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Labour Markets, Trade and Regional Heterogeneity: How important are their affects on Average Pay across European Regions?

Don Webber*

Policy Research Institute, Leeds Metropolitan University, UK

Abstract

The affects of trade and labour market variables on changes in relative average regional pay are examined across Germany, Holland, Italy and Spain between 1986-1994. Using pooled cross-section estimations with fixed effects, labour market variables of unemployment benefits and employment rates are identified as being statistically significant while negative signs on the change in labour supply suggest support for the Rybczynski theorem. However, much of the change in relative average regional pay appears to be the result of unobserved regional heterogeneity, suggesting that regional characteristics essentially determine relative average regional pay and not trade or labour markets.

JEL Classification: C23, F10, J30, R10.

Keywords: Pay; Labour Markets; Trade; Regions.

* Policy Research Institute, Leeds Metropolitan University, Leeds, LS6 3QS,UK. Tel: (+44/0) 113 2831747; Fax: (+44/0) 113 2831748. Email: d.webber@lmu.ac.uk. Marion Jackson, Peter Taylor and Wayne Thomas are thanked for their useful comments. All errors are the author's responsibility.

1. Introduction

There are two, often contradictory, fields of thought associated with the spatial determinants of pay. Traditional trade theory suggests that differences in the quantity of factor endowments will determine comparative advantage. Any changes in the demand for goods will affect the derived demand for labour and hence its reward. In contrast, the labour market literature suggests that shifts in the demand and supply for labour will directly influence labour's return.

The relationship between trade, labour markets and wage inequality across countries has been the subject of considerable scrutiny recently. Verspagen (1998, p. 16) recognised the need for "a focus on the institutions of labour markets" in an attempt to identify the determinants of the trend in wages while other researchers have stressed the relationships between international wage differentials and either skill-biased or sector-biased technical change (see Freeman, 1995; Feenstra and Hanson, 1999; Haskel, 1999; Haskel and Slaughter, 1999).

Empirical papers frequently present investigations that employ national level data in an attempt to identify the importance of labour markets and trade on pay. They usually ignore the importance of regions, which is surprising given that Ohlin's (1967) original focus was on international and interregional trade.

The purpose of this paper is to investigate the statistical importance of trade and labour market variables on the change in relative average pay across regions of the European Union (EU). Data is analysed that corresponds to thirty-two regions across Germany, Holland, Italy and Spain for the period 1986-1994, measured at the regional and national levels to incorporate regional and national labour market characteristics. The next section reviews theory. Data and method are then discussed. The results are then presented. Finally, conclusions are drawn.

2. Theory

Some literature has stressed the interaction between trade and/or labour market factors and pay at the national level to develop and refine the theoretical mechanisms through which trade influences pay (Brecher, 1974; Murphy and Welch, 1991; Johnson and Stafford, 1993; and Harrigan, 1998). Slaughter (1999) and Haskel (1999) clarified the connection between trade and wages on the one-hand and labour markets and wages on the other stressing that these two perspectives are distinct in their approaches to the derivation of the supply and demand curves for labour. The trade perspective has its foundations in the Stolper-Samuelson theorem (1941) with the level of demand for the product determining the quantity of labour required for its production: an increase in the demand for the product increases pay.

Trade Theory

The Ricardo-Viner model retains all of the assumptions of the standard Heckscher-Ohlin-Samuelson model except that one factor, usually capital, is assumed to be sector-specific and internationally mobile, while labour is assumed to be perfectly mobile between sectors. In this paper, labour is assumed geographically specific and sectorally mobile. Labour is restricted in its geographical mobility because of psychic costs associated with social and family ties, the inconvenience of moving, fear of the unknown, etc. With ever-increasing economic integration across the EU, capital is

likely to be more geographically mobile than labour. Capital is assumed to be perfectly mobile across sectors and geographically, and labour and capital are assumed not to be complementary at the level of regional aggregation.

According to Heckscher-Ohlin theory, economies export commodities that require for their production, relatively intensive use of productive factors found locally in relative abundance. For this reason much of the traditional trade literature suggests that the quantity of a factor endowment is an important determinant of aggregate production decisions, and underpins specialisation and comparative advantage. Specialisation will then be determined by the relative endowments of labour across economies. Comparative advantage will depend on the abundance of labour relative to competitors'.

