.028*** (0.003)	0.02** (0.007)	-0.009** (0.004)	-0.004 (0.005)
R-squared	0.62	0.89	0.68	0.57	0.48
Observations	36	26	36	36	24
Diagnostic Tests					
RESET, p value	0.00	0.73	0.95	0.96	0.47
Normality, p value	0.01	0.56	0.95	0.27	0.53

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

(1) Newey-West standard error are reported in brackets, which are consistent with autocorrelation and heteroskedasticity of unknown form

Long-run specifications / Manufacturing sector**The dependent variable is the employment level in the manufacturing sector (emh_m_l)**

Employment level (emh_l)	Germany	Spain	Italy	France	Netherlands
Trend value added (trend_m_l)	1.43*** (0.46)	3.55*** (0.62)	0.31** (0.17)	2.00*** (0.34)	2.20*** (0.36)
Real wages in level (rw_m_l)	-0.65*** (0.00)	-0.31*** (0.07)	-0.29 (0.19)	-0.48*** (0.14)	-0.62*** (0.16)
time trend (ttrend_l)	-0.01* (0.00)	-0.06*** (0.014)	-0.005*** (0.002)	-0.047*** (0.013)	-0.042*** (0.01)
Product market regulation (regref_l)					
Replacement rate (rep_l)		-0.23*** (0.086)			
Employment protection (Epl_l)					-0.18** (0.072)
Union density (Undens_l)				-0.12*** (0.05)	
Terms of trade (tot)			0.22*** (0.07)	0.15* (0.08)	
constant	-1.40 (2.61)	-6.82*** (2.62)	5.75*** (1.51)	-2.34* (1.30)	-2.56* (1.28)
R-squared	0.92	0.90	0.88	0.99	0.91
Observations	37	27	37	37	25
Augmented Dickey-Fuller (p-value)	0.09	0.02	0.01	0.02	0.00

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Table A3: CONSTRUCTION**ECM Specifications / Construction sector**

The dependent variable is the change in employment in the construction sector (emh_h_dl)

Employment growth (emh_c_dl)	Germany ⁽¹⁾	Spain ⁽¹⁾	Italy ⁽¹⁾	France ⁽¹⁾	Netherlands ⁽¹⁾
Construction value added gap (va_m_gap)	0.006*** (0.001)	0.005*** (0.002)	0.005*** (0.001)	0.003*** (0.0006)	0.002* (0.001)
Changes in real wages (rw_c_dl)	-0.28*** (0.08)	-1.13*** (0.24)	-0.26** (0.12)	-0.47*** (0.12)	-0.567* (0.275)
Error correction coefficient (emh_c_ecm_lag1)	-0.58*** (0.097)	-0.28 (0.26)	-0.60*** (0.06)	-0.54*** (0.14)	0.084 (0.29)
Product market regulation (regref_dl)			-0.24*** (0.073)		
Union density (undens_dl)				-0.25** (0.12)	
Oil price (oil_r_nc_l)		-0.046** (0.02)			
constant	-0.012** (0.006)	0.05*** (0.017)	-0.004 (0.005)	-0.009 (0.006)	-0.0025 (0.0074)
R-squared	0.72	0.70	0.64	0.67	0.33
Observations	36	26	36	35	24
Diagnostic Tests					
RESET, p value	0.63	0.95	0.94	0.23	0.10
Normality, p value	0.11	0.74	0.37	0.61	0.72

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

(1) Newey-West standard error are reported in brackets, which are consistent with autocorrelation and heteroskedasticity of unknown form

Long-run specifications / Construction sector

The dependent variable is the employment level in the construction sector (emh_h_l)

