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**Working Paper**

## Driving forces behind the sectoral wage costs differentials in Europe

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Institut für Makroökonomie  
und Konjunkturforschung  
Macroeconomic Policy Institute

# Working Paper

10/2011

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## **Driving forces behind the sectoral wage costs differentials in Europe**

**Camille Logeay, Sabine Stephan, Rudolf Zwiener**

September 2011

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## Abstract

In 2004, Eurostat starts publishing new figures on hourly wage costs for all European countries. These figures are new in several respects: It is the first time that internationally comparable hourly figures on wage costs are available covering a quite important time period (1995-2005), so that not only cross-country comparisons but also dynamic analyzes are possible. Furthermore, these figures are fairly detailed at the sectoral level, therefore allowing for inter-sectoral comparisons. Concerning Germany, the Eurostat statistics provide quite unexpected insights; the gap between wage costs in the manufacturing sector and the (private and business) services sector is much larger than in other countries. This study aims at giving some explanations. According to theory, various explanations are possible. First, the neo-classical theory emphasizes factors affecting or indicating the level of individual productivity, as well as firm or sectoral productivity; indicators corresponding to this approach are tested. Second, dropping the assumption of perfect competition on both labor and goods markets allows for other factors (mark-up, market power) to influence the wage costs levels; these potential determinants are also tested. Finally, we think that the structure of demand (driven by domestic or foreign demand) could also have a major impact on wages in the industry and the services sector and indeed this factor seems to play an important role. This paper is structured as follows: First, the new Eurostat statistics is presented focussing on some interesting descriptive results. In the second section, we present a list of potential determinants of wage differentials between the industry and the services sector derived from theory and literature. A bivariate analysis (correlation) is then performed and conclusions are drawn. In a third step, a multivariate analysis (panel estimation) is performed. The final section concludes.

JEL: J31, C23, E24

Keywords: Wage differentials, Europe, sectoral level, macroeconomic panel.

## **Abstract**

Im Jahr 2004 begann Eurostat für alle Mitgliedsländer der Europäischen Union harmonisierte Zahlen zu den Arbeitskosten je Stunde zu veröffentlichen. Damit sind zum ersten Mal international vergleichbare Daten über einen längeren Zeitraum (ab 1995) verfügbar, die Ländervergleiche und dynamische Analysen ermöglichen. Zudem erlauben die Daten auch detaillierte intersektorale Analysen. Für Deutschland zeigt sich ein außergewöhnliches Phänomen: der Unterschied zwischen den Arbeitskostenniveaus im Verarbeitenden Gewerbe und im privaten Dienstleistungssektor ist hier viel größer als in den anderen EU-Mitgliedsländern. Das vorliegende Working Paper befasst sich mit möglichen Erklärungsmustern. Zunächst werden unterschiedliche Produktivitätsentwicklungen auf individueller, Unternehmens- und sektoraler Ebene als Einflussfaktoren analysiert, dann werden mögliche Einflussfaktoren auf den Güter- und Arbeitsmärkten bei unvollständigem Wettbewerb (mark up pricing, Marktmacht) untersucht und schließlich werden die Einflüsse der Nachfragestruktur auf die Arbeitskosten in der Industrie und im Dienstleistungssektor getestet. Dazu werden zuerst bivariate Analysen und anschließend Panelschätzungen durchgeführt.

# Contents

<b>1</b>	<b>Introduction</b>	<b>5</b>
<b>2</b>	<b>Overview of the literature</b>	<b>6</b>
2.1	Theory: several competing explanations . . . . .	6
2.2	Empirics: Strong evidence for productivity and rent-sharing factors . . .	7
<b>3</b>	<b>Bivariate analysis: A correlation assessment</b>	<b>10</b>
3.1	The data to explain . . . . .	10
3.2	Individual factors . . . . .	12
3.3	Job quality . . . . .	15
3.4	Market power . . . . .	17
3.5	Growth composition indicators . . . . .	22
3.6	Bivariate conclusions . . . . .	24
<b>4</b>	<b>Multivariate analysis</b>	<b>25</b>
4.1	Static regressions . . . . .	26
<b>5</b>	<b>Conclusions</b>	<b>27</b>
	<b>References</b>	<b>30</b>
<b>6</b>	<b>Annex: Description of the variables used</b>	<b>32</b>
6.1	Individual factors/ Job quality . . . . .	32
6.2	Market power . . . . .	33
6.3	Demand structure . . . . .	34
<b>7</b>	<b>Annex: Overview of the estimators used</b>	<b>35</b>
7.1	Pooled OLS . . . . .	35
7.2	Static Fixed Effects (SFE) . . . . .	35
7.3	Static Random Effects (SRE) . . . . .	36
<b>8</b>	<b>Annex: Scatter diagrams of the data</b>	<b>38</b>

# 1 Introduction

In 2004, Eurostat starts publishing new figures on hourly wage costs for all European countries. These figures are new in several respects: It is the first time that internationally comparable hourly figures on wage costs are available covering a quite important time period (1995-2006), so that not only cross-country comparisons but also dynamic analyzes are possible. Furthermore, these figures are fairly detailed at the sectoral level, therefore allowing for inter-sectoral comparisons.

Concerning Germany, the Eurostat statistics provide quite unexpected insights; the gap between wage costs in the manufacturing sector and the (private and business) services sector is much larger than in other countries. This study aims at giving some explanations. According to theory, various explanations are possible. First, the neo-classical theory emphasizes factors affecting or indicating the level of individual productivity, as well as firm or sectoral productivity; indicators corresponding to this approach are tested. Second, dropping the assumption of perfect competition on both labor and goods markets allows for other factors (mark-up, market power) to influence the wage costs levels; these potential determinants are also tested. Finally, we think that the structure of demand (driven by domestic or foreign demand) could also have a major impact on wages in the industry and the services sector and indeed this factor seems to play an important role.

This paper is structured as follows: First, the new Eurostat statistics is presented focussing on some interesting descriptive results. In the second section, we present a list of potential determinants of wage differentials between the industry and the services sector derived from theory and literature. A bivariate analysis (correlation) is then performed and conclusions are drawn. In a third step, a multivariate analysis (panel estimation) is performed. The final section concludes.

## 2 Overview of the literature

### 2.1 Theory: several competing explanations

There are different theories explaining persisting wage differentials. The neo-classical tradition focuses on factors affecting or indicating the level of individual productivity as well as firm and sectoral productivity respectively. Theories dropping the assumption of perfect competition on both labor and goods markets consider additional determinants (mark-up, market power) influencing wage cost levels. We think, however, that the structure of demand (domestic versus foreign demand) could also play an important role in determining wages in specific sectors.

Schramm (2004, chap. 3) distinguishes three different explanations for cross-sectoral wage differentials: First, the neo-classical approach assuming perfect competition on the labor market and explaining wage differentials due to different labour/job quality or compensation for non-monetary remunerations. Second, the efficiency wage theory broadens the neo-classical view assuming that wages above the equilibrium give workers incentives to work in a more efficient manner. The so-produced rent can be divided among employers and employees (rent-sharing). Therefore, employers act reasonably if they pay more than the equilibrium wage because of moral hazard problems. The third approach focuses on non-competitive features on the labor and goods markets due to institutional set-ups that give also rise to rent-sharing for both sides, independently from the productivity level. Sociological aspects are also put forward to explain the persistence of the differences over the business cycles.

Schettkat (2006, chap. 2) quotes the same explanations and puts more emphasis on the assumption of a monopsonistic labor market (Manning 2003). In this model (contrary to the efficiency wage), the actual wage is fixed below the optimal level. A lot of empirical case studies, esp. in relation to the introduction of a minimum wage in the UK (Metcalf 2007), show that several sub-branches of the service sector are better modeled as a monopsony rather than within a perfect competition framework (Card & Krueger 1994, Dickens & Katz 1986, Card 1996, Machin & Manning 2002). Thus not only productivity differences but also the structure of the labor market could explain wage differentials across sectors.

The efficiency wage theory assumes that the wage level directly affects workers'

efforts and that the information about the strength of this effort is asymmetric; workers know, employers can only guess (Shapiro & Stiglitz 1984, Krueger & Summers 1988). Consequently, moral hazard problems occur. This is the reason why employers have incentives to take workers' interests into account. Wages above the optimal wage level (without efficiency wage consideration) produce involuntary unemployment but reduce turn-over (hiring/firing costs) and provide incentives for high-productive workers to apply and stay in the firm and to increase their work-effort. Therefore, cross-sectional wage differences can be due to different productivity/qualifications of workers as stated in the neo-classical theory; but they can be modified according to the social consensus – if society prefers a more equal income distribution, we would face a smaller wage dispersion (due to a higher wage compression) than the one occurring according to productivity/quality differences in the specific sectors.

Nowadays, institutional factors are also put forward; especially the presence of a coordinated wage bargaining system should reduce wage dispersion across sectors and qualifications. Thus, a high union density or a high coverage of union agreements should go hand in hand with a smaller wage differential (Layard, Nickell & Jackman 1991, “the battle of markups”). The market power of trade unions, however, probably depends on the firm size; Very small firms could be able to resist trade unions' demands more easily than bigger ones (where strikes could be more likely and costly)<sup>1</sup>. Not only the size of the firms may play a role but also the amount of the rent the owner receives. A higher rent could encourage workers to organize in a trade unions in order to force the owner to share it. In the insider-outsider theory the more institutions protect the insider, the higher the wage they can achieve (Lindbeck & Snower 1988, Lindbeck & Snower 2002).

## **2.2 Empirics: Strong evidence for productivity and rent-sharing factors**

According to the neo-classical theory, only differences in the labor productivity or in the job-conditions can explain wage differences. Schramm (2004), however, reports that empirical studies on job-conditions (health, ecological, hardness, job-security, working-time and vacations, non-monetary rewards, ...) come to the conclusion that the only robust determinant explaining wage differences is a higher death probability. Thus, different wages in the industrial and the service sectors could only be attributed to

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<sup>1</sup>The idea is also that workers in smaller firms may be less attainable by trade-unions.



differences in the ability and productivity of workers in these sectors.

Regarding Europe, Genre, Momferatou & Murre (2005) give a broad descriptive analysis of the wage differentials within the Euro Area. Using essentially OECD data, their wage data differ from our data. Nevertheless, they find similar results: the ranking of the countries did not change much over time. On average higher wages are paid in the industry compared to the service sector. This cannot be fully explained by part-time, self-employment or age effects nor by qualification effects (that even have an opposite effect). Gender appears however to play no role. The individual productivity-approach in the whole cannot fully explain the differences. The alternative theories provide variables as capital intensity, average firm size and sectoral labor productivity. This means that rent-sharing theories are in line with the observed data.

Haisken-DeNew & Schmidt (1999) confirm with more recent data for Germany and the US that even after controlling for human capital components, job characteristics, status and geographical factors, the inter-industry wage structure is very persistent on both sides of the Atlantic.

Freeman & Schettkat (2001) compare the skill distributions among the unemployed and the employment in USA and Germany, as well as the wage distribution in these two countries and come to the conclusion that the productivity-theory, i.e. the neoclassical one, is not able to explain the better employment performance in the USA.

In most studies focussing on the USA, the inter-industry wage differentials are found to be stable over time, even after controlling for unionization and observable characteristics of the workers and job characteristics. Since these differences are highly stable over time, they cannot be attributed to transitory supply or demand shocks affecting a specific industrial sector. Thus, the competitive theories seem to be unable to explain these differentials. Some authors argue that non-standard theories would do a better job; efficiency wage theories for example can explain why the quit rate in high-wage-industries is lower (Krueger & Summers 1988), or rent-sharing theories can explain why profitability seems to be higher in high-wage industries (Dickens & Katz 1986). On the other side, some authors argue that non-observed abilities of workers may affect the inter-industry wage differentials even in the long-run, since these abilities may be judged or perceived differently across industries (Gibbons & Katz 1992). In this latter explanation the competitive model is not challenged anymore. However, the empirical evidence is not that clear.

Martins, Scarpetta & Pilat (1996) find that market power exist in the studied industrial sectors and differ across products.

Suedekum & Blien (2007) use a German panel for 326 regional districts and 28 industries and services categories between 1993/5-2002 and find that 70% of the wage differential across regions and industries can be explained by industries and area type fixed effects as well as time-varying characteristics such as qualification (low, medium and high), firm size (small, medium and large), age and gender structure. In a second step they regress the employment growth rate on the unexplained regional wage differential and find out that the elasticity is strongly negative for export-oriented and exposed sectors such as manufacturing and insignificant (and even positive) for rather domestically oriented service sectors (gastronomy and household-related services). Thus, for export-exposed industries, the supply-side effects of wages are dominant whereas for the service sector the demand-side aspects of wages have a bigger impact (however the authors claim that the supply-side effects dominate for both type of industries). It is also remarkable that for Germany the qualification variable is correctly signed (branches and regions with higher workers pay higher wages too)<sup>2</sup>, the effect of age is slightly positive, as the firm size and the proportion of men.

Erdil & Yetkiner (2001) perform a macroeconomic panel using the STAN-OECD and UNIDO databases. After showing that the wage differentials within the manufacturing sector is constant over the whole available sample period (1970-1992), explanation for these differentials are put forward. For the OECD countries only labor productivity and gender have the right sign and robust effects. Profitability and competitiveness seem to play a role only in 1990. However, their dataset is quite restrictive regarding possible control-variables; working-time, nationality or race, qualification, country size cannot be accounted for.

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<sup>2</sup>A finding not found by the ECB.

## 3 Bivariate analysis: A correlation assessment

### 3.1 The data to explain

#### 3.1.1 Sources and definitions

The labor costs analyzed in this study are taken from the Labour Cost Statistics (Eurostat)<sup>3</sup>.

The wage costs per hour include social security contributions of both employees and employers, as well as the personal income tax paid by the employees. Some additional and quite negligible costs paid by the employers are also included in the statistics (working clothes, ...). The countries covered are the EU-27 countries; i.e. EU-25+2: Euro Area(12) + UK, Denmark, Sweden and the new 10 Eastern countries + Romania and Bulgaria<sup>4</sup>. While Ireland is completely missing, others have very few data (Hungary, Malta and Italy for example). Note that for the EU-15 only those employees are considered which are working in firms employing at least 10 employees, whereas for the new member states all are considered. This implies that the wage cost levels are probably over-estimated in the EU-15, since small firms pay lower wages on average (see detailed Eurostat statistics for the NMS-10 grouped by firm size).

In this study we focus on the business sectors C to K with CDE = Industry (without construction) and GHIJK = business services (without state and near-state services like health care or education)<sup>5</sup>.

The study is based on annual data covering the years 1995 to 2006. For some countries the data base is incomplete, i.e. we face an unbalanced panel.

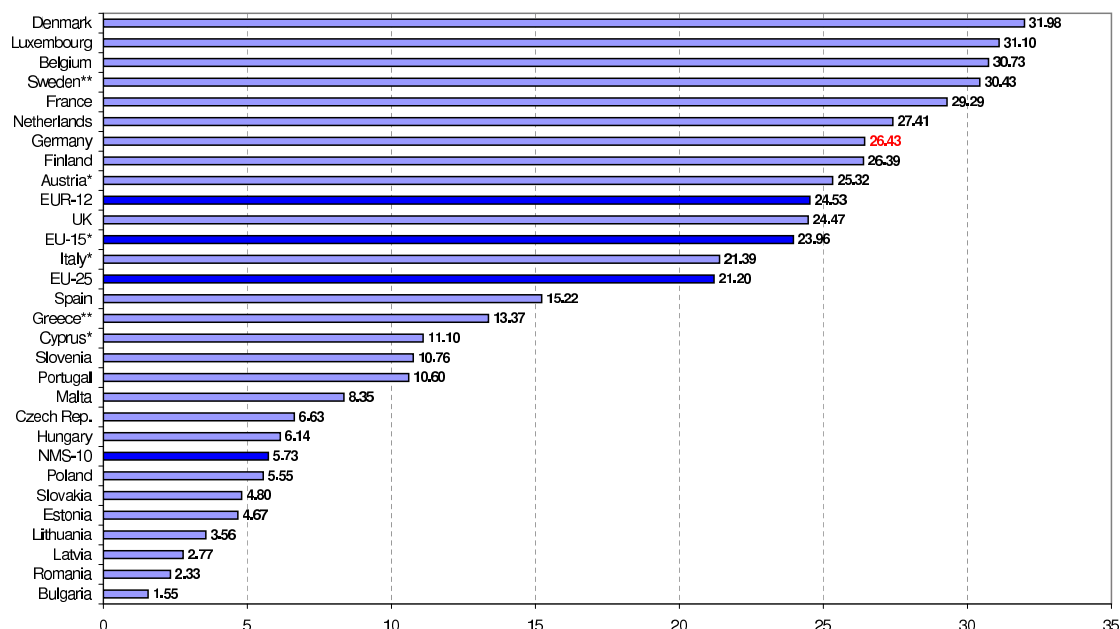
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<sup>3</sup>See: <http://epp.eurostat.ec.europa.eu/> → Data → Labour Market → Labour costs → Labour costs annual data → hourly labor costs.

<sup>4</sup>As the data ends in 2006, Slovenia, Malta, Cyprus and Slovakia are not yet members of the Euro Area but belong to the 10 new member states. These countries joined the Euro Area resp. 2007 for the first, 2008 for the two followers and 2009 for the last one. Greece did join 2001. The Euro Area started 1999.

<sup>5</sup>More and more data for the other sectors (AB=agriculture and forestry and LMNO=state and near-state services) are available. However, these sectors are either negligible in size or cannot be considered as market-driven and are thus not considered in this study.

Chart 1: EU-27-Country ranking for the hourly wage costs in €, in 2005 and for the market economy (C-K) (Data-update: Jan. 2008).



\*: data of 2004; \*\*: data of 2003. No data for Ireland. NMS-10=New Member States.  
Source: Eurostat.

### 3.1.2 Two interesting results

1. Contrary to the broadly accepted view (Sinn 2007, Schröder 2007) Germany is not the country with the highest wage costs. In fact, several Northern and Western European countries form a bulk of high-wage countries, while Germany has a rather middle position within the EU-15. The Southern countries and especially the new member states are well below the Western average. See Chart 1 and a detailed descriptive analysis in Dütthmann et al. (2006), Horn et al. (2007) and Joebges et al. (2008).

2. The second interesting result is the fact that in Germany the wage costs in the industry sector differ largely from those in the service sector. Explaining this puzzling result is the aim of this paper. Business services are quite heterogeneous. We can divide them into several groups; the domestic oriented services (GHI: trade, restauration/hotels, transportation/communication) on the one hand and the financial services (J) and real estate business and services to other firms (K). These two last categories show quite high wage rates. Financial services are internationally embedded like the industry. Real estate business, as a wealth-market, is special in the sense that price-setting behavior

is much more determined by expectations and “animal spirits” and much more subject to long lasting bubbles. As the period studied embraced an era of increasing optimism (the first year of sentiment reversal 2007 is not in the sample), the gap between these services and the rest of the business economy was increasing quite sharply and reflect the bubble formation from the 1990’s to 2006 and for this reason we let these services by side.

As can be seen in Chart 2, Germany has the highest Industry/Services differential; German industry workers earn around 20% more than services workers. Comparative to domestic services workers, the industrial sectors pay almost 40% more. In the new Member states, industry workers earn less than in the services, but the differences are very small. Portugal present an opposite picture; services pay 20 to 30% more than in the industry.<sup>6</sup> These differentials between industries wages are quite stable over the years. The dependent variable in our empirical study is the hourly wage costs in the industry (CDE)<sup>7</sup> in relation to those in the domestic business service sector (GHI).

## 3.2 Individual factors

As introduced above, we focus on different categories of explanatory variables. The first set which is in line with all theories are the individual features. These variables are indicators for the individual productivity (stemming from working experience or education), or for some inherent social discrimination (that per se says nothing about the individual productivity but rather how high social discrimination is or may indicate some hidden specific job characteristics). The correlations are shown in Table 1 (p. 15). A precise description of the variable can be found in the annex (32).

### 3.2.1 Age/Experience

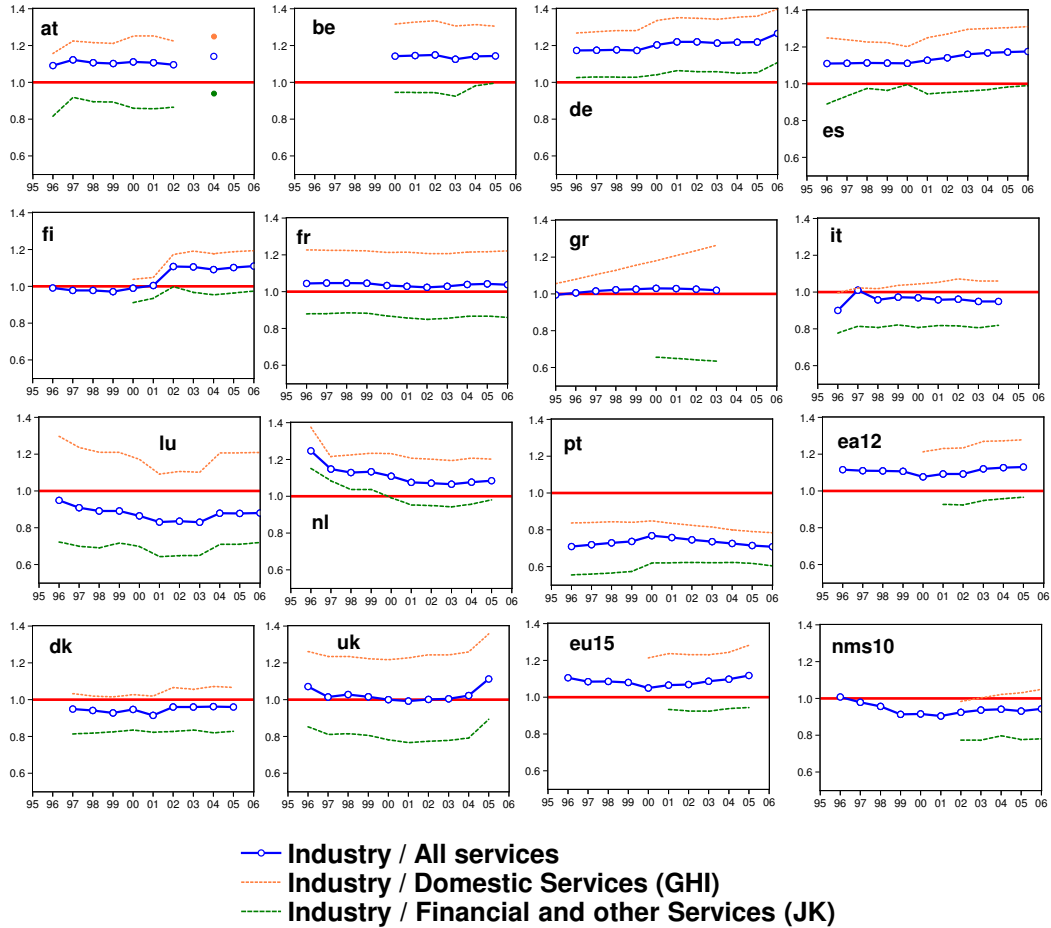
Two variables are constructed: a variable for young employees (15-24 years old: *agey*) and one for elder employees (more than 50 years: *ageo*). The variables are constructed similar to the wage costs: a value above one means that the proportion of younger resp. elder employees in the services is higher than in the industry sector.

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<sup>6</sup>Interestingly the contribution of domestic demand to GDP growth was 0.8%-points in Germany and 3.7%-points in Portugal between 1995-2005!

<sup>7</sup>For robustness check and data availability we look also at the manufacturing industry only (D).

Chart 2: Relative wage costs in Europe: Industry/Services



A value above 1 indicates that the average wage costs in the industry are higher than those in the service sectors.

Source: Eurostat, own calculations. Some countries are missing (Ireland for example).

The age can be regarded as a proxy for the working experience and thus the acquired qualification of the employee. Usually, a hump-shaped productivity-age-curve is assumed. However, in empirical studies the curve is rather flat at the end, so that a real decline at higher ages is probably not significant. Therefore, a negative sign for the 15-24-variable is expected and a presumably positive albeit not significant correlation for the 50+-variable.

The correlations show the expected signs and are mostly significant at 1%. The

results are robust regarding sample size (EU27 vs EU15 vs big countries<sup>8</sup>) and variable definitions (domestic services compared to the whole industry or only to the manufacturing services). Therefore, the hypothesis of an hump-shaped age-productivity-curve inducing higher wages for elder employees is supported by our data.

### 3.2.2 Qualification

Data for the formal qualification composition of the sectoral labor force are available from the Labour Force Survey (Eurostat), according to the ISCED classification. The employed persons are divided into three groups according to the highest level of education attained: low, medium and high qualifications<sup>9</sup>. For each sub-sectoral group, a weighted mean was calculated, as well as the proportion of each group to the total. Again, if the variable (*qualif*) is above one it means that on average employees in the services are (formally) better qualified than those in the industry sector. For each category, a variable putting the proportion of this group in the service workforce to the similar proportion in the industry was constructed (*low*, *medium* and *high*).

As for the acquired qualification, a positive effect (more qualification should go along with higher wages and thus higher wage costs) is expected here. Along these thoughts, we expect at least a negative correlation for *low* and a positive for *high* and *qualif*.

Contrary to the ECB's study (Genre et al. 2005), we find the expected signs; high formal education goes along with higher wages. The correlations are all significant and robust to sample and variable-definition variations.

### 3.2.3 (Labor) Productivity

Productivity measures are only available on a per-capita basis, because figures for hours are not available for all countries. Working time reductions have reduced the productivity per head but increased wages per hour in the past. Nevertheless we have a stronger argument against this variable; taking the ratio of sectoral gross value added to the

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<sup>8</sup>Countries with a GDP greater than 1% of the GDP of the EA-12 during the whole 1995-2006-years).

<sup>9</sup>Low: At most lower secondary (ISCED 0-2); Medium: Upper secondary (ISCED 3-4); High: Tertiary (ISCED 5-6). See: [http://forum.europa.eu.int/irc/dsis/employment/info/data/eu\\_lfs/f\\_lfs\\_statistical\\_classifications.htm](http://forum.europa.eu.int/irc/dsis/employment/info/data/eu_lfs/f_lfs_statistical_classifications.htm).

sectoral employment levels is thought to be highly endogenous and may yield to strong endogeneity problems. We think indeed that the way value added is measured in national account statistics is strongly affected by the pricing behavior of firms. As such the value added per employee is probably not a good indicator of what economists understand by labor productivity and instead reflects rather the possibility for each firm to charge high prices for their goods or services; In these lines it is interesting to note that the labor productivity in the financial sector is one of the highest, together with sectors with high pricing-power (mining/quarrying and energy/water/electricity).

Therefore, we decided not to use productivity per capita as explanatory variable although it is positively and significantly correlated.

Table 1: Individual factors: Correlation between the wage cost variable and individual variables, 1995-2006.

		domestic services (GHI) / industry (CDE)								
<b>Definitions</b>		EU-27			EU-15			EU: big countries		
50+ Employees	ageo	<b>25.1%</b>	0.8%	111	<b>47.4%</b>	0.0%	62	<b>29.9%</b>	0.3%	95
15-24 Employees	agey	-7.5%	62.3%	45	<b>-89.9%</b>	0.0%	24	-7.5%	62.3%	45
High educ. Employees	high	<b>47.6%</b>	0.0%	233	<b>69.0%</b>	0.0%	124	<b>58.0%</b>	0.0%	157
Medium educ. Employees	medium	<b>44.0%</b>	0.0%	233	<b>66.7%</b>	0.0%	124	<b>54.2%</b>	0.0%	157
Low educ. Employees	low	<b>-42.7%</b>	0.0%	233	<b>-32.4%</b>	0.0%	124	<b>-37.7%</b>	0.0%	157
Ø employees' education level	qualif	<b>57.1%</b>	0.0%	233	<b>64.0%</b>	0.0%	124	<b>62.3%</b>	0.0%	157
		domestic services (GHI) / manufacturing industry (D only)								
<b>Definitions</b>		EU-27			EU-15			EU: big countries		
50+ Employees	ageo	<b>37.0%</b>	0.0%	204	<b>48.3%</b>	0.0%	122	<b>45.5%</b>	0.0%	157
15-24 Employees	agey	<b>-30.9%</b>	0.0%	216	-20.4%	2.3%	124	<b>-28.1%</b>	0.0%	159
High educ. Employees	high	<b>61.7%</b>	0.0%	234	<b>74.3%</b>	0.0%	124	<b>71.6%</b>	0.0%	157
Medium educ. Employees	medium	<b>38.4%</b>	0.0%	234	<b>71.7%</b>	0.0%	124	<b>49.3%</b>	0.0%	157
Low educ. Employees	low	<b>-54.7%</b>	0.0%	234	<b>-36.7%</b>	0.0%	124	<b>-48.6%</b>	0.0%	157
Ø employees' education level	qualif	<b>66.8%</b>	0.0%	234	<b>69.7%</b>	0.0%	124	<b>70.1%</b>	0.0%	157
First column = correlation coefficient; Second column = associated probability (H0: $\rho=0$ ); Third column = nb. of obs. Bold figures are significant at the 1% level.										

### 3.3 Job quality

The correlation results can be found in Table 2 (p. 18).



### 3.3.1 Gender

Data for the gender composition of the sectoral labor force is available from the Labour Force Survey (Eurostat). The variable (*gender*) is constructed similar to the wage costs: a value above one implies that the proportion of men in the services is higher than the proportion of men in the industry.

There is no “theoretical” explanation – along the productivity-theories – why women should earn less than men. But it is a stylized fact reported in various and numerous gender studies, that women are discriminated with respect to wages. Thus, omitting this variable could yield a severe bias in quantifying the effects of the other variables. This variable is correlated with the part-time proportion (-41%) and working-time (+58%); implying that where the working-time is long, the men are over-represented.

The sign of the expected effect is positive. And indeed the correlation is strong and positive.

### 3.3.2 Part-time

Data for part-time jobs on a sectoral level are available from Eurostat from several sources. We picked here data from the LFS. Again the variable (*partt*) takes values above one if the part-time ratio is higher in the services than in the industry.

Like for gender, it is a stylized fact that the hourly wages for part-time employees are lower than those of full-time employees (OECD 1999, p. 22-25). One explanation is that firms invest less in the training of part-time workers and that jobs that can be fulfilled with a part-time are rather less qualified jobs (this is confirmed by the high correlations between the qualification variables and the part-time variable (-70% between *qualif* and *partt*). This variable is negatively correlated with the gender variable as mentioned above, so that this variable may be an indicator for social discrimination and for job quality. This would yield a negative correlation.

The correlation is indeed negative (although not significant for EU-15 what must be due to small countries).

### 3.3.3 Working time

An alternative to the part-time variable for measuring the effect of working time on wages is to take the working time average in the sectors. These data are available in the LFS (Eurostat). Again the variable (*wt*) takes values above one if the average working time in the services is higher than in the industry. Similar to the part-time variable but with reverse sign, we expect a positive correlation.

The correlation is indeed robustly positive significant at 1%.

### 3.3.4 Short-term contracts

Data for contract type on a sectoral level are available from Eurostat (LFS). Again the variable takes values above one if the fixed-term contract proportion is higher in the service than in the industry. Because of a lack of data for the branches C and E, the results of the first panel of Table 2 should not be interpreted.

Like for gender, it is a stylized fact that the employees with fixed-term contracts are lower than those of employees with long-term contracts (OECD 2002, chap. 3). This variable may be an indicator for social discrimination and for job quality. This would yield a negative correlation.

The correlation is but positive and to some extent significant. An explanation is that we exclude here the sector K, where “temporary” workers are counted. So here we count only workers with fixed-term contracts directly with the firm they are working in. For those, the pay gap may be not severe. Data quality may be also an issue here.

## 3.4 Market power

The second set of possible explanatory variables describe the degree of market power of either parts of the labor market. Firm- or sector-specific variables are also indicators for productivity in the sense that they are in fact not linked to the personal abilities of the workers, but through capital-intensity still affect the overall labor productivity. We interpret them but in line with the rent-sharing theories; the bigger the firm, the more likely it possesses some market power and therefore receives a monopolistic rent that can

Table 2: Job quality: Correlation between the wage cost variable and job quality variables, 1995-2006.

		domestic services (GHI) / industry (CDE)								
<b>Definitions</b>		EU-27			EU-15			EU: big countries		
Male Employees	gender	<b>52.5%</b>	0.0%	235	<b>77.6%</b>	0.0%	123	<b>66.0%</b>	0.0%	158
Ø working time	wt	<b>47.0%</b>	0.0%	190	<b>42.2%</b>	0.0%	118	<b>46.0%</b>	0.0%	152
Ø full-time working time	wtft	<b>23.3%</b>	0.1%	188	22.1%	1.7%	117	<b>25.6%</b>	0.2%	151
Part-time	partt	<b>-32.0%</b>	0.0%	181	-12.6%	17.5%	117	<b>-25.2%</b>	0.2%	146
Short-term Contracts	cdd	<b>-73.9%</b>	0.0%	35	-21.8%	34.3%	21	<b>-73.9%</b>	0.0%	35

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		domestic services (GHI) / manufacturing industry (D only)								
<b>Definitions</b>		EU-27			EU-15			EU: big countries		
Male Employees	gender	<b>63.0%</b>	0.0%	236	<b>82.2%</b>	0.0%	124	<b>73.5%</b>	0.0%	159
Ø working time	wt	<b>56.6%</b>	0.0%	235	<b>47.1%</b>	0.0%	124	<b>55.8%</b>	0.0%	158
Ø full-time working time	wtft	<b>26.5%</b>	0.0%	234	<b>28.8%</b>	0.1%	124	<b>32.5%</b>	0.0%	158
Part-time	partt	<b>-40.9%</b>	0.0%	181	-20.1%	3.0%	117	<b>-34.2%</b>	0.0%	146
Short-term Contracts	cdd	17.3%	2.1%	180	<b>41.3%</b>	0.0%	124	<b>20.7%</b>	1.0%	155

First column = correlation coefficient; Second column = associated probability (H0:  $\rho=0$ ); Third column = nb. of obs. Bold figures are significant at the 1% level.

be shared with the workers, leading to wage differences that cannot be explained due to productivity differences. To which extent the monopolistic rent is shared with the workers is linked to their market power, measured by the bargaining-power-variables. The correlations are shown in Table 3 on p. 23.

### 3.4.1 Firm size/capital intensity

Data on firm size are difficult to obtain. Data from Eurostat could be collected however (Eurostat, annual Structural Business Statistics – SBS). The quality may be questioned however.

This variable is a proxy for capital intensity or the degree of market power in the sector: the larger a firm, the bigger the economies of scale, and thus the larger the amount of capital per head but also the more likely the fact that the firm possesses market power. The first explanation yields a positive effect on labor productivity and hence on wages, the second through the rent-sharing among employers and workers a positive effect on wages too. Thus, in both cases, a positive correlation is expected.

The correlations are however negative albeit almost all not significant. We suspect here measurement errors to be great.

For Germany, the Federal Statistical Office (Destatis 2006, p. 15, Chart 4) shows that the size of firms and the wage costs are positively correlated and that this is a long-term feature (1992-2004). Capital intensity (measured as gross capital formation/head) is also positively correlated through the German branches in 2004 with the amount of the wage costs.

### 3.4.2 Self-employment ratio/capital intensity

Data on self-employment and employment in a sectoral disaggregation can be taken from the national account statistics (Eurostat). The variable (*selfvgr*) takes a value above one if the proportion of self-employed in the services is larger than those in the industry.

This variable is also a proxy for the firm size (the correlation between the two variables is but not existent what confirms our suspicion about the data quality of *firmsize*) and consequently for the capital intensity and/or for the market power of the firms. Because the link is reversed (a larger proportion of self-employed goes along with a smaller average firm size), we expect a negative sign.

The correlation is negative, and robustly significant at 5%.

### 3.4.3 Unemployment rate/strength of workers

Data on the standardized unemployment rate are provided by Eurostat (ILO-concept). The unemployment rate here is the national-wide rate (no sectoral differences are available). This should be an indicator for the market power or relation between employers and employees as predicted by the insider/outsider theory: A higher unemployment rate goes along with a weaker bargaining position of employees. By which extent this should affect employees in industrial sectors more than in service sectors is an open question. But if no other indicators are included, as in the years observed (1995-2006), the structural change operates in favor of services: A higher unemployment rate should weaken the industry employees more than those in the service sectors on the one hand (negative effect), on the other hand a higher unemployment rate may be rather an indication for poor macroeconomic performance, which could weaken the service sector more than the

industry<sup>10</sup> (positive effect).

The correlation is mostly insignificant and not very robust as the sign change if the variables definition is changes.

### 3.4.4 Minimum wage

A dummy variable takes value 1 if the country has a minimum wage and 0 otherwise. There are only seven countries without legal national minimum wage throughout the sample (Austria, Germany, Finland, Italy, Denmark, Sweden and Cyprus), the UK has adopted a minimum wage in 1999.

Another interesting variable would be the proportion of employees covered by minimum wage(s); as we exclude civil servants and employees of the social services, for countries where the minimum wage is legal and national, this coverage rate will be 100%<sup>11</sup>. More interesting is the proportion covered in the North-South axis of countries that do have minimum wages only at sectoral levels and set by collective agreements (Italy, Germany, Austria, Denmark and the three scandinavian countries). From Funk & Lesch (2005) and Husson (2006) some figures are available for some years. It appears that Austria, Denmark, Finland and Italy have high coverage rates (above 85%) whereas Germany and Norway have low coverage rates (around 70% in 2004, but here we suspect that this concerns only West-Germany<sup>12</sup>). A closer look at low-pay sectors that are all in the Services (textile/clothing, retail, hotel/restaurants, hairdressing) also shows that the coverage of the minimum wages set by the collective agreements are much smaller in those two countries than in the others. Due to lack of data however, the aim to construct such a variable was abandoned.

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<sup>10</sup>Industry-firms are thought to be more likely to export their products than Services in general. This is confirmed by the Input-Output tables for Belgium, Germany, Ireland, Spain, France, Italy, Netherlands, Austria, Portugal, Finland, Denmark, Sweden, UK, Lithuania, Hungary, Slovenia and Slovakia for the available years between 1995 and 2004. By this way, industrial firms may compensate domestic slackness through better foreign demand more significantly than firms in the Services.

<sup>11</sup>In Belgium the minimum wage concerns only the employees in the private sector. As we only look at the private sector, excluding construction and the primary sectors, the coverage rate is 100%. In Cyprus, the minimum wage concerns only some professions; sales staff, clerical workers, auxiliary health care staff and auxiliary staff in nursery schools, crèches and schools. Thus the coverage rate is not 100%.

<sup>12</sup>From the WSI-Tarifarchiv (2006) figures, the coverage rate by collective agreements, where minimum wages are normally defined, varied from 76% to 67% between 1998 and 2005 in West-Germany and from 63% to 53% in the East.

A national-wide minimum wage affects (almost) all employees. It should reduce the wage differentials because it increases the very low wages in all sectors. Thus the absence of a minimum wage should be associated with more extreme values of our dependent variable and the presence of a national minimum wage with values concentrated around one. This non-linear effect can be caught if the sample is divided in two (countries/years with a value of the dependent below a chosen value and countries/years with a value above the chosen value). In the first group ( $w \leq \bar{w}$ ) a positive coefficient is expected and in the second ( $w \geq \bar{w}$ ) a negative one.

For the whole sample, a positive (non-significant) correlation can be observed. For the split sample – with  $\bar{w}=1$  and  $\bar{w}=\text{median}$  – the expected non-linear effect is not met, it is even counter-intuitive, the negative correlation in the first sub-sample appears to be much higher than in the second sub-sample.

### 3.4.5 Union density rate, union coverage

The union density rate is taken from the OECD-database (Bassanini & Duval 2006). The data (*udens\_1*) ends in 2003 and covers only Western European countries. Another measure (*udens\_2*) was taken from the OECD-database (OECD.stat). It covers less years (1999-2002) but there is some information for the New Member States. The measure for union coverage (Bassanini & Duval 2006) is also considered. The strength of the unions (and employers' unions) are measured by the number of days lost per 1000 employees and by the number of employees involved per 1000 employees.

One would expect that the union density is especially low in service sector, as mentioned above. Thus, a higher union density would rather go along with a smaller difference between union coverage in the services compared to the industry sector. This would support a positive effect in the labor cost relation between Industry and Services. The correlation here is positive and at most significant at the 10% level.

It is remarkable that a non-linear effect can be found (the correlation coefficient is significant positive for values of the dependent below the chosen value and significant negative for values of the dependent above the chosen value). The explanation is quite straightforward and follows the arguments for a hump-shaped wage/centralization degree of wage bargaining à la Calmfors & Driffill (1988). The stronger the trade-unions, the more likely they coordinate their actions and promote wage compression over all

sectors leading to a reduction of the wage differential. On the other hand, the less representative, the more firm-specific the trade-unions demands will be, yielding a higher wage dispersion across sectors. This means that values well above and below the chosen value (one or median) in our dependent variable should be associated with low values of union density, and values about the chosen value (one or median) of our dependent variable should be associated with high values of union density. This means that the correlation should be positive for values of the dependent below and negative for values above the chosen value.

### **3.4.6 Strikes**

Data on number of days lost through strikes and lock-outs are available in the Eurostat-LFS. The intuition is not so straightforward; The more organized the trade-unions, the more strikes they can impose and therefore the more they can achieve in terms of wages. But if we consider the examples of France and Germany, the French trade-unions may be well implanted in strategic firms (public transports, education, civil service) and achieve quite paralyzing strikes but in the business sector and especially at the firm level, they are rather poorly implanted and their achievements in terms of firm-specific pays and working conditions can be seen as poor. On the contrary, German trade-unions are more implanted in the firms and achieve more through the social dialogue culture than through activist striking actions. By the way German civil servants are not legally allow to strike; therefore the German figures are downward biased. So the German figures show low striking days relatively to France and yet the German trade-unions are stronger than the French ones.

And indeed both strike's measures should non-significant results near zero.

## **3.5 Growth composition indicators**

The idea for this last set of variables is that the demand addressed to a sector plays at least as an important role in the wage determination as the relative competitiveness of this sector. Thus, we think that the wage costs in a sector are not only reflecting the (marginal) productivity of this sector net of the employer's rent due to imperfect competition but also the structure of the demand (foreign versus domestic demand) a

Table 3: Individual factors: Correlation between the wage cost variable and individual variables, 1995-2006.

		domestic services (GHI) / industry (CDE)								
Definitions		EU-27			EU-15			EU: big countries		
Ø Firm Size	fsize	-0.3%	96.7%	189	-12.7%	21.5%	97	-13.6%	12.4%	130
Self-employed Proportion	selfvgr	<b>-21.1%</b>	0.2%	211	-25.7%	1.6%	88	<b>-42.6%</b>	0.0%	128
Lost working days in ‰	streik	1.1%	88.2%	182	-1.1%	90.7%	108	0.6%	94.8%	136
Striking employees in ‰	streikee	0.4%	96.2%	151	-3.7%	72.6%	93	-2.1%	81.9%	117
Minimum Wage dummy	minw	13.0%	3.9%	253	2.6%	77.3%	124	12.5%	11.0%	164
Unemployment rate	ur	-4.0%	54.2%	238	-20.2%	2.4%	124	-8.1%	30.4%	162
Union density (OECD.stat)	udens.1	21.5%	13.5%	50	28.1%	7.1%	42	21.7%	14.7%	46
Union density (BD-06)	udens.2	–	–	–	18.6%	8.5%	87	–	–	–
Union coverage (BD-06)	ucov	–	–	–	19.0%	7.8%	87	–	–	–
		domestic services (GHI) / manufacturing industry (D only)								
Definitions		EU-27			EU-15			EU: big countries		
Ø Firm Size	fsize	-12.4%	9.0%	189	-18.9%	6.4%	97	<b>-27.7%</b>	0.1%	130
Self-employed Proportion	selfvgr	<b>-29.3%</b>	0.0%	180	-29.7%	1.4%	68	<b>-56.7%</b>	0.0%	108
Lost working days in ‰	streik	3.3%	72.7%	115	5.9%	65.5%	60	7.8%	49.8%	78
Striking employees in ‰	streikee	2.6%	78.7%	109	16.1%	22.0%	60	19.9%	8.1%	78
Minimum Wage dummy	minw	<b>23.8%</b>	0.0%	253	9.1%	31.7%	124	<b>25.1%</b>	0.1%	164
Unemployment rate	ur	6.6%	31.3%	238	-17.1%	5.7%	124	1.6%	83.9%	162
Union density (OECD.stat)	udens.1	12.6%	38.2%	50	21.0%	18.1%	42	12.8%	39.5%	46
Union density (BD-06)	udens.2	–	–	–	13.0%	23.0%	87	–	–	–
Union coverage (BD-06)	ucov	–	–	–	18.4%	8.8%	87	–	–	–
First column = correlation coefficient; Second column = associated probability (H0: $\rho=0$ ); Third column = nb. of obs. Bold figures are significant at the 1% level.										

specific sector is confronted with.

Here, however, a precision has to be made. As the sectoral wage differentials are persistent over time i.e. over the business cycles, the state of demand, reflected within traditional business cycle indicators like the growth rate, cannot explain the wage gap. Here, we think rather in terms of long-term structure or strategies; Germany for example has a long tradition of using external trade to foster growth, whereas other European countries push rather domestic demand. In that respect, it is likely that the participation to the Monetary Union has induced a change in preferences in economic policy in those countries which traditionally focus rather on domestic forces than in countries with a long experience of de facto monetary bindings like Netherlands or Austria.

In these respects, we thought that the indicator should be cumulative and relative, i.e. has a chance to persist over-business cycles, and reflects long-lasting differences in the demand addressed to the industry and service sector or the growth strategy pursued by the country. We look at the composition of growth as an explanatory factor for the wage differential; industry sectors are traditionally more export-oriented, whereas



the service sector typically depends on the domestic market (with some exceptions of course). Growth will not have the same impact on the wage opportunities for workers in the industry and the service sector, depending on the driving forces; the German model of export-led growth should favor the industry more than the service sector whereas the Portuguese model of domestic demand-led growth should be more favorable to the services. The correlations are shown in Table 4.

Along these thoughts several variables were constructed. Among others, the respective shares of domestic demand and exports to GDP are thought as reflexes of long-term economic strategies. A high share of domestic demand (or alternatively closed to negative trade balances) reflects a demand-led strategy and should narrow the wage-gap between industry and services (positive correlation).

The correlations have the expected signs and are significant for the domestic demand and GDP. The results show that development of the domestic demand is much more important than export demand.

### 3.6 Bivariate conclusions

The bivariate correlations show that along the productivity theory, sectoral wage differences are partly explained by difference of workers' qualification (acquired measured by age and formal measure by the ISCED-indicators). But Job quality factors (gender, working-time) as well as more institutional factors (firm size measured by the proportion of self-employed, union density and coverage, the presence of a minimum wage, the height of unemployment rate) show explanatory power. This means that wages can be also considered as a bargaining process where on the one side firms may acquire monopolistic rent on the good markets and on the other side the traditional "battle of mark-ups" (Layard et al. 1991) between workers and employers. Finally and extending this last aspect, if the macroeconomic growth strategy favors trade surpluses over domestic growth (strategy of Finland, Netherlands, Germany and to certain extent Austria) then the industry should be advantaged. If the strategy is more balanced (France) or even accept trade deficits (Spain, Italy, Portugal), then domestic services should benefit from a strong domestic demand. This is confirmed from the growth variables tested.