The Restrictive Version of the Stolper-Samuelson theorem states that the progression towards free trade lowers the real wage of the scarce factor and raises that of the abundant factor when compared to autarky (Deardorff and Stern, 1994, p. 12). However, Chipman (1969, p. 399) argues that:

> "In generalising the theory to more than two commodities and two factors, it no longer holds that a more than proportionate increase in one factor price entails a fall in all the remaining factor prices. The case in which this does occur will be referred to as the *strong* form of the Stolper-Samuelson theorem, whereas the more general case will be called the *weak* form".

Hence, if comparative advantage is based on the relative abundance of labour, we should not necessarily expect the return to capital to be affected whichever direction the reward to labour turns. Across the EU, reductions in barriers to trade have accompanied reductions in barriers to factor mobility. Owners of capital can invest to gain a return that is greater than the return would have been in an alternative productive location and over the long run the returns to capital are assumed to equate across EU regions.

An increase in the demand for a product (brought about by an increase in the demand for goods in regions which are now better able to accrue the benefits of comparative advantage because of deeper economic integration) increases pay in that region. Initially, a region with a large quantity of labour should have an average pay level that is lower than in a comparative economy where labour is relatively scarce. As the derived demand for labour is likely to increase to a greater extent if the benefits of comparative advantage are to be realised, the effect of economic integration on pay is likely to be greater in regions that produce labour intensive goods. This effect should be augmented over time by the process of economic integration, productive dematerialization and improvements in infrastructure.

The standard Heckscher-Ohlin-Samuelson theory has been developed to include changes in factor endowments. Under standard assumptions, the Rybczyski (1955) theorem suggests a reduction in the endowment of labour will be associated with a rise in wage rates. Migration is known to occur for a small proportion of the population as a whole. However, changes in the size of the endowment of labour in any region are also likely to be influenced by the participation rate. Any increase in the endowment of labour in a region due to either immigration (inter-regionally and inter-nationally) or an increase in the local participation rate should result in a fall in region's average pay levels.

Labour Market Theory

Differences in labour market conditions across regions and countries could affect average regional pay because differences in rigidities in the labour market influence the choice of plant location for mobile firms.

A lower rate of employment implies a greater proportion of workers is available to fill vacancies. The need to pay higher wages will depend on the amount of slack in the labour market; the lower the employment rate then the greater the ability of a firm to attract workers and the less the incremental increase in pay would have to be for a firm to be successful in attracting workers, *ceteris paribus*. Disparities in the rate of employment between regions illustrate contrasting availabilities of labour. From a mobile firm's viewpoint, this could affect the decision to locate to a region, as the higher the rate of employment then the lower the proportion of workers available for recruitment. However, as Murphy and Welch (1992, p. 285) concluded, "employment alone cannot account for observed changes in relative wages" and therefore other institutional labour market variables should also be included in an attempt to identify the effect of labour markets on pay.

Differences in the level of unemployment benefits across countries could be associated with differences in the disutility of work and society's expectations toward the unemployed. There may be interregional differences in cultures and attitudes to unemployment that influence the rate of unemployment. If the expected opportunity cost is large then a worker will not participate in the job market. High unemployment benefits could be given to provide aid for the worker in finding a new job and to dissuade workers from being unemployed. But unemployment benefits could also increase frictional unemployment. Greater unemployment benefits allow workers to search for positions that match their skills and experience better. One has a longer period of time to search for a new job and higher unemployment benefits might allow for a better skill-match between job and worker, thus creating greater future productivity and higher wages. This could be the case in Holland where the unemployed, in 1994, received nearly 320 ECUs per week. In contrast, unemployment benefits in Spain are much lower (in 1994 they were about 100 ECUs per week), possibly to give the unemployed individual a greater monetary incentive to return to work by increasing the differences between earned income and the unemployment benefit. The greater the remuneration of unemployment benefits then the lower the net cost of an individual remaining unemployed and the more able the worker is to postpone being recruited and to search for a higher paid job.

Variations in the strength and activity of trade unions between countries influence the international differences in the flexibility of pay. Disruptions to production, due to strike action, might deter firms from locating to a region that is frequently affected by strike action, even if average pay is much lower. Consequently, a higher incidence of strike action should be associated with regions that have lower rates of increase in average regional pay. However, this relationship may not necessarily be the case. Hungerford (1989) studied the effect of trade on the incidence of lay-offs in US manufacturing and found that industries with high proportions of unionised workers tended to lay-off workers in adverse times. This supports Medoff (1979) who suggests that unionised firms make labour adjustments through layoffs and not through alterations in pay levels.