Employment level (emh_l)	Germany	Spain	Italy	France	Netherlands
Trend value added (trend_c_l)	1.48*** (0.10)	-	0.77*** (0.27)	1.094*** (0.31)	3.83*** (0.38)
Real wages in level (rw_c_l)	-0.49*** (0.11)	-0.71*** (0.16)	-0.30** (0.14)	-0.52*** (0.18)	-0.69*** (0.17)
time trend (ttrend_l)	0.00002 (0.0008)	0.046*** (0.028)	-0.006** (0.003)	-0.061*** (0.004)	-0.029*** (0.003)
Product market regulation (regref_l)			-0.169** (0.067)	-0.189*** (0.116)	
Replacement rate (rep_l)		-1.09*** (0.197)			
Employment protection (Epl_l)					-0.24*** (0.054)
Union density (Undens_l)					-0.36*** (0.087)
constant	-0.73 (0.69)	7.209*** (1.10)	3.58*** (1.29)	-1.37 (1.59)	-5.41*** (1.11)
R-squared	0.91	0.97	0.84	0.99	0.97
Observations	37	27	37	36	25
Augmented Dickey-Fuller (p-value)	0.00	0.00	0.01	0.01	0.01

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Table A4: SERVICES**ECM Specifications / Service sector**

The dependent variable is the change in employment in the service sector (emh_h_dl)

Employment growth (emh_c_dl)	Germany ⁽¹⁾	Spain ⁽¹⁾	Italy ⁽¹⁾	France ⁽¹⁾	Netherlands ⁽¹⁾
Service value added gap (va_s_gap)	-	0.011*** (0.002)	0.003* (0.002)	0.005*** (0.001)	0.003*** (0.001)
Changes in real wages (rw_s_dl)	-0.296*** (0.09)	-0.24** (0.13)	-0.16** (0.08)	-0.049 (0.08)	-0.54* (0.30)
Error correction coefficient (emh_s_ecm_lag1)	0.03 (0.12)	-0.61*** (0.07)	-0.33** (0.14)	-0.42** (0.18)	-0.98*** (0.345)
Replacement rate (rep_dl)					-0.142** (0.056)
Employment protection (Epl_dl)					-0.083* (0.026)
Real effective exchange rate (reer_ppi_l)		-0.124*** (0.039)			
constant	0.013*** (0.003)	0.59*** (0.17)	0.02*** (0.003)	0.017 (0.002)	0.021*** (0.002)
R-squared	0.14	0.78	0.38	0.50	0.58
Observations	36	26	36	35	24
Diagnostic Tests					
RESET, p value	0.27	0.96	0.65	0.10	0.31
Normality, p value	0.84	0.76	0.17	0.84	0.55

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

(1) Newey-West standard error are reported in brackets, which are consistent with autocorrelation and heteroskedasticity of unknown form

Long-run specifications / Service sector

The dependent variable is the employment level in the service sector (emh_h_l)

Employment level (emh_l)	Germany	Spain	Italy	France	Netherlands
Trend value added (trend_s_l)	1.17*** (0.11)	0.80* (0.49)	1.05*** (0.13)	0.86*** (0.19)	1.95*** (0.26)
Real wages in level (rw_s_l)	-0.20* (0.11)	-0.78* (0.406)	-0.43** (0.16)	-0.12 (0.07)	-0.60*** (0.10)
time trend (ttrend_l)	-0.019* (0.003)	0.036 (0.017)	-0.005* (0.003)	-0.01* (0.006)	-0.035*** (0.008)
Product market regulation (regref_l)				-0.212*** (0.052)	
Replacement rate (rep_l)			-0.0167*** (0.004)		
Employment protection (Epl_l)					-0.12*** (0.04)
Union density (Undens_l)					
Real effective exchange rate (reer_ppi_l)					
constant	1.48 (0.45)	1.41 (2.86)	1.46 (1.19)	4.09*** (1.24)	-3.17** (1.19)
R-squared	0.99	0.99	0.99	0.99	0.99
Observations	37	27	37	36	25
Augmented Dickey-Fuller (p-value)	0.01	0.01	0.09	0.01	0.00

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Appendix B: Pooled Results

Table B1: Total economy

The dependent variable is the change in employment (emh_dl)

Employment growth (emh_dl)	Mean Group MG	Pooled Mean Group PMG	Dynamic Fixed Effects DFE
Short-run			
Output gap (gap)	0.006*** (0.00)	0.006*** (0.00)	0.006*** (0.00)
Changes in real wages (rw_dl)	-0.16 (0.10)	-0.17 (0.12)	-0.20** (0.10)
Error correction coefficient (emh_ecm_lag1)	-0.38*** (0.1)	-0.29*** (0.07)	-0.26*** (0.04)
constant	2.48* (1.45)	-0.048*** (0.01)	-0.24 (0.26)
Long-run			
GDP level (trend_l)	0.15 (0.41)	1.02*** (0.11)	1.18*** (0.14)
Real wages in level (rw_l)	-0.78*** (0.27)	-0.88*** (0.04)	-0.81*** (0.07)
time trend (ttrend_l)	0.01 (0.01)	0.005* (0.003)	-0.01*** (0.003)
Observations	180	180	180
Log-Likelihood		556	
Hausman test	-	0.63	-

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Table B2: Manufacturing

The dependent variable is the change in employment (emh_m_dl)

Employment growth (emh_m_dl)	Mean Group MG	Pooled Mean Group PMG	Dynamic Fixed Effects DFE
Short-run			
Manufacturing value added gap (va_m_gap)	0.005*** (0.00)	0.005*** (0.00)	0.005*** (0.00)
Changes in real wages (rw_m_dl)	-0.03 (0.09)	-0.13 (0.11)	-0.18*** (0.06)
Error correction coefficient (emh_m_ecm_lag1)	-0.38*** (0.06)	-0.26*** (0.04)	-0.17*** (0.03)
constant	-0.18 (0.94)	0.79*** (0.15)	-0.33** (0.17)
Long-run			
Trend value added (trend_m_l)	1.30*** (0.51)	0.53*** (0.07)	0.56*** (0.14)
Real wages in level (rw_m_l)	-0.57*** (0.09)	-0.69*** (0.05)	-0.92*** (0.11)
time trend (ttrend_l)	-0.02* (0.01)	-0.001 (0.00)	0.004 (0.00)
Observations	170	170	170
Log-Likelihood		511	
Hausman test	-	0.64	-

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Table B3: Construction

The dependent variable is the change in employment (emh_c_dl)

Employment growth (emh_c_dl)	Mean Group MG	Pooled Mean Group PMG	Dynamic Fixed Effects DFE
Short-run			
Construction value added gap (va_c_gap)	0.006*** (0.00)	0.004*** (0.00)	0.005*** (0.00)
Changes in real wages (rw_c_dl)	-0.19** (0.09)	-0.27*** (0.07)	-0.27*** (0.06)
Error correction coefficient (emh_c_ecm_lag1)	-0.53*** (0.02)	-0.39*** (0.05)	-0.45*** (0.03)
Product market regulation (regref_dl)	-0.12* (0.06)	-0.13*** (0.04)	-0.13*** (0.04)
constant	1.26 (0.83)	0.34*** (0.05)	0.41*** (0.1)
Long-run			
Trend value added (trend_c_l)	0.87** (0.42)	1.24*** (0.04)	1.18*** (0.04)
Real wages in level (rw_c_l)	-0.51*** (0.12)	-0.41*** (0.05)	-0.47*** (0.04)
time trend (ttrend_l)	-0.007 (0.006)	-0.002*** (0.00)	-0.003*** (0.00)
Observations	169	169	169
Hausman test	-	0.36	-

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Table B4: Services

The dependent variable is the change in employment (emh_s_dl)

Employment growth (emh_s_dl)	Mean Group MG	Pooled Mean Group PMG	Dynamic Fixed Effects DFE
Short-run			
Services value added gap (va_s_gap)	0.006** (0.002)	0.003** (0.001)	0.003*** (0.00)
Changes in real wages (rw_s_dl)	0.00 (0.11)	-0.01 (0.10)	-0.13** (0.06)
Error correction coefficient (emh_s_ecm_lag1)	-0.52*** (0.17)	-0.13* (0.07)	-0.08*** (0.03)
constant	2.64 (2.57)	0.38* (0.21)	-0.12 (0.25)
Long-run			
Trend value added (trend_s_l)	0.84 (0.54)	0.71*** (0.19)	0.77* (0.43)
Real wages in level (rw_s_l)	-0.43** (0.22)	-0.56*** (0.1)	-1.75*** (0.43)
time trend (ttrend_l)	-0.002 (0.02)	0.00 (0.00)	-0.001 (0.01)
Replacement rate (rep_l)	0.10 (0.22)	-0.03*** (0.01)	-0.06** (0.03)
Observations	169	169	169
Hausman test	-	0.44	-