Table 4: Growth strategy: Correlation between the wage cost variable and growth variables, 1995-2006.

		domestic services (GHI) / industry (CDE)								
Definitions		EU-27			EU-15			EU: big countries		
Corr(DD, GDP), $\Delta\%$	<i>g_corr_dd</i>	5.4%	39.0%	253	19.5%	3.0%	124	19.1%	1.4%	164
Corr(EXP, GDP), $\Delta\%$	<i>g_corr_exp</i>	-6.8%	27.8%	253	-2.6%	77.7%	124	-6.5%	40.5%	164
DD: nat./EA12 (index)	<i>g_dd2i</i>	15.8%	1.2%	253	13.4%	13.8%	124	16.4%	3.6%	164
EXP: idem	<i>g_exp2i</i>	-1.4%	82.0%	253	<b>-36.7%</b>	0.0%	124	-0.9%	91.3%	164
GDP: idem	<i>g_gdp2i</i>	15.6%	1.3%	253	3.3%	71.7%	124	7.2%	35.9%	164
DD: % of GDP	<i>g_shredd</i>	<b>27.3%</b>	0.0%	253	<b>33.9%</b>	0.0%	124	<b>34.6%</b>	0.0%	164
DD: % EA12-DD	<i>g_shreddeur</i>	<b>-44.5%</b>	0.0%	253	<b>-42.5%</b>	0.0%	124	<b>-46.2%</b>	0.0%	164
EXP: % of GDP	<i>g_shareexp</i>	-3.3%	59.8%	253	<b>-23.5%</b>	0.9%	124	-8.4%	28.4%	164
EXP: % EA12-EXP	<i>g_shareexp eur</i>	<b>-50.5%</b>	0.0%	253	<b>-51.3%</b>	0.0%	124	<b>-53.6%</b>	0.0%	164
GDP: % of EA12-GDP	<i>g_sharegdpeur</i>	<b>-44.7%</b>	0.0%	253	<b>-42.8%</b>	0.0%	124	<b>-46.5%</b>	0.0%	164
Trade Bal. in % of GDP	<i>g_tb</i>	<b>-27.1%</b>	0.0%	253	<b>-33.8%</b>	0.0%	124	<b>-34.4%</b>	0.0%	164
		domestic services (GHI) / manufacturing industry (D only)								
Definitions		EU-27			EU-15			EU: big countries		
Corr(DD, GDP), $\Delta\%$	<i>g_corr_dd</i>	12.8%	4.3%	253	14.8%	10.1%	124	<b>22.5%</b>	0.4%	164
Corr(EXP, GDP), $\Delta\%$	<i>g_corr_exp</i>	<b>-26.9%</b>	0.0%	253	-10.4%	24.9%	124	<b>-27.2%</b>	0.0%	164
DD: nat./EA12 (index)	<i>g_dd2i</i>	<b>20.7%</b>	0.1%	253	16.4%	6.8%	124	<b>27.4%</b>	0.0%	164
EXP: idem	<i>g_exp2i</i>	9.8%	12.2%	253	<b>-33.7%</b>	0.0%	124	14.6%	6.2%	164
GDP: idem	<i>g_gdp2i</i>	14.1%	2.5%	253	4.5%	61.7%	124	9.7%	21.6%	164
DD: % of GDP	<i>g_shredd</i>	<b>41.0%</b>	0.0%	253	<b>43.5%</b>	0.0%	124	<b>49.7%</b>	0.0%	164
DD: % EA12-DD	<i>g_shreddeur</i>	<b>-51.9%</b>	0.0%	253	<b>-44.5%</b>	0.0%	124	<b>-52.7%</b>	0.0%	164
EXP: % of GDP	<i>g_shareexp</i>	-8.4%	18.0%	253	<b>-28.3%</b>	0.1%	124	-13.6%	8.3%	164
EXP: % EA12-EXP	<i>g_shareexp eur</i>	<b>-59.1%</b>	0.0%	253	<b>-54.3%</b>	0.0%	124	<b>-61.3%</b>	0.0%	164
GDP: % of EA12-GDP	<i>g_sharegdpeur</i>	<b>-52.3%</b>	0.0%	253	<b>-44.9%</b>	0.0%	124	<b>-53.2%</b>	0.0%	164
Trade Bal. in % of GDP	<i>g_tb</i>	<b>-40.9%</b>	0.0%	253	<b>-43.8%</b>	0.0%	124	<b>-49.6%</b>	0.0%	164
First column = correlation coefficient; Second column = associated probability ( $H_0: \rho=0$ ); Third column = nb. of obs. Bold figures are significant at the 1% level.										

## 4 Multivariate analysis

The advantage of performing a multivariate analysis which includes both dimensions (time and cross-sections) is twofold: first with an increasing number of observations, we expect to obtain more accurate estimates for the effects of individual variables on the relative wage differential and second – contrary to the bivariate correlations – in a multivariate analysis, one controls for different effects at the same time and should be able to isolate the genuine effect of a factor, reducing therefore potential omitted variable bias.

However with the unbalanced data we have, not too much hope in multivariate analysis should be put. The regressors we use, summarized in  $X_{it}$ , are [*ageo*, *agey*, *gender*, *qualif*, *wt*, *selfvgr*, *ur*, *minw*, *g\_dd2i*, *g\_shareexp eur*]. We dropped the other

variables because they had too few data. Still the dataset remains unbalanced. All variables are time-variable, whereas the dummy *minw* actually is time-invariant for all countries but for the UK<sup>13</sup>.

## 4.1 Static regressions

It is not obvious that the model should contain a dynamic term, since the series are quite stable (they are all relative and thus do not have trends). Because our dataset is a macro-panel with countries from the EU-27, it seems also reasonable to rule out random-effects. At least a discussion about which variable may be correlated with country-specific unobserved characteristics should be done.

For comparison purposes, the pooled model is reported in the first column of Table 5.

In principle, all variables may be correlated with the country-effects. But certainly the unemployment rate, the presence or not of a minimum wage may be very likely candidates. As we have only the minimum-wage dummy that may be considered as almost time-invariant, the fixed-effects estimator may be the most appropriate:

$$lohnkosten_{it} = X'_{it}\beta + \lambda'DT_t + \alpha_0 + \alpha_i + u_{it} \quad (1)$$

The results of the standard estimators are reported in Table 5 and 6. The Hausman-test (H0: Random Effects are present) is not rejected and the Breusch-Pagan test (H0: Fixed effects are present) is consistently rejected. This is not in line with our intuition that a fixed-effect model would better describe a macro-panel. Besides PcGive and Stata do not produce the same estimates for the random effect model, as STATA let the random effect model collapse to the pooled OLS ( $\theta=0$ ).

Gender has the same positive sign, as well as the cumulative and relative growth variable (*g\_dd2i*). The other variables are not robustly estimated (change in signs or not really significant). Problematic is the persistent wrong sign of the other growth variable (*g\_shareDD*; Share of domestic demand in GDP), that is not at all consistent with the bivariate correlations. Perhaps one should not use the share of domestic demand in GDP and the cumulative and relative growth variable at the same time.

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<sup>13</sup>It takes the value 0 between 1995 and 1998 and 1 after.

## 5 Conclusions

In this article we analyze the data provided by Eurostat on hourly wage costs, which are comparable across all European countries. Among other interesting features, a surprising result is the outlier position of Germany where in the industry sector wages are on average 25% higher than in the service sector. The aim of this paper is to explain this puzzle.

In a first and descriptive step, a bivariate correlation analysis was performed and the following results were found: only gender is a significant factor at the individual level. Especially the (formal) qualification shows significant wrong-signed correlation, a contradiction with the widely asserted low productivity in services. On the contrary, firm specific factors indicating the importance of capital intensity in explaining wage differentials (self-employment share) do not seem to have a great explanatory power. Factors (country specific and demand indicators) that are in accordance with non-standard wage determination theories are found significant (unemployment rate, minimum wage, growth structure).

In a second step a multivariate analysis is performed, allowing to control for each effect. The signs found in bivariate correlations are so far confirmed for the elder-age-variable (+), gender (+), qualification (counter-intuitive -) and the domestic demand growth variable (+). But the cumulative and relative growth variable should not be used as a regressor at the same time.

From these preliminary results, it seems that our hypothesis is confirmed; the structure of the demand addressed to the sectors is quite an important factor explaining the development of wages and therefore the EU sectoral wage differentials.

Table 5: Static Panel Estimations, 1995-2006 (Pc Give).

Dependent variable: Wage cost differential (Domestic services / Manufacturing industry)																
Estimated with heteroskedasticity-robust standard errors																
Estimation Method: PcGive																
	Pooled OLS		Fixed Effects				Random Effects				MLE					
	Coefs	t-prob	LSDV		First Diff.		Within		GLS (b/w)		GLS (ols res.)		GLS (ols res.)			
			Coefs	t-prob	Coefs	t-prob	Coefs	t-prob	Coefs	t-prob	Coefs	t-prob	Coefs	t-prob		
ago	0.370	0.001	-0.011	0.743	0.008	0.746	-0.011	0.743	-0.027	0.622	0.057	0.400	0.028	0.666	-0.007	0.887
agey	0.168	0.000	-0.015	0.391	-0.009	0.543	-0.015	0.391	-0.006	0.781	0.059	0.017	0.051	0.030	-0.006	0.774
qualif	0.719	0.046	-0.264	0.178	-0.211	0.115	-0.264	0.178	0.208	0.429	0.553	0.046	0.624	0.021	-0.067	0.791
gender	0.205	0.237	0.174	0.203	0.188	0.119	0.174	0.203	0.359	0.005	0.455	0.001	0.433	0.001	0.256	0.039
wt	1.140	0.029	-0.296	0.252	-0.139	0.657	-0.296	0.252	0.250	0.385	0.522	0.086	0.485	0.104	0.099	0.727
cdd	-0.001	0.978	-0.014	0.095	-0.010	0.144	-0.014	0.095	0.008	0.567	0.008	0.623	0.014	0.358	-0.005	0.667
fsize	0.034	0.752	0.093	0.233	0.066	0.544	0.093	0.233	0.079	0.379	0.072	0.430	0.070	0.433	0.083	0.341
selfvgr	-0.017	0.281	0.000	0.993	0.004	0.365	0.000	0.993	-0.010	0.235	-0.014	0.200	-0.011	0.226	-0.010	0.283
minw	0.023	0.459	-0.090	0.121	0.000	-	0.000	-	0.021	0.610	0.015	0.556	0.012	0.617	0.026	0.664
ur	0.003	0.349	0.002	0.625	0.000	0.912	0.002	0.625	0.003	0.252	0.006	0.025	0.005	0.029	0.004	0.118
dd2i	0.003	0.050	0.003	0.003	0.002	0.001	0.003	0.003	0.001	0.123	0.002	0.008	0.002	0.049	0.003	0.003
sharedd	-0.006	0.034	-0.008	0.004	-0.005	0.015	-0.008	0.004	-0.004	0.144	-0.005	0.055	-0.003	0.171	-0.007	0.010
R <sup>2</sup>	0.739		0.972		0.232		0.404		0.666		0.849		0.849		0.573	
Wald (joint):	906.6 [0.000] **		185.0 [0.000] **		224.7 [0.000] **		172.1 [0.000] **		28.44 [0.005] **		91.16 [0.000] **		86.81 [0.000] **		31.66 [0.002] **	
Wald (dummy):	56.38 [0.000] **		9819. [0.000] **		17.59 [0.040] *		26.03 [0.002] **		1.662 [0.197]		12.08 [0.280]		3.081 [0.079]		28.66 [0.001] **	
Wald (time):	43.00 [0.000] **		26.03 [0.002] **		17.59 [0.040] *		26.03 [0.002] **		-		8.934 [0.443]		-		19.88 [0.019] *	
AR(1) test:	2.733 [0.006] **		1.406 [0.160]		-1.555 [0.120]		1.406 [0.160]		4.751 [0.000] **		6.744 [0.000] **		6.809 [0.000] **		3.633 [0.000] **	
AR(2) test:	2.363 [0.018] *		-1.045 [0.296]		-0.2937 [0.769]		-1.045 [0.296]		1.501 [0.133]		3.875 [0.000] **		3.500 [0.000] **		0.7060 [0.480]	
Nb Obs.	107		107		88		105		105		105		105		105	
Nb. Param	22		40		21		38		13		22		22		22	
Time Dummies	9		9		8		9		0		9		0		9	
Test in LSDV All Individual Dummies = 0: $\chi^2(18) = 1.82107e+006 [0.0000]$ **																

Test in LSDV All Individual Dummies = 0:  $\chi^2(18) = 1.82107e+006 [0.0000]$  \*\*

Table 6: Static Panel Estimations, 1995-2006 (STATA).