3. Method and Data

Given that the causal factors behind the movements of relative average regional pay across the EU is the focus of this paper a pooled cross-section analysis is utilised comprising of annual observations for trade and labour market variables. This method should reduce the amount of possible collinearity between explanatory variables, increase the efficiency of the econometric estimates and reduce the magnitude of bias attributable to mis-specification or omitted variables.

Region specific heterogeneous factors and variables that are common across a group of regions may both contribute to the determination of the dynamics of regional comparative advantage and should be incorporated into this analysis. Regions also possess characteristics that are common between regions in different countries but not common between regions within their own country.[1] A method of including regional heterogeneity in an empirical model is to incorporate it into the intercept term. By allowing the intercept to be at a different point for each region permits the incorporation of time-invariant regional heterogeneity. Economic integration *per se* may influence the change in relative average regional rewards to labour so a time-variant (region-invariant) intercept is incorporated to capture these time effects. The intuition behind variable-intercept models is that the affects of numerous omitted variables, which may vary with respect to time or region, are individually unimportant but collectively significant. By employing fixed-effects we are able to test whether the differences between the regions are important contributory factors in the determination of changes in the relative average regional pay. The theoretical model employed here is:

$$\Delta P_{r,t} = \mu_{r,t} + \alpha_r + \alpha_t + \beta X_{r,t} + u_{r,t} \qquad (1)$$

where $\Delta P_{r,t}$ is the change in relative average regional pay, *r* and *t* denote region r and period t respectively, X represents all explanatory regressors, β is the coefficients for the explanatory variables, α_r and α_t represent region and period effects, $\mu_{r,t}$ is the mean-intercept and $u_{r,t}$ is the error term that is assumed to be serially uncorrelated with any of the intercept terms, as well as being well-behaved and normally distributed.

$\Delta P_{r,t}$ is identified for each region using an index such that the average across the sample is 100. If a region has a $P_{r,t}$ value of 150, this means that the average pay level for region *i* in period *t* is 50% greater than the sample average. The index is reset for each year to avoid the possibility of a unit root in the data biasing the results. This proxy is formed by dividing the aggregate 'compensation of employees' by the total 'number of pay and salary earners' for each NUTS classified region. [See the Appendix for more details on each variable proxy.]

Several partial log-linear models are estimated to measure the affects of traditional trade and labour variables on the dynamics of relative average regional pay. The regressions seek to explain the evolutionary path of relative average pay across regions of the EU between 1986 and 1994. Table 1 provides the descriptive statistics

[1] For example, Southampton and Rotterdam are important ports. They are likely to have more in common than the Spanish regions of Extremadura and Madrid, which have different industrial structures.

for all variables employed in the empirical estimation. The dependent variable in each regression is $\Delta P_{r,t}$ and all regressions contain the following core variables:

- $L_{r,t}$ is the relative supply of a region's residential economically-active labour force, which measures the regional specific endowment of labour relative to other regions (at the same point in time). It is current labour supply, measured in relative terms, which is of interest here because traditional trade theory is essentially static. Clearly, this is not an indicator of the intensity with which labour is employed, but if a region is to gain from the exploitation of its comparative advantage then firms within a region should be able to take advantage of locally abundant labour and produce goods that employ labour in its most appropriate level of intensity.
- $L_{r,t}$ may not provide us with enough information about the dynamics of comparative advantage. The Rybczynski theorem suggests that a reduction in the supply of labour will be associated with an increase in its return. Accordingly, changes in the relative quantity of the region's labour supply ($\Delta L_{r,t}$) is incorporated (and illustrates fluctuations in the participation rate or migration).
- $Ben_{r,t}$ is a measure of the relative difference in the magnitude of unemployment benefits. Although this is initially observed at the national level it is weighted by the average regional pay level and is a proxy for the region's unemployment benefit level (relative to the sample average) relative to the region's average pay.
- $Union_{r,t-1}$ is the relative difference in the activity of unions between countries. It is measured as the number of workers involved in strike action expressed as a percentage of the regional labour force. Restrictions due to data availability mean that this variable is measured at the national level.
- The relative regional employment rate variable used here has two alternative measures. First, $E_{r,t-1}$ is a measure is for the amount of employment (relative to the sample average) in the previous year to capture the delay in the reaction of pay to changes in the employment rate. The second proxy is the relative change in the rate of employment between consecutive years, $\Delta E_{r,t}$; a relative reduction in a region's employment rate would suggest a decrease in the upward pressure on pay relative to other regions.

The complete model for estimation is therefore:

$$\Delta P_{r,t} = \mu_{r,t} + \alpha_r + \alpha_t + \beta_1 L_{r,t} + \beta_2 Ben_{r,t} + \beta_3 Union_{r,t-1} + \beta_4 E_{r,t-1} + u_{r,t} \qquad (2)$$

The thirty-two regions in the sample are from four countries – German, Holland, Italy and Spain – and the number of regions in the sample is constrained by data availability. There is large variation in the size of the labour force between regions, from just over a ¼ million (Bremen) to just under 8 million (Nordrhein-Westfalen). Taking each region as being in competition with each other would suggest, according to the literature on comparative advantage, that there is a large range of products that can be competitively produced. If the comparative advantage of a region is based on

the quantity of labour endowment, then a region will specialise in the production of goods that require their given quantity of labour.[2]

4. Results

Table 2 presents the results of least squares' pooled cross-section estimations that incorporate fixed and period effects, while Tables 3 and 4 present the corresponding estimates of fixed and period effects respectively. The F statistics are invariably significant at the 5% level, suggesting the null hypothesis of no causal relationship between the regressand and the regressors (and fixed effects) can be rejected. Regression (d) has the best fit; 23.3% of the inter-regional variation in average regional pay levels over the period 1986-94 can be explained by the regressors and the fixed and period effects. This value is stable over the full range of equation specifications.

Variances were assumed to be the same for all regions. However, group specific variance was estimated to identify the group mean squared residual and then the asymptotic covariance matrix was estimated. These results were compared to the original set of results and the differences in the regressor coefficients and the *t*-ratios were small. This led to the conclusion that heteroskedasticity was not significantly affecting the results.

Trade theory suggests that the reduction in barriers to trade should increase the demand for goods and increase comparative advantage and specialisation. Regions with larger pools of labour should initially have a lower rate of return, but as barriers reduce there should be a increase in the relative pay level as regions begin to fulfil their capability of producing labour intensive goods. Hence there should be a positive coefficient between the relative supply of labour and the change in the relative average regional pay level. However, the coefficient for the size of the regional labour force, $L_{r,t}$, is not significantly different from zero. Moreover, although insignificant, the coefficient in column (a) for $L_{r,t}$ is negative, suggesting that regions with larger pools of labour, relative to other regions in the sample, experience a downward trend in average pay. This could be indicating one of two things. First, it could be that the increase in the level of competition has forced wages down further, especially in regions that specialise in the production of goods that are labour intensive. Second, this may be indicating that the *quality* of the labour supply is also needed here, which would fit in with much of the literature on skill-biased technical change (see, for example, Haskel, 1999).

The other proxy employed from the traditional trade theoretic perspective is the change in regional labour supply, $\Delta L_{r,t}$. The Rybczynski theorem suggests that a reduction in the supply of labour will be associated with an increase in its return. This variable has a coefficient that is negative and statistically significant at the 5% (8%) level in column d (a), suggesting support for the Rybczynski theorem.

From the above empirical analysis it can be inferred that traditional trade theory can shine some light on the reasons why and how pay evolves at the regional

[2] $Ben_{r,t}$ varies substantially across the EU. This is as expected given the relatively high level of unemployment benefits in Holland when compared to Spain. The rates of employment also vary substantially between regions.[2]

level. However, this is not conclusive, as endowments appear insignificant while evidence for Rybczynski effects is statistically unstable.

Unemployment benefit, union strength and employment rates were incorporated into the model to capture differences in the institutional labour market frameworks and to assess their statistical effects on the change in the relative average regional pay between regions over time.

Coefficients for the unemployment benefits variable were consistently negative and statistically significant at the 1% level. The negative coefficient is not supportive of the theory that higher unemployment benefit levels relative to pay entice individuals to look for a better position and avoid skill mis-match, and hence find work in a more appropriate job that pays them a higher wage. Indeed, it indicates that higher unemployment benefits (relative to the regions average pay level) reduce the rate of increase in average regional pay. This could be the result of a reduction in the incentive to find appropriate work, creating more slack in the regional economy and less upward pressure on pay. It could also be partly due to the countries included in the sample (Holland has a very generous benefit system and high wages, Spain has a relative low unemployment benefit system and relative low wages).

The coefficients on the union strength variable are not significantly different from zero. It appears that there is no significant relationship between the extent of union activity and changes in the relative regional average pay. Multinational firms may not be dissuaded from locating to a region that has a relatively high level of strike action; lower wages may compensate for this effect. As this variable is measured at the national level (even though it is divided by the region's residential labour supply), it may be capturing unobserved country specific heterogeneity of, for example language variations, as well as country specific institutional labour market forces.

Coefficients for the effect of lagged relative employment rates on relative average regional pay have the expected signs: lower rates of regional employment stimulate higher increases in average regional pay (less slack in the economy puts upward pressure on pay). This line of thought is also supported by the coefficient on the change in the rate of employment. An increase in the rate of employment puts upward pressure on relative average regional pay. The relative employment rate coefficients are consistently significant at the 1% level. As regional employment rates increase so too do average regional pay levels.[3]

There is also the need to identify the importance of regional heterogeneity, and whether regional heterogeneity plays a part in the determination of the change in the relative average regional pay. Tables 3 and 4 show the estimated fixed group (α_r) and period (α_t) effects respectively. It has been argued that regional heterogeneity, identified through the fixed group effects, could be an important contributory factor in the determination of the evolution of pay.[4]

The results presented in Table 3 highlight the importance of regional specific characteristics. Negative coefficients are predominantly associated with all Italian and

[3] As employment rates increase, a) workers may recognise that there are fewer alternative workers to recruit and ask for a higher reward, and b) firms pay higher wages to tempt workers from alternative productive activities.

[4] This may be incorrect if the importance of regional and time heterogeneity fluctuate over time and are, therefore, not fixed. To test this assumption, an alternative model specification was tested with random effects techniques. Results were then compared. The results of a Hausman test statistics were invariably large with the smallest being 14.86. Large values of the Hausman statistic argue in favour of the fixed effects model over the random effects model.

some Spanish regions. Negative coefficients for the fixed effects for German regions are not significant at the 5% level and apply to Saarland, Nordrhein-Westfalen, Baden-Wuerttemberg, Bayern and Berlin, which are regions associated with declining industries. These results are fairly stable across the six different model specifications. The negative coefficients on Spanish regions either correspond to regions that are on the periphery of the country (Noroeste and Noreste) or the region that encapsulates the capital city (Centro) which could be a net outward commuting region.

The fixed period effects estimates, presented in Table 4, suggest a great deal of importance of the latter waves of data 1991-1994. The coefficients on the fixed period effects are consistently negative (suggesting convergence) except for the years 1990-1993 inclusive. These fixed period effects could be indicating the presence of the business cycle and support the proposition that time is an important factor in the trend in average regional pay. It may also be associated with economic integration, new motorways, closer co-operation of member states, or the progression towards an increasingly dematerialised economy.

Test statistics for the classical model were estimated to identify whether the two-way fixed effects have any explanatory power. The results, presented at the bottom of Table 2, suggest that the best estimation is the complete model, which contains the mean-intercept, regressors and group and time effects being consistently significantly better at the 95% level. However, the 'full' model is not consistently statistically better than the same model without the fixed period effects, suggesting that the incorporation of the period effects do not significantly improve the model. These findings suggest that regional heterogeneity is more important for the determination of change in the relative average regional pay levels than any other labour market characteristic or trade variable included in this empirical estimation.

Economic integration may have the affect of reducing the importance of factor endowments, and the main driving force behind pay dynamics could now be attributable to institutional labour markets. This could be one of the reasons why labour market factors incorporated as independent explanatory variables are more stable and consistently statistically significant than the trade effect. An alternative argument is that the quality of the labour force is a further import contributory factor that requires incorporation into the model; lack of available data restricts such an empirical examination.

5. Conclusions

This paper has presented the results of an empirical investigation into the statistical effects of trade and labour market related variables on the change in relative average regional pay. The model was grounded in the trade and labour debate that is examining their roles in the determination of wage inequalities. Distinct to this paper is the adoption of a European regional perspective and the analysis here is at a much more disaggregated level than the majority of associated studies.

Fixed effects pooled cross-section estimations, which impose common slope coefficients but allows for a time and regionally varying intercepts, were used to investigate the possible affects on average regional pay of relative variations in the endowment of labour, unemployment benefits, union strength and employment rates across Germany, Holland, Italy and Spain. The results presented suggest that, over the period 1986 to 1994, relative unemployment benefits and relative employment rates were statistically significant determinants of the change in relative average regional

pay. This supports the propositions that institutional labour market factors are important in the determination of the change in the relative average regional pay. There is empirical support here for the Rybczynski theorem as the change in the endowment is negatively associated with changes in relative average pay. However, the size of the labour supply is insignificant suggesting that traditional trade theory may be a less important determinant of relative average pay levels across regions than the literature suggests it is across countries. However, it has been shown that incorporating regional heterogeneity into the model via fixed group effects is an important explanation in the change in the relative average regional pay across this sample of countries.

Two lines of investigation are recommended for further research. First, an investigation into the mechanisms driving the changes in the relative average regional pay over time should be made with close attention being placed on the determinants of regional heterogeneity. Initial attempts could be focused on the distance the region is from the core of the market, skill differentials or regional industrial mix. Second, it should be identified whether these results are time or sample specific, which could be investigated, as data for more regions become available.

APPENDIX: DATA SOURCES AND DEFINITIONS

- Sample. The data set contains the following thirty-two NUTS classified regions which has been limited only by data availability: German (11): Baden-Wuerttemberg, Bayern, Berlin, Bremen, Hamburg, Hessen, Niedersachen, Nordrhein-Westfalen, Rheinland-Pfalz, Saarland, Schleswig-Holstein; Spanish (6): Noroeste, Noreste, Comunidad de Madrid, Centro, Este, Sur; Italian (11): Nord Ovest, Lombardia, Nord Est, Emilia Romagna, Centro, Lazio, Ambruzzo-Molise, Campania, Sud, Sicilia, Sardegna; and Holland (4): Noord-Nederland, Oost-Nederland, West-Nederland, Zuid-Nederland.
- Pay. $\Delta P_{r,t}$ is calculated by dividing the region's aggregate 'compensation of employees' by the region's total 'number of pay and salary earners'; this was then indexed according to the sample average for the year; the change between consecutive years was then employed. The 'compensation of employees' variable is in millions of ECUs and is therefore in a comparable currency. Source: Eurostat NewCronos Regio Database.[5]
- Labour Supply. $L_{r,t}$: defined as the quantity of the economically active resident regional population relative to the sample average. Source: Eurostat NewCronos Regio Database.
- Changes in the labour supply. This is the difference between consecutive year's $L_{r,t}$.
- Employment Rate. Data to represent the regional employment rate relative to the sample average is defined as the number of wage and salary earners in each region expressed as a percentage of the region's economically active 'residential' population. Two measures were employed: first, the lagged regional employment rates, $E_{r,t-1}$, and second the change in consecutive year's regional employment rates, $\Delta E_{r,t}$. Source: Eurostat NewCronos Regio Database.
- Unemployment Benefits. $Ben_{r,t}$ is measured at the national level and weighted according to the average regional pay level. Source: Eurostat NewCronos Regio Database.
- Union Strength. $Union_{r,t-1}$ is measured at the national level. It is defined as the number of workers involved in strike action divided by the size of the economically active residential regional population. Source: International Labour Office (1988, 1996)

[5] This is proposed to be the best obtainable proxy for factor rewards at the regional level of disaggregation. The proxy includes the following: bonuses, overtime, costs of living allowances, local allowances, expatriation allowances, bonuses based on productivity and profits, Christmas and New Year bonuses, "13th Month" pay, allowances for transport to and from work, holiday pay, commission, tips, bonus shares, saving scheme contributions, remuneration in kind, sickness payments, and housing allowances paid in cash by employers to their employees. However, it does not include such items as supplying sporting or recreational facilities, the supply of work clothes and the provision of specific tools required by the employee for the job.

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Table 1. Descriptive Statistics

Variable	Mean	σ	Skewness	Kurtosis	Minimum	Maximum
$\Delta P_{r,t}$	-0.105	6.3856	0.5	12.4	-32.122	36.296
$L_{r,t}$	100.000	67.810	1.4	5.3	12.798	336.190
$\Delta L_{r,t}$	-1.778	22.848	-4.9	55.2	-238.959	107.860
$Ben_{r,t}$	0.234	0.136	0.4	2.4	0.047	0.566
$Union_{r,t-1}$	100.000	101.806	0.7	2.4	0.612	364.413
$E_{r,t-1}$	100.000	18.995	0.8	3.3	63.044	157.373
$\Delta E_{r,t}$	-0.284	6.430	0.4	15.9	-33.855	37.980

Table 2. Least Squares with Group Dummy Variables and Period effects

	(a)	(b)	(c)	(d)
N	279	275	275	275
$L_{r,t}$	-0.163 (1.727)		0.639 (0.673)	
$\Delta L_{r,t}$		-0.032 (1.778)		-0.413* (2.302)
$Ben_{r,t}$	-90.393** (4.587)	-99.707** (5.195)	-99.529** (5.011)	-97.839** (5.170)
$Union_{r,t-1}$	0.853 E-02 (1.283)	0.845 E-02 (1.270)	0.884 E-02 (1.331)	0.747 E-02 (1.133)
$E_{r,t-1}$	-0.241** (4.087)	-2.226** (3.967)		
$\Delta E_{r,t}$			0.265** (4.173)	0.285** (4.628)
Mean-Intercept	59.860** (4.799)	44.409** (5.887)	15.447 (1.674)	21.454** (5.028)
F Test	1.45*	1.45*	1.47*	1.61*
Estimated Autocorrelation	0.052	0.081	0.041	0.039
Hausman	16.74	16.94	14.86	15.32
R^2	0.214	0.215	0.216	0.232
Log-likelihood Ratio Tests				
(4) vs. (3) [31]	53.496**	54.400*	34.628	36.055
(5) vs. (4) [8]	11.868	13.480	12.879	13.029
(5) vs. (3) [40]	65.365**	64.880**	47.507	49.084
F Tests for the Classical Model				
(4) vs. (3) [31]	1.622*	1.541*	1.009	1.052
(5) vs. (4) [8]	1.277	1.454	1.388	1.404
(5) vs. (3) [40]	8.765**	4.582**	2.279**	2.407**

Notes: The dependent variable in each case is $\Delta P_{r,t}$. $|t|$ is in round brackets beneath each regression coefficient. See the appendix for definitions of the variables. The degrees of freedom for the F test are in square brackets. ** implies significant at the 1% confidence level. * implies significant at the 5% level. Models (3), (4) and (5) were compared in the log-likelihood ratio test and the F test for the classical model are the following: Model (3) is for the regressors and the mean-intercept only (and no group of period effects) [$\Delta P_{it} = \alpha + X_{it} + \varepsilon_{it}$]. Model (4) contains the full group effects and variables (but no time effects) [$\Delta P_{it} = \alpha_i + X_{it} + \varepsilon_{it}$]. Model (5) contains the results of the complete model that has the mean-intercept, the regressors and group and time effects [$\Delta P_{it} = \alpha + \alpha_i + \alpha_t + X_{it} + \varepsilon_{it}$].