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Appendix C: Alternative specification of the labour demand – a robustness exercise

Table C1: TOTAL ECONOMY - employment rate in the left-hand side

Error correction specifications

The dependent variable is the change in the employment rate (er_dl)

Employment growth (emh_dl)	Germany ⁽¹⁾	Spain ⁽¹⁾	Italy ⁽¹⁾	France ⁽¹⁾	Netherlands ⁽¹⁾
Output gap (gap)	0.005*** (0.00)	0.007*** (0.00)	0.004*** (0.00)	0.003*** (0.00)	0.007*** (0.00)
Changes in real wages (rw_dl)	-0.25** (0.10)	-0.66*** (0.16)	-0.10* (0.06)	-0.31*** (0.07)	-0.42* (0.21)
Error correction coefficient (emh_ecm_lag1)	-0.55*** (0.10)	-0.35*** (0.08)	-0.36*** (0.12)	-0.03 (0.08)	-0.34*** (0.08)
Replacement rate (rep_dl)		-0.16*** (0.03)	-0.002 (0.00)		
Oil price (oil_r_nc_l)					-0.02** (0.00)
Terms of trade (tot)					0.46** (0.20)
Real effective exchange rate (reer_ppi_l)			0.04 (0.05)		
constant	0.008 (0.006)	0.02*** (0.00)	-0.42*** (0.15)	0.003 (0.00)	-0.44*** (0.16)
R-squared	0.62	0.61	0.47	0.27	0.59
Observations	36	36	35	36	36
Diagnostic Tests					
RESET original, p value	0.57	0.41	0.17	0.31	0.24
Normality, p value	0.09	0.30	0.15	0.59	0.28

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

(1) Newey-West standard error are reported, which are consistent with autocorrelation and heteroskedasticity of unknown form

Long-run specifications

The dependent variable is the employment rate (er_l)

Employment level (emh_l)	Germany	Spain	Italy	France	Netherlands
GDP level (trend_l)	0.76*** (0.28)	1.41*** (0.23)	0.08 (0.14)	0.28 (0.20)	2.96*** (0.37)
Real wages in level (rw_l)	-0.39*** (0.10)	-0.53*** (0.10)	0.16 (0.10)	0.07 (0.19)	-1.27*** (0.15)
time trend (ttrend_l)	-0.01 (0.00)	-0.02*** (0.01)	-0.01* (0.00)	-0.02*** (0.00)	-0.05*** (0.01)
Product market regulation (regref_l)	-0.09*** (0.02)		-0.19*** (0.03)	-0.33*** (0.03)	
Replacement rate (rep_l)		-0.21*** (0.05)			
constant	-7.12*** (2.19)	-10.2*** (1.56)	-0.06 (1.24)	-1.35 (1.95)	-20.79*** (2.23)
R-squared	0.67	0.91	0.86	0.88	0.84
Observations	37	37	37	37	37
Augmented Dickey-Fuller (p-value)	0.00	0.00	0.02	0.00	0.00

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Table C2: TOTAL ECONOMY – total employment in full time equivalent in the left-hand side (with unitary elasticity of output in the long-run)

Error correction specifications

The dependent variable is the change in employment (emh_dl)