Estimation Method: stata												
Dependent variable: Wage cost differential (Domestic services / Manufacturing industry)												
Fixed Effects (xtreg, fe)				Random Effects (xtreg, re)				Random Effects (xtreg, re sa theta)*				
Within (TD)		Within (w/o TD)		GLS (TD)		GLS (w/o TD))		GLS (TD)		GLS (w/o TD))		
Coefs	t-prob	Coefs	t-prob	Coefs	t-prob	Coefs	t-prob	Coefs	t-prob	Coefs	t-prob	
ageo	-0.011	0.821	-0.041	0.420	<b>0.370</b>	0.000	-0.017	0.760	<b>0.368</b>	0.000	-0.025	0.631
agey	-0.015	0.467	<b>-0.036</b>	0.083	<b>0.168</b>	0.000	-0.002	0.926	<b>0.167</b>	0.000	-0.010	0.620
qualif	-0.264	0.312	-0.233	0.393	<b>0.719</b>	0.005	0.245	0.341	<b>0.717</b>	0.005	0.160	0.534
gender	0.174	0.179	<b>0.287</b>	0.030	<b>0.205</b>	0.090	<b>0.340</b>	0.004	<b>0.206</b>	0.088	<b>0.334</b>	0.005
wt	-0.296	0.348	-0.270	0.381	<b>1.140</b>	0.000	0.361	0.197	<b>1.138</b>	0.000	0.263	0.346
cdd	-0.014	0.267	-0.007	0.614	-0.001	0.977	0.008	0.544	-0.001	0.975	0.006	0.638
fsize	0.093	0.312	0.059	0.528	0.034	0.738	0.104	0.230	0.034	0.737	0.094	0.280
selfvgr	0.000	0.993	0.007	0.463	<b>-0.017</b>	0.089	-0.011	0.179	<b>-0.017</b>	0.088	-0.009	0.271
minw	(dropped)		(dropped)		0.023	0.208	0.023	0.501	0.023	0.208	0.026	0.512
ur	0.002	0.569	-0.001	0.604	0.003	0.184	0.002	0.266	0.003	0.184	0.002	0.351
dd2i	<b>0.003</b>	0.003	0.001	0.327	<b>0.003</b>	0.003	<b>0.001</b>	0.063	<b>0.003</b>	0.003	<b>0.001</b>	0.095
sharedd	<b>-0.008</b>	0.003	<b>-0.005</b>	0.039	<b>-0.006</b>	0.026	<b>-0.004</b>	0.060	<b>-0.006</b>	0.026	<b>-0.004</b>	0.071
R <sup>2</sup> overall	0.121	0.180			0.739		0.542		0.739		0.499	
R <sup>2</sup> within	0.404	0.223			0.003		0.110		0.003		0.135	
R <sup>2</sup> between	0.165	0.279			0.832		0.599		0.832		0.556	
Wald (time):	2.58 [0.002] **	—			240.85 [0.000] **		—		6.37 [0.702]		—	
Breusch-Pagan-test	χ <sup>2</sup> (1)=80.34 [0.000]**	χ <sup>2</sup> (1)=81.98 [0.000]**							θ̂ ∈ [0.001;0.008]		θ̂ ∈ [0.66;0.89]	
Hausman-test	χ <sup>2</sup> (19)=14.28 [0.767]	χ <sup>2</sup> (19)=39.01 [0.00]**										
Nb Obs.	107	107			107		105		107		107	
Time Dummies	8	0			9		0		9		0	

\* With small sample correction for the standard errors (Swamy-Arora) and non-constant theta

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## 6 Annex: Description of the variables used

### 6.1 Individual factors/ Job quality

The individual factors as well as the job-quality indicators are all taken from the Labor Force Survey of Eurostat. We were not able to perform a national/foreign- variable as the data delivered by Eurostat were organized in such a way that it was impossible to recode the data. The same applied for the job status (ISCO).

$$ageo = \frac{\text{Elder (50+) employees/All employees; in the services}}{\text{Elder (50+) employees/All employees; in the industry}} \quad (2)$$

$$agey = \frac{\text{Young employees (15-24)/All employees; in the services}}{\text{Young (15-24) employees/All employees; in the industry}} \quad (3)$$

$$\begin{aligned}
low &= \frac{\text{Proportion of low educated workers in the services}}{\text{Proportion of low educated workers in the industry}} & (4) \\
medium &= \frac{\text{Proportion of medium educated workers in the services}}{\text{Proportion of medium educated workers in the industry}} & (5) \\
high &= \frac{\text{Proportion of high educated workers in the services}}{\text{Proportion of high educated workers in the industry}} & (6) \\
qualif &= \frac{\text{Weighted } \emptyset \text{ of the qualification categorical variable in the services}}{\text{Weighted } \emptyset \text{ of the qualification categorical variable in the industry}} & (7)
\end{aligned}$$

$$gender = \frac{\text{Male employees/All employees; in the services}}{\text{Male employees/All employees; in the industry}} \quad (8)$$

$$partt = \frac{\text{Part-time employees/All employees; in the services}}{\text{Part-time employees/All employees; in the industry}} \quad (9)$$

$$wt = \frac{\text{Average working time/week; in the services}}{\text{Average working time/week; in the industry}} \quad (10)$$

$$wtft = \frac{\text{Average full-time working time/week; in the services}}{\text{Average working full-time time/week; in the industry}} \quad (11)$$

$$cdd = \frac{\text{Fixed-term contracts' employees/All employees; in the services}}{\text{Fixed-term contracts' employees/All employees; in the industry}} \quad (12)$$

## 6.2 Market power

The data for strikes statistics are taken from the Labor Force Survey of Eurostat. For the proportion of self-employed, the national account statistics was also considered as more data were available. The firm size was calculated from the Eurostat-Business data.

$$firmsize = \frac{\text{Average number of employees per firm in the services}}{\text{Average number of employees per firm in industry}} \quad (13)$$

$$selfvgr = \frac{\text{Self-employed/All employment; in the services}}{\text{Self-employed/All employment; in the industry}} \quad (14)$$

$$streik = \frac{\text{Lost working days per 1000 employees in the services}}{\text{Lost working days per 1000 employees in industry}} \quad (15)$$

$$streikee = \frac{\text{Employees involved in strikes or lock-outs in } \emptyset/\emptyset; \text{ in the services}}{\text{Employees involved in strikes or lock-outs in } \emptyset/\emptyset; \text{ in the industry}} \quad (16)$$

The minimum wage variable is calculated by ourself, the unemployment figures comes from Eurostat-LFS. The other variable are taken from the OECD resp. Bassanini & Duval (2006).

$$minw = \text{Dummy variable for presence of legal minimum wage} \quad (17)$$

$$ur = \text{unemployment rate in \%} \quad (18)$$

$$udens\_1 = \text{Union density from oecd.stat} \quad (19)$$

$$udens\_2 = \text{Union density from Bassanini \& Duval (2006)} \quad (20)$$

$$ucov = \text{Union coverage from Bassanini \& Duval (2006)} \quad (21)$$

### 6.3 Demand structure

All data are taken from the Eurostat-national accounts in national currency.

$$g\_corr\_dd = \text{Correlation(GDP, Domestic Demand; 1995-2006) in \%} \quad (22)$$

$$g\_corr\_exp = \text{Correlation(GDP, Exports; 1995-2006) in \%} \quad (23)$$

$$g\_dd2i = \frac{\text{Index}_{1995=100}(\text{Country } i); \text{ Domestic demand}}{\text{Index}_{1995=100}(\text{EA-12}); \text{ Domestic demand}} \quad (24)$$

$$g\_exp2i = \frac{\text{Index}_{1995=100}(\text{Country } i); \text{ Exports}}{\text{Index}_{1995=100}(\text{EA-12}); \text{ Exports}} \quad (25)$$

$$g\_gdp2i = \frac{\text{Index}_{1995=100}(\text{Country } i); \text{ GDP}}{\text{Index}_{1995=100}(\text{EA-12}); \text{ GDP}} \quad (26)$$

$$g\_sharedd = \text{Share of domestic demand in \% of GDP} \quad (27)$$

$$g\_shareddeur = \text{Country's domestic demand in \% of EA-12-DD} \quad (28)$$

$$g\_shareexp = \text{Share of exports in \% of GDP} \quad (29)$$

$$g\_shareexpeur = \text{Country's exports in \% of EA-12-EXP} \quad (30)$$

$$g\_sharegdpeur = \text{Country's GDP in \% of EA-12-GDP} \quad (31)$$

$$g\_tb = \text{Current trade balance in \% of GDP (=100-g\_sharedd)} \quad (32)$$

## 7 Annex: Overview of the estimators used

### 7.1 Pooled OLS

In the pooled model, there is no country effects and the time effects are common to all individuals. The errors are supposed to be uncorrelated in the time dimension and across countries and homoskedastic in the cross-sectional dimension:

$$y_{it} = \alpha^* + X'_{it}\beta + u_{it} \quad (33)$$

In STATA, the command is xtreg with time dummies.

### 7.2 Static Fixed Effects (SFE)

In the fixed effects model, the error term is decomposed in a fixed unit-specific component (a country-specific intercept) and an observational error term. There exists several methods to estimate such a model; Either one adds individual dummies (LSDV-estimator):

$$y_{it} = \alpha' DI_i + \lambda' DT_t + X'_{it}\beta + u_{it} \quad (34)$$

Or one can transform the variables (subtract the group mean), so that the time-invariant variables are dropped from the model (WITHIN-estimator):

$$y_{it} - \bar{y}_i = (\alpha_i - \bar{\alpha}_i) + \lambda'(DT_t - \overline{DT}) + (X_{it} - \bar{X}_i)'\beta + (u_{it} - \bar{u}_i) \quad (35)$$

This is achieved in Stata with the command xtreg and the option “fe”. In both cases (that yield exactly the same estimates for the  $\beta$ , as the OLS method is applied, we need to have homoskedastic and uncorrelated errors, and that they are unrelated to the  $\alpha_i$  and the other exogenous factors, for the estimators to be consistent and BLUE.

### 7.3 Static Random Effects (SRE)

In the fixed effects model, the error term is decomposed in a random unit-specific component (a country-specific error term) and an observational error term. As now it is clear that the overall error term will not meet the assumption of autocorrelation and probably also not of homoskedasticity, the GLS-estimator is required. One can show further that the GLS reduce to OLS applied to the following transformed model:

$$y_{it} - \theta_i \bar{y}_i = (1 - \theta_i) \alpha^* + \lambda' (DT_t - \theta_i \overline{DT}) + (X_{it} - \theta_i \bar{X}_i)' \beta + \varepsilon_{it} - \theta_i \bar{\varepsilon}_{it} \quad (36)$$

$\theta_i$  stands for  $1 - \sqrt{\frac{\sigma_u^2}{\sigma_u^2 + T_i \sigma_\alpha^2}}$  and  $\varepsilon_{it} = \alpha_i + u_{it}$ .

We need to estimate  $\theta$ , and there exists therefore different estimators, as we can only perform F-GLS.

In Stata the commands `[xtreg, re]` and `[xtreg, re sa]` call the GLS estimator. In both cases the Swamy-Arora variance estimator based on the within and between regressions is implemented. The second specification has a small sample correction, that differ from the first one in unbalanced panels. Important to note here, is that the  $u_{it}$ -error term possess the usual properties: homoskedastic across individual, uncorrelated between the individuals and in the time-dimension. It is also unrelated to the individual-specific error  $\alpha_i$  and to the other exogenous variables. As this is a F-GLS estimation, test-distributions hold only asymptotically ( $\chi^2$  rather than F).

It is possible to estimate the F-GLS also with maximum-likelihood `[xtreg, mle]`. In this case, the residual are assumed also to be normally distributed and an iterated regression is performed. In case the total number of observation (here 107) is smaller than 300 and the data unbalanced (our case too) the `[mle]` and `[re]` regressions will yield different results.

If the correlation structure of  $u_{it}$  is not as simple as assumed above esp. if some time-autocorrelation is present, then the GLS estimator needs to be adapted. There is several ways to take account of richer variance structure.

`[xtgee]` is the first possibility embraced in the estimation part. It fits a population-averaged panel-data model; the option `[f(gauss) i(id)]` consider that the errors are normally distributed and the model linear in the coefficients. This estimator consider then

the within-group correlation structure  $R_i$ :

$$\begin{pmatrix} \text{corr}(u_{i1}, u_{i1}) & \text{corr}(u_{i1}, u_{i2}) & \dots & \text{corr}(u_{i1}, u_{iT_i}) \\ \text{corr}(u_{i2}, u_{i1}) & \text{corr}(u_{i2}, u_{i2}) & \dots & \text{corr}(u_{i2}, u_{iT_i}) \\ \vdots & \vdots & \ddots & \vdots \\ \text{corr}(u_{iT_i}, u_{i1}) & \text{corr}(u_{iT_i}, u_{i2}) & \dots & \text{corr}(u_{iT_i}, u_{iT_i}) \end{pmatrix} = \begin{pmatrix} r_{11} & r_{12} & \dots & r_{1T_i} \\ r_{21} & r_{22} & \dots & r_{2T_i} \\ \vdots & \vdots & \ddots & \vdots \\ r_{T_i1} & r_{T_i2} & \dots & r_{T_iT_i} \end{pmatrix}$$

Then the within-group correlation structure  $R_i$  can take two forms:

- `corr(exch)`:  $r_{ts} = \begin{cases} 1 & \text{if } t = s \\ \rho & \text{if } t \neq s \end{cases}$ . This equivalent to the `[xtreg, re]` and `[xtreg, mle]` commands if the data are balanced, with `[xtreg, pa]` otherwise.
- `corr(ar1)`:  $r_{ts} = \begin{cases} 1 & \text{if } t = s \\ \rho^{|t-s|} & \text{if } t \neq s \end{cases}$ . This equivalent to the `[xtreg, re]` command.

`[xtgls]` is another possibility. It is a F-GLS estimator which allows for ar(1)-autocorrelation within panel, as `[xtgee]`, and cross-sectional correlation and cross-sectional heteroskedasticity. The variance of the overall residuals ( $\alpha_i + u_{it}$ ) can be written as the Kronecker product of the within-group variance ( $\sigma$ ) and the cross-sectional variance ( $\Omega$ ):

$$E(\varepsilon\varepsilon') = \sigma \otimes \Omega = \begin{pmatrix} \sigma_{11} & \sigma_{12} & \dots & \sigma_{1N} \\ \sigma_{21} & \sigma_{22} & \dots & \sigma_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{N1} & \sigma_{N2} & \dots & \sigma_{NN} \end{pmatrix} \otimes \begin{pmatrix} \Omega_{11} & \Omega_{12} & \dots & \Omega_{1N} \\ \Omega_{21} & \Omega_{22} & \dots & \Omega_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ \Omega_{N1} & \Omega_{N2} & \dots & \Omega_{NN} \end{pmatrix}$$

If the diagonal of the  $\sigma$ -matrix is filled with different numbers, the individuals do not have the same overall variance (panel-heteroskedasticity). If the off-diagonals are not zero, the individuals are correlated with each other (panel-correlation). If the  $\Omega$ -matrix is not identity, then the residuals are autocorrelated in the time dimension (within-group correlation). With this estimator several options are possible:

- `panels(hetero)`: state that the  $\Omega$ -matrix is identity (default if no `corr`-option specified) and  $\sigma = \begin{pmatrix} \sigma_{11} & 0 & \dots & 0 \\ 0 & \sigma_{22} & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & \sigma_{NN} \end{pmatrix}$

- `corr(ar1)`: state that the  $\Omega$ -matrix is such that the serial correlation structure is

$$r_{ts} = \begin{cases} 1 & \text{if } t = s \\ \rho^{|t-s|} & \text{if } t \neq s \end{cases}$$

- `corr(psar1)`: state that this correlation factor can be different for each individual:

$$r_{ts,i} = \begin{cases} 1 & \text{if } t = s \\ \rho_i^{|t-s|} & \text{if } t \neq s \end{cases}$$

The last estimator used in this paper is `[xtpcse]`; it calculates a panel-corrected standard errors for the OLS-estimates (actually Prais-estimator that corrects for first order autoregression in the time-dimension, i.e. a GLS estimator!). We use the `[pairwise]` option that specifies that all information available for an individual should be used to calculate the covariance matrix. This has influence only when the data are unbalanced. The option `[hetonly]` is also selected implying that panel-heteroskedasticity is allowed (see above). Two sorts of within-group autocorrelation is then allowed as above, a common `ar(1)`-structure (`ar1`) or individual-specific one (`psar1`). `[xtgls]` and `[xtpcse]` are consistent, and under the correct assumption of the error structure F-GLS would be more efficient. But it is argued that with the typical small samples used in social science, `xtpcse` should be preferred, as it is more conservative.

## 8 Annex: Scatter diagrams of the data

Chart 3: Scatter diagram: Age (15-24 and 50+) vs Wages, EU-27

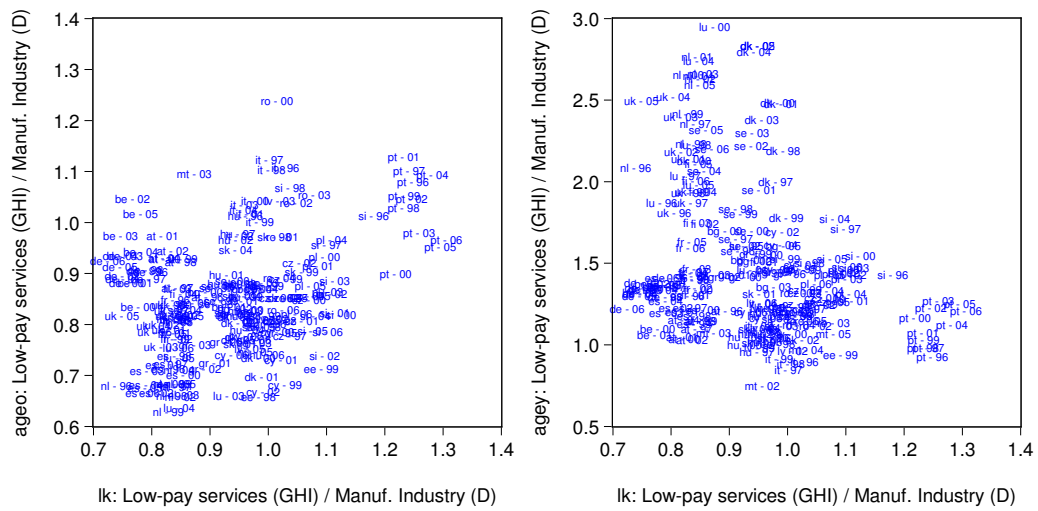




Chart 4: Scatter diagram: Qualification vs Wages, EU-27

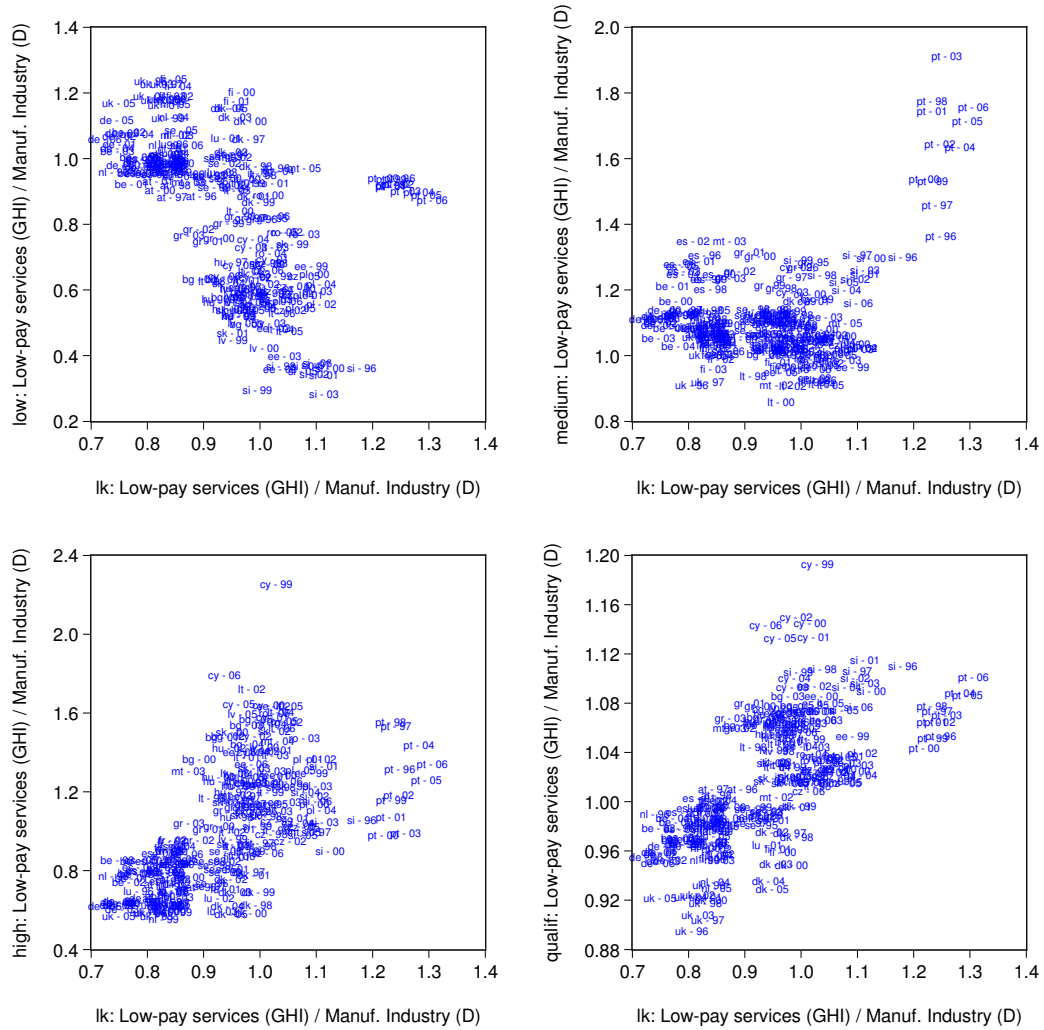


Chart 5: Scatter diagram: Gender vs Wages, EU-27

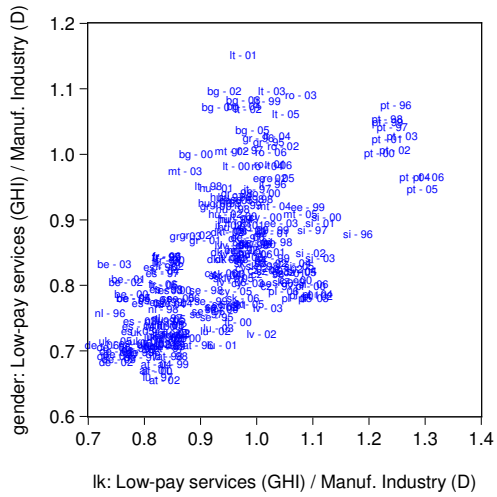


Chart 6: Scatter diagram: Part-time employment vs Wages, EU-27

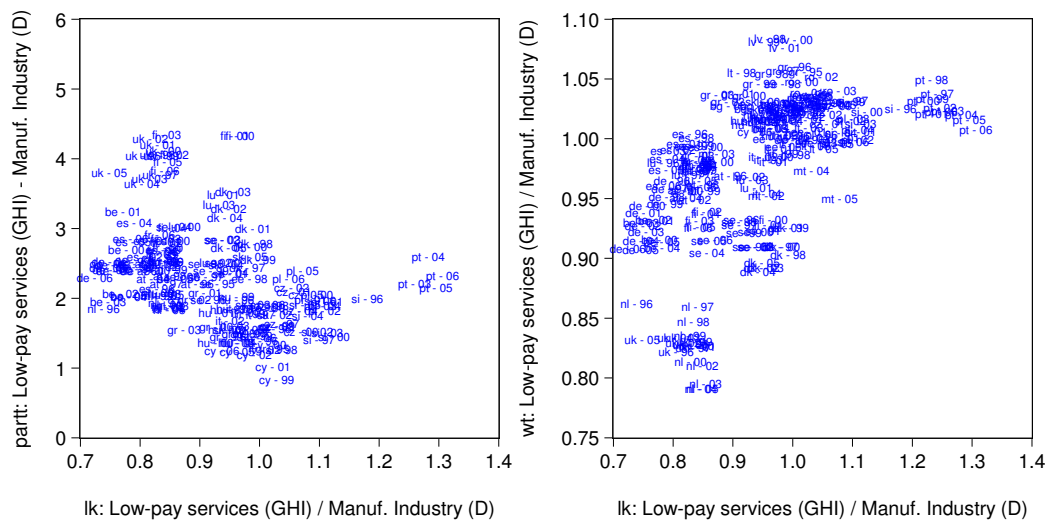


Chart 7: Scatter diagram: Fixed-term employment vs Wages, EU-27

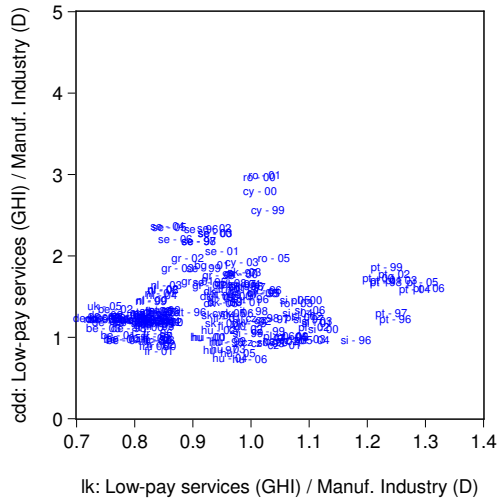


Chart 8: Scatter diagram: Firm size vs Wages, EU-27

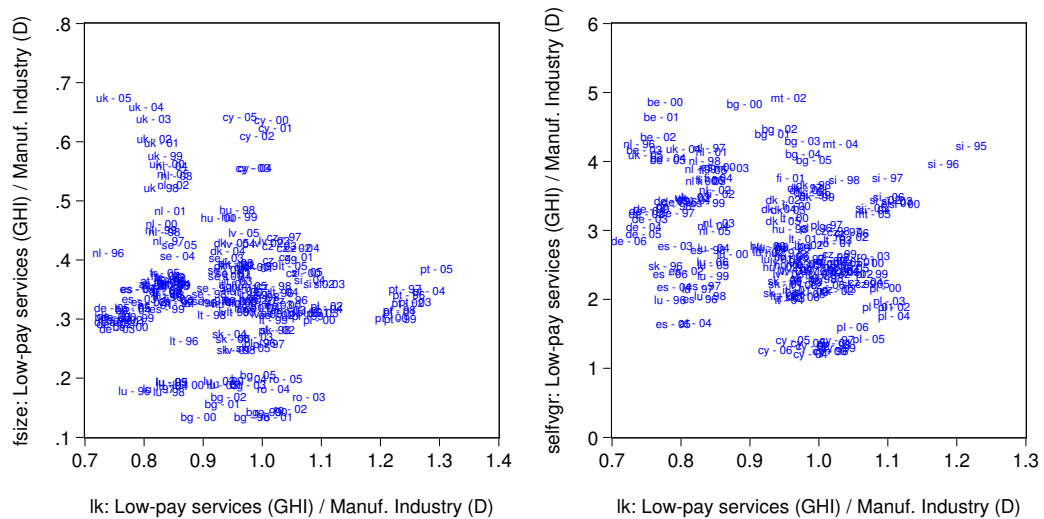
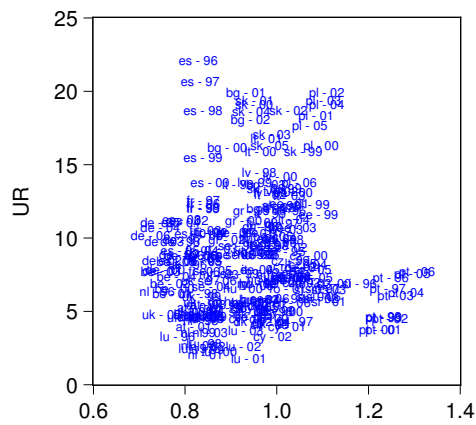
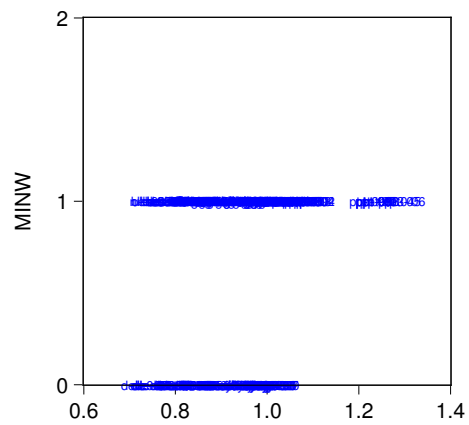


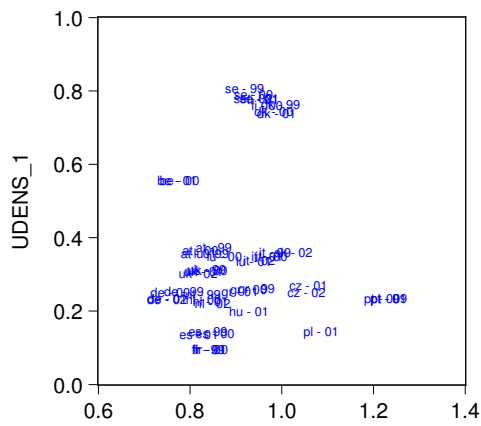
Chart 9: Scatter diagram: Institutional factors rate vs Wages, EU-27



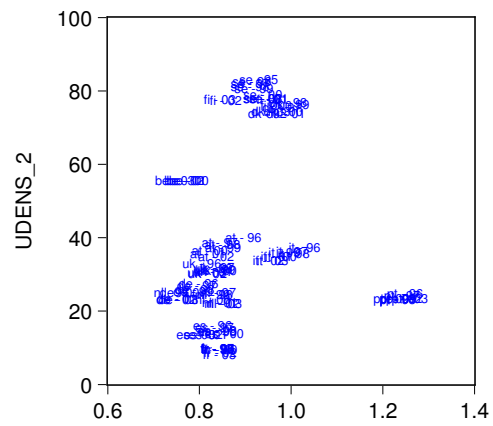
Ik: Low-pay services (GHI) / Manuf. Industry (D)



Ik: Low-pay services (GHI) / Manuf. Industry (D)

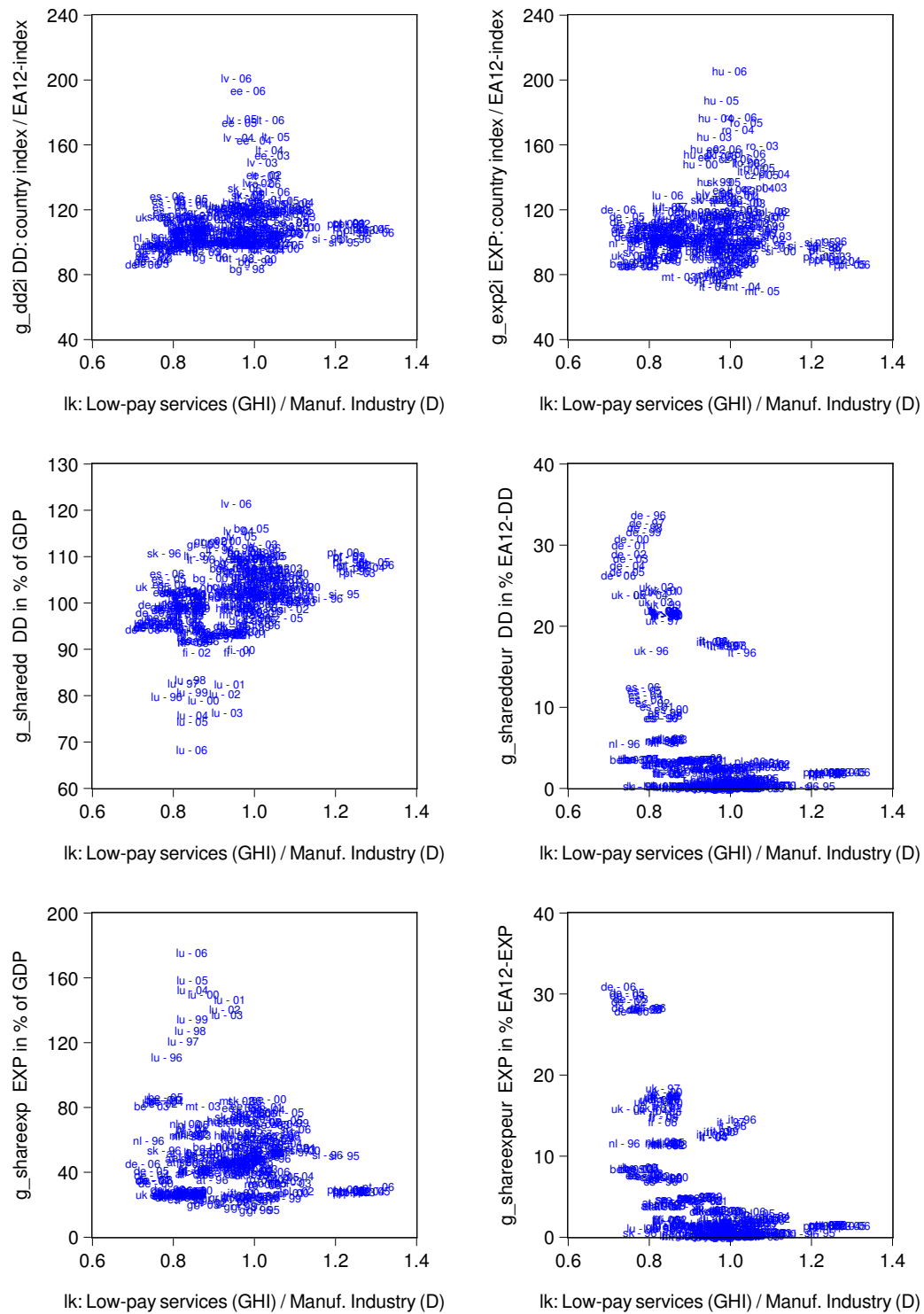


Ik: Low-pay services (GHI) / Manuf. Industry (D)



Ik: Low-pay services (GHI) / Manuf. Industry (D)

Chart 10: Scatter diagram: Relative export growth vs Wages, EU-27 and EU-15



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