Table 3. Estimated Group Fixed effects

Region	Country	No. Obs.	(a)	(b)	(c)	(d)
Baden-Wuerttemberg	Germany	8	26.809** (2.579)	10.098** (3.530)	-1.534 (0.153)	4.850* (1.941)
Bayern	Germany	9	33.72** (2.353)	10.258** (3.690)	-2.140 (0.151)	7.426** (2.858)
Berlin	Germany	9	-0.692 (0.142)	5.780** (2.335)	9.379* (1.936)	5.696** (2.332)
Bremen	Germany	9	2.835 (0.330)	16.602** (4.392)	10.575 (1.185)	4.759* (1.943)
Hamburg	Germany	9	4.876 (0.750)	15.032** (4.420)	9.189 (1.364)	5.084** (2.337)
Hessen	Germany	9	11.611** (3.525)	9.141** (3.288)	3.214 (1.159)	4.630* (1.946)
Niedersachen	Germany	9	17.498** (3.419)	10.669** (3.661)	5.247 (1.075)	8.174** (2.952)
Nordrhein-Westfalen	Germany	8	46.903** (2.131)	10.041** (3.549)	-8.977 (0.411)	5.335 (1.021)
Rheinland-Pfalz	Germany	9	3.711 (1.014)	7.427** (2.824)	8.766** (2.318)	5.933 (2.311)
Saarland	Germany	9	-1.237 (0.153)	11.816** (4.183)	11.604 (1.385)	6.086** (2.470)
Schleswig-Holstein	Germany	9	1.554 (0.283)	9.816** (3.390)	11.804* (2.074)	8.911** (3.155)
Noroeste	Spain	9	-10.242** (2.738)	-5.979** (2.305)	2.207 (0.651)	0.688 (0.304)
Noreste	Spain	9	-6.190* (1.634)	-0.982 (0.442)	2.251 (0.621)	0.382 (0.178)
Comunidad de Madrid	Spain	9	-2.121 (0.753)	1.171 (0.533)	0.697 (0.243)	-0.366 (0.171)
Centro	Spain	9	-6.383** (1.969)	-3.132 (1.212)	3.659 (1.277)	2.899 (1.277)
Este	Spain	9	13.121* (1.660)	-0.579 (0.252)	-3.073 (0.378)	2.682 (1.216)
Sur	Spain	9	1.885 (0.619)	-1.023 (0.386)	2.809 (0.933)	4.066 (1.720)
Nord Ovest	Italy	9	-9.063** (2.133)	-12.430** (3.244)	-13.000** (2.981)	-11.791** (3.135)
Lombardia	Italy	9	-3.170 (0.382)	-15.593** (4.044)	-20.990** (2.475)	-15.953** (4.188)
Nord Est	Italy	9	-12.157** (2.721)	-16.760** (4.535)	-18.406** (4.050)	-17.038** (4.667)
Emilia Romagna	Italy	9	-19.478** (4.715)	-17.207** (4.488)	-13.719** (3.427)	-14.882** (3.976)
Centro	Italy	9	-15.553** (3.941)	-17.709** (4.682)	-16.817** (4.211)	-15.870** (4.137)
Lazio	Italy	9	-15.054** (3.894)	-15.019** (3.862)	-15.295** (3.942)	-15.593** (4.054)
Ambruzzo-Molise	Italy	9	-30.842** (4.165)	-20.497** (5.417)	-11.963* (1.678)	-16.349** (4.571)
Campania	Italy	9	-19.500** (5.063)	-19.088** (4.942)	-14.729** (4.073)	-14.479** (4.043)
Sud	Italy	9	-16.510** (4.351)	-18.482** (5.017)	-15.867** (4.205)	-15.036** (4.332)
Sicilia	Italy	9	-21.735** (5.454)	-19.071** (5.240)	-14.980** (3.946)	-15.919** (4.565)
Sardegna	Italy	9	-28.800** (3.834)	-18.346** (4.727)	-9.764 (1.368)	-14.161** (3.902)
Noord-Nederland	Holland	8	13.824 (1.387)	27.638** (4.874)	36.372** (3.643)	31.044** (5.562)
Oost-Nederland	Holland	7	16.473* (2.043)	25.914** (4.326)	31.435** (3.868)	28.273** (4.777)
West-Nederland	Holland	7	30.273** (4.921)	26.002** (4.669)	23.753** (3.893)	25.851** (4.705)
Zuid-Nederland	Holland	7	17.623** (2.356)	25.943** (4.465)	30.123** (3.978)	27.357** (4.763)

Table 4. Estimated Period Fixed effects

	No. Obs.	(a)	(b)	(c)	(d)
1986	28	-3.402**	-4.057**	-4.010**	-3.932**
		(2.402)	(2.920)	(2.827)	(2.866)
1987	32	-1.364	-1.646*	-1.791*	-1.624*
		(1.228)	(1.604)	(1.602)	(1.492)
1988	32	-0.746	-0.997	-1.142	-0.981
		(0.684)	(0.919)	(1.041)	(0.917)
1989	32	-0.628	-0.803	-0.950	-0.803
		(0.595)	(0.760)	(0.894)	(0.720)
1990	32	0.834	0.778	0.629	0.755
		(0.791)	(0.735)	(0.594)	(0.721)
1991	32	2.439**	2.548**	2.396**	2.491*
		(2.120)	(2.200)	(2.077)	(1.739)
1992	32	2.586**	2.711**	2.558**	2.651**
		(2.222)	(2.313)	(2.192)	(2.292)
1993	32	2.814**	2.962**	2.809**	2.898*
		(2.371)	(2.479)	(2.360)	(1.616)
1994	27	-3.507**	-2.376*	-1.185	-2.306*
		(2.333)	(1.931)	(0.780)	(1.899)