Employment growth (emh_dl)	Germany ⁽¹⁾	Spain ⁽¹⁾	Italy ⁽¹⁾	France ⁽¹⁾	Netherlands ⁽¹⁾
Output gap (gap)	0.007*** (0.00)	0.008*** (0.00)	0.003*** (0.00)	0.009*** (0.00)	0.006*** (0.00)
Changes in real wages (rw_dl)	-0.44*** (0.08)	-0.73*** (0.12)	-0.14** (0.07)	-0.16 (0.26)	-0.28*** (0.08)
Error correction coefficient (emh_ecm_lag1)	-0.68*** (0.07)	-0.42*** (0.09)	-0.44*** (0.12)	-0.58*** (0.16)	-0.37*** (0.04)
Replacement rate (rep_dl)		-0.16*** (0.04)	-0.005* (0.00)		
Oil price (oil_r_nc_l)					-0.01*** (0.00)
Terms of trade (tot)					0.10 (0.08)
Real effective exchange rate (reer_ppi_l)			0.09*** (0.03)		
constant	0.006 (0.004)	0.03*** (0.00)	-0.41*** (0.15)	0.01* (0.00)	-0.08 (0.08)
R-squared	0.58	0.73	0.69	0.46	0.83
Observations	36	36	35	36	36
Diagnostic Tests					
RESET original, p value	0.08	0.04	0.23	0.03	0.40
Normality, p value	0.29	0.69	0.72	0.00	0.39

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

(1) Newey-West standard error are reported, which are consistent with autocorrelation and heteroskedasticity of unknown form

Long-run specifications with unitary elasticity of output

The dependent variable is the employment level (emh_l)

Employment level (emh_l)	Germany	Spain	Italy	France	Netherlands
GDP level (trend_l)	1.00	1.00	1.00	1.00	1.00
Real wages in level (rw_l)	-0.57*** (0.07)	-0.55*** (0.11)	-0.27*** (0.07)	-0.14 (0.31)	-0.53*** (0.10)
time trend (ttrend_l)	-0.01*** (0.00)	-0.03** (0.01)	-0.02*** (0.00)	-0.02*** (0.00)	-0.01*** (0.00)
Product market regulation (regref_l)	-0.04*** (0.01)		-0.13*** (0.02)	-0.33*** (0.07)	
Replacement rate (rep_l)		-0.25*** (0.05)			
constant	1.38*** (0.29)	2.0*** (0.60)	2.66*** (0.35)	3.49** (1.34)	1.21*** (0.36)
R-squared	0.89	0.94	0.93	0.77	0.96
Observations	37	37	37	37	37
Augmented Dickey-Fuller (p-value)	0.00	0.00	0.15	0.00	0.00

Standard errors are reported in brackets.

*** significance at 1% level, ** significance at 5% level, * significance at 10% level

Appendix D: Stationarity tests and Johansen Cointegration tests

Johansen tests for cointegration

TOTAL ECONOMY

Germany

Trend: constant Number of obs = 35
 Sample: 1972-2006 Lags = 2

Maximum				trace	5% critical
rank	parms	LL	eigenvalue	statistics	value
0	20	494.02228	.	61.0019	47.21
1	27	511.0194	0.6214	27.0077*	29.68
2	32	518.42854	0.34517	12.1894	15.41
3	35	524.44311	0.29085	0.1603	3.76
4	36	524.52325	0.00457		

Spain

Trend: constant Number of obs = 35
 Sample: 1972-2006 Lags = 2

Maximum				trace	5% critical
rank	parms	LL	eigenvalue	statistics	value
0	20	450.84219	.	138.563	47.21
1	27	494.12494	0.91569	51.9975	29.68
2	32	510.12163	0.59912	20.0041	15.41
3	35	518.98577	0.39741	2.2759*	3.76
4	36	520.1237	0.06296		

France

Trend: constant Number of obs = 35
 Sample: 1972-2006 Lags = 2

Maximum				trace	5% critical
rank	parms	LL	eigenvalue	statistics	value
0	20	497.81807	.	172.8684	47.21
1	27	567.77942	0.98164	32.9457	29.68
2	32	578.19782	0.44862	12.1089*	15.41
3	35	584.2412	0.29202	0.0221	3.76
4	36	584.25226	0.00063		

Italy

Trend: constant Number of obs = 35
 Sample: 1972-2006 Lags = 2

Maximum				trace	5% critical
rank	parms	LL	eigenvalue	statistics	value
0	20	515.80532	.	86.2756	47.21
1	27	541.93651	0.81074	28.0132*	29.68
2	32	549.66141	0.35688	12.5634	15.41
3	35	554.87324	0.25756	2.1397	3.76
4	36	555.9431	0.0593		

Netherlands

Trend: constant Number of obs = 35
 Sample: 1972-2006 Lags = 2

Maximum				trace	5% critical
rank	parms	LL	eigenvalue	statistics	value
0	12	409.87786	.	110.7387	29.68
1	17	459.09057	0.93992	12.3133*	15.41
2	20	464.86899	0.28122	0.7564	3.76
3	21	465.24721	0.02138		

Johansen tests for cointegration
MANUFACTURING

Germany

Trend: constant		Number of obs =	35		
Sample: 1972-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	12	358.2	.	77.54	29.68
1	17	387.4	0.81	19.21	15.41
2	20	396.9	0.42	0.15*	3.76
3	21	397.0	0.00		

Spain

Trend: constant		Number of obs =	25		
Sample: 1982-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	312.8	.	171.51	47.21
1	27	373.7	0.99	49.77	29.68
2	32	392.6	0.78	11.91*	15.41
3	35	396.9	0.29	3.31	3.76
4	36	398.6	0.12		

France

Trend: constant		Number of obs =	35		
Sample: 1972-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	480.4	.	113.83	47.21
1	27	521.0	0.90	32.66	29.68
2	32	531.4	0.45	11.96*	15.41
3	35	534.8	0.18	5.06	3.76
4	36	537.3	0.13		

Italy

Trend: constant		Number of obs =	35		
Sample: 1972-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	446.8	.	55.27	47.21
1	27	464.3	0.63	20.08*	29.68
2	32	471.2	0.32	6.41	15.41
3	35	474.3	0.17	0.08	3.76
4	36	474.4	0.00		

Netherlands

Trend: constant		Number of obs =	23		
Sample: 1984-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	303.8	.	122.12	47.21
1	27	348.1	0.98	33.69	29.68
2	32	358.6	0.60	12.60*	15.41
3	35	362.3	0.27	5.29	3.76
4	36	364.9	0.21		

CONSTRUCTION

Trend: constant		Number of obs =	35		
Sample: 1972-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	9	328.7	.	42.22	24.31
1	14	343.5	0.57	12.57	12.53
2	17	349.0	0.27	1.50*	3.84
3	18	349.8	0.04		

Trend: constant		Number of obs =	25		
Sample: 1982-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	266.5	.	119.29	47.21
1	27	297.4	0.92	57.36	29.68
2	32	319.5	0.83	13.16*	15.41
3	35	324.6	0.34	2.94	3.76
4	36	326.1	0.11		

Trend: constant		Number of obs =	34		
Sample: 1972-2005		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	384.4	.	192.75	47.21
1	27	466.5	0.99	28.56*	29.68
2	32	476.1	0.43	9.36	15.41
3	35	480.6	0.43	0.29	3.76
4	36	480.8	0.01		

Trend: constant		Number of obs =	35		
Sample: 1972-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	409.0	.	87.20	47.21
1	27	440.0	0.83	25.19*	29.68
2	32	448.8	0.40	7.46	15.41
3	35	452.0	0.16	1.17	3.76
4	36	452.6	0.03		

Trend: constant		Number of obs =	23		
Sample: 1984-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	30	348.7	.	217.16	68.52
1	39	412.4	1.00	89.78	47.21
2	46	436.5	0.87	41.54	29.68
3	51	449.3	0.68	15.99	15.41
4	54	456.5	0.47	1.59*	3.76
5	55	457.3	0.07		

SERVICES

Trend: constant		Number of obs =	35		
Sample: 1972-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	12	430.6	.	32.49	29.68
1	17	443.7	0.53	6.36*	15.41
2	20	445.9	0.12	1.93	3.76
3	21	446.9	0.05		

Trend: constant		Number of obs =	25		
Sample: 1982-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	12	294.9	.	53.15	29.68
1	17	312.5	0.76	17.87	15.41
2	20	321.5	0.51	0.0004*	3.76
3	21	321.5	0.00		

Trend: constant		Number of obs =	34		
Sample: 1972-2005		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	511.8	.	69.12	47.21
1	27	529.1	0.64	34.41	29.68
2	32	539.3	0.45	13.99*	15.41
3	35	546.2	0.33	0.21	3.76
4	36	546.3	0.01		

Trend: constant		Number of obs =	35		
Sample: 1972-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	20	443.1	.	78.43	47.21
1	27	463.9	0.69	36.90	29.68
2	32	474.9	0.47	14.85*	15.41
3	35	479.7	0.24	5.39	3.76
4	36	482.3	0.14		

Trend: constant		Number of obs =	35		
Sample: 1972-2006		Lags =	2		
Maximum rank	parms	LL	eigenvalue	trace statistics	5% critical value
0	12	433.3	.	122.41	29.68
1	17	484.7	0.94	19.69	15.41
2	20	493.8	0.40	1.54*	3.76
3	21	494.5	0.04		

Appendix E: Data description

Macroeconomic variables, total economy (source European Commission available from 1970 to 2006 unless otherwise specified):

Employment: Total employment in full time equivalent.

Employment rate: Total employment in persons divided by the labour force.

Real wage: To obtain the real labour cost the wage concept used has been that of compensation per employee. Compensation per employee encompasses total labour costs, i.e. direct (wages) and indirect (social security contribution) remuneration¹³. Real compensation per employee has been obtained by deflating nominal compensation by the value added deflator at market prices both at the total economy level and at the sectoral level.

GDP level = trend real GDP filtered with an HP filter with $\lambda=100$.

Output gap: real GDP minus its trend as a percentage of trend real GDP.

Macroeconomic variables, sectoral (source European Commission, available from 1970 to 2006 except for services in France up to 2005 and for construction and services in Spain from 1980):

Employment: Sectoral employment in full time equivalent.

Real wage: as above.

Trend value added= trend real value added filtered with an HP filter with $\lambda=100$.

Sectoral value added gap= real sectoral value added minus its trend as a percentage of trend real sectoral value added.

¹³ However, unlike employment data, compensation per employee covers only employees' compensation, excluding remunerations of self-employed, which are unavailable. By using the employment series as a measured counterpart of the labour demand, we are implicitly assuming that the average compensation received by the self-employed has grown at the same pace as compensation per employee.

Other macroeconomic variables (available from 1970 to 2006):

Oil price: The real oil price has been obtained by deflating the oil price in euro by the national consumer price index. Source Datastream and European Commission.

Terms of trade: The term of trade is obtained by the ratio of the export deflator to the import deflator. Source European Commission.

Real effective exchange rate: The real effective exchange rate for each country uses as a deflator the producer price index of manufactured goods. Source BIS.

Structural variables:

Employment Protection Legislation: OECD summary indicator of the stringency of Employment Protection Legislation (a higher index indicates stricter regulation). Source: Bassanini and Duval, 2006. Data are available annually from 1982 to 2006.

Product market regulation: OECD summary indicator of regulatory impediments to product market competition in seven non-manufacturing industries (a higher index indicates stricter regulation). The OECD indicator of product market regulation for seven non-manufacturing sectors (airline, telecom, electricity, gas, post, rail and road) is used. This indicator rather than the economy-wide indicator was used given its time-series availability. Source: Conway, P., D. De Rosa, G. Nicoletti and F. Steiner (2006), “Regulation, competition and productivity convergence”. OECD Economics Department Working Paper No. 509. Data are available annually from 1970-2003 and kept constant thereafter.

Replacement rate: Average unemployment benefit replacement rate across two income situations, three family situations, and three different unemployment durations. Source: OECD, Benefits and Wages Database, available annually from 1970-2003 and kept constant thereafter.

Union density: trade union density rate as a percentage of workers affiliated to a trade union. Source: Bassanini and Duval, 2006, available annually from 1970-2003 and kept constant thereafter. Data for Spain are available since 1981.

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