

Wages and Phillips curves in the Belgian regions

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Abstract

In the forthcoming decades, starting already within a few years, Flanders will suffer from the ageing problem. Although somehow odd in the current economic climate, a possible consequence of ageing could be supply shortages on the labour market, and hence upward pressure on wages. The principal aim of this paper is to investigate whether and how much wages are influenced by changes in unemployment. It furthermore discusses the wage evolution since 1980 in a European context and analyses some determinants of the wage evolution at the sectoral level.

Keywords: Phillips curves, regional economics

JEL: J31, E24, R11, R23

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1. Introduction

In the forthcoming decades, starting already within a few years, Belgium will suffer from the ageing problem. Although somehow odd in the current economic climate, a possible consequence of ageing could be supply shortages on the labour market, and hence upward pressure on the wages. The principal aim of this paper is to investigate whether and how much wages are influenced by changes unemployment with a primary focus on the Flemish economy. Given the fact that Flanders will be more affected by the ageing problem than the other Belgian regions this question is not without importance for the Flemish economy.

Firstly, the macro-economic wage evolution from 1980 onwards will be discussed. Nominal and real evolution of the wage per head in the Flemish economy is compared to the evolution in the other Belgian regions (the Brussels Capital Region and the Walloon Region) and to the evolution in the Netherlands, Germany, France and the EU-15. Next, sectoral evolutions are discussed. In this paper we only consider 13 broad sectors which can be derived from the NACE A31 classification.

The paper continues by looking at the correlation between wage growth and employment growth at the sectoral level. Both the normal Pearson correlation and the non-parametric Spearman rank correlation are used. Since the labour demand curve is negatively sloped, negative correlations are theoretically expected. Next, by estimating sectoral wage equations the historical evolution of wages is explained by variables such as employment growth, productivity growth and price effects.

Furthermore, to analyse the sensitivity of wages to unemployment, Phillips-curves (Phillips, 1958) are estimated for each region and country. The inverse of the unemployment coefficient can be interpreted as a measure of wage flexibility. Moreover, from the coefficient estimates one can also derive an estimate of the 'non-accelerating inflation rate of unemployment' (NAIRU). If unemployment drops below the NAIRU for a longer period, one can expect inflationary pressure. So, this concept is interesting in the case that population aging leads to a significant decrease in unemployment.

Section 2 discusses the wage evolution at the macro-economic and sectoral level. In Section 3 the relation between wage growth and employment growth at the sectoral level is analysed. Section 4 then presents the Phillips-curves. Section 5 concludes.

2. Wage evolution

In Belgium the macro-economic wage policy is based on the law of July 25 of 1996 'to promote employment and to the preventative safeguarding of the competition power'². The law clearly states the margins in which the social partners can negotiate with respect to the nominal wage growth, the so-called wage norm. The maximum nominal wage growth, calculated per working hour, is determined on the basis of the average expected wage evolution in the three most important trading partners (i.e. Germany, The Netherlands and France).

In the light of this law, section 2.1 starts with looking at the macro-economic evolution of the nominal wage per employee from 1980 onwards in the Belgian regions. Their evolution is compared with the evolution in France, Germany, the Netherlands and the EU-15. Also the real wage per employee and the wage per unity of value added are discussed. Section 2.2 then analyses the evolution of the nominal wage per employee at a more detailed level, i.e. the sectoral level, in the earlier mentioned regions and countries.

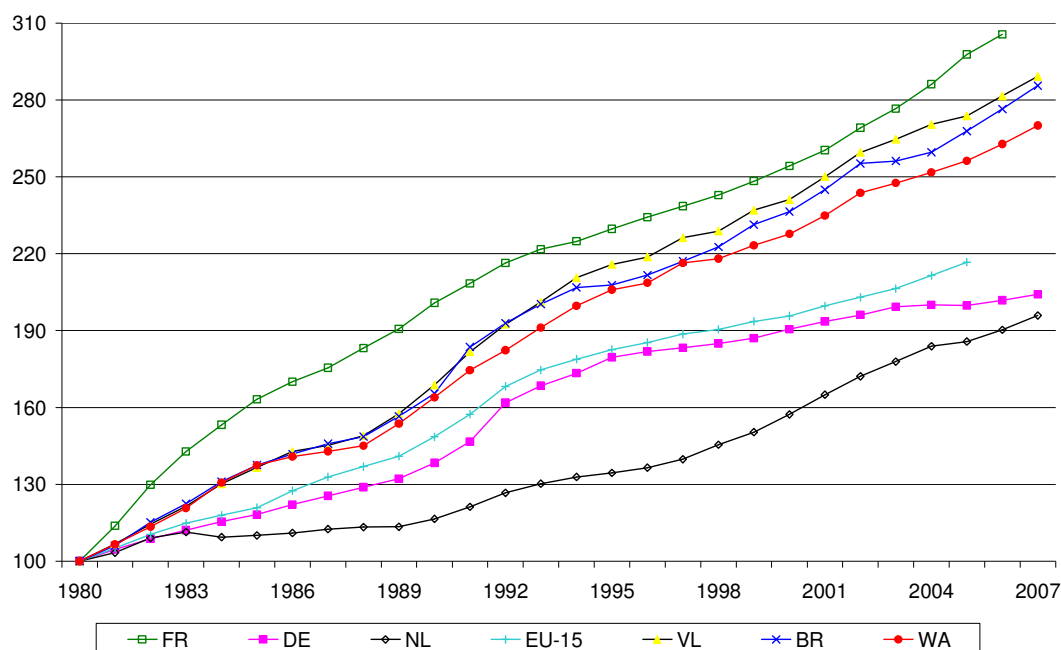
2.1. Macro-economic wage evolution

The nominal wage evolution from 1980 onwards differs significantly between the studied countries/regions. Figure 1 considers the evolution of the nominal wage per head (employee) in index form. For each country/region the basis year equals 1980. In France wages increased obviously the most: the average wage per employee in 2006 is more than three times the wage per head in 1980 (2006: 306%). On the other side of the spectrum we find the Netherlands. In 2007, the

² In Dutch: 'ter bevordering van de werkgelegenheid en tot de preventieve vrijwaring van het concurrentievermogen'. This law builds upon an earlier law from 1989.

wage per head in the Netherlands is only 90% higher than in 1980. That said, one should put into perspective this number, given the increased importance of part time labour in the Netherlands.

Figure 1: Evolution of the nominal wage per employee (1980=100)



The numbers for the years 2006 and 2007 of the Belgian regions are model estimates.

Source: EUKLEMS, EUROSTAT, HERMREG, SVR.

When considering average yearly growth rates, these evolutions boil down to a nominal wage growth of 4,4% in France versus 2,5% in the Netherlands (cf. Table 1). The Netherlands is also the only country (in this paper) which shows a temporary decrease of the nominal wage per employee (namely, in 1984). Since the early nineties Germany follows a strict policy of wage cost moderation, and this can be seen in Figure 1.

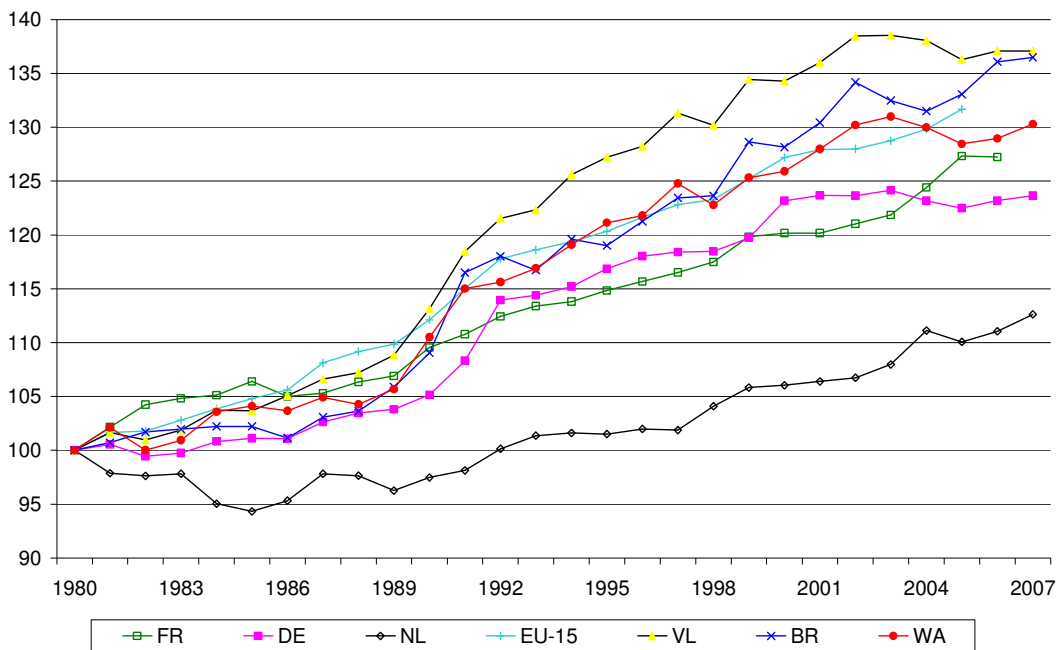
The Belgian regions are situated just below France. The nominal wage per employee grew the most in the Flemish Region. In Flanders the nominal wage per employee increased by more or less 182% in the period 1980-2007. This is

equivalent to a average growth of 4,0% per year. In the Walloon Region the nominal wage per employee rose by 163% and in the Brussels Capital Region by 176% (respectively 4,0% and 3,7% average per year). In Germany the nominal wage per head doubled compared to the level in 1980. Also in the EU-15 the wage increase (2005: 117%) was lower than in the Flemish Region.

In the subperiod 1980-1990 the evolution of the nominal wage per employee was relatively comparable between the Brussels Capital Region and the Walloon Region (respectively +65% and +64%). In the Flemish Region on the other hand the nominale wage per employee rose somewhat faster (+69%). In the subperiod 1990-2000 the growth of the nominal wage per employee was considerably lower, analogous to the lower inflation. The nominal wage per employee in the Walloon Region rose by 39%, whereas the increase in the Brussels Capital Region and the Flemish Region amounted to more or less 43%. Also during the last seven years the evolution of the nominal per wage per employee was roughly equal in Brussels and Flanders (+17%); in Wallonia the increase amounted to 15%. During the period 1980-2007, the average per year growth rate of the nominal wage per employee in the Belgian regions more or less halved (e.g. Flemish Region: from 5,4% in 1980-1990 to 2,6% in 2000-2007).

Although ultimately it are the nominal wages which are paid by firms, and which are important in an international context in which not only the domestic price level is of concern (competitiveness), we also compare the regions/countries with respect to the real wage per employee, thereby excluding differences in (domestic) price evolutions. Figure 2 presents the evolution of the real wage per employee (1980=100).

Figure 2: Evolution of the real wage per employee (1980=100)



Source: EUKLEMS, EUROSTAT, HERMREG, SVR.

Whereas in the neighbouring countries the growth of the real wage per employee was limited during 1980-2007, the real wage per employee rose particularly rapidly in the Flemish Region. It was about 37% higher in 2007 compared to 1980 in Flanders. From 2005 onwards the real wage per employee stabilized in the Flemish Region. Also in the Brussels Capital Region the real wage per employee increased more than in the neighbouring countries (+36%). Concerning the EU-15, more recent numbers are lacking, but in 2005 the increase amounted to 32%, and with that the EU-15 is located between Brussels and Wallonia. In the latter region the growth of real wage per employee was more modest (2007: +30%) compared to the other Belgian regions.

In nominal terms France registered the biggest increase over the period 1980-2006, while in real terms France is located in the middle. The bigger increase of the nominal wage per employee in France is mainly due to inflation, comparatively more than in the other countries/regions. The nominal wage per

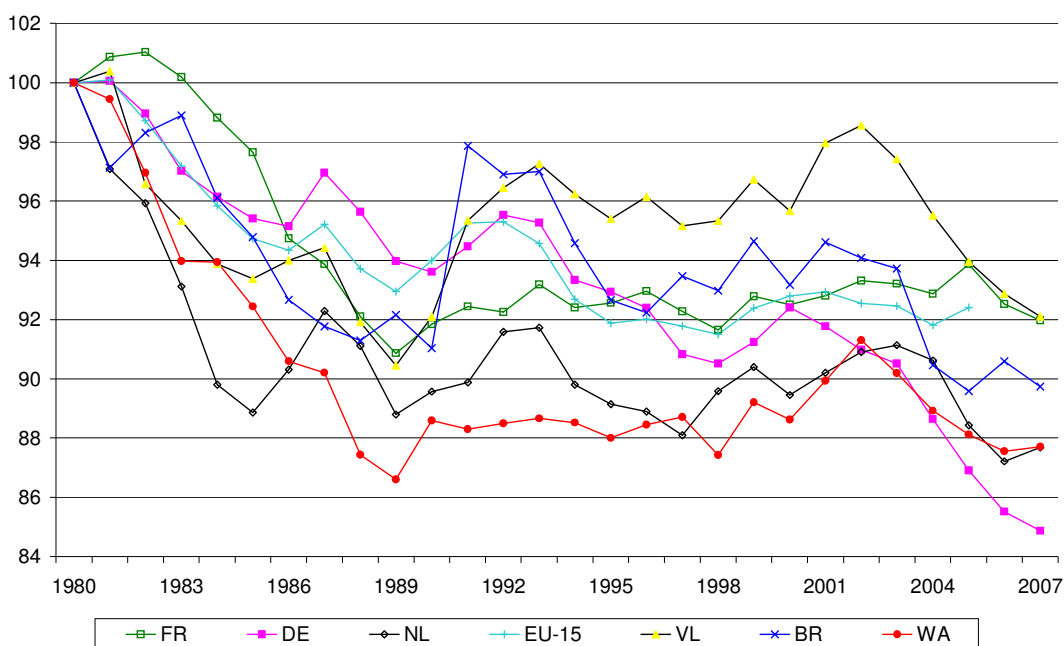
employee rose there by 206%, whereas the real wage per employee only increased by 27% (1980-2006). Besides that it is also striking that the real wage per employee in the Netherlands during the eighties and begin nineties was lower than in 1980. In 2007 the real wage per employee was only 13% higher than in 1980 (of course this is related to the evolution of part time labour). In Germany the increase of the real wage per employee amounted to 24% (2007). In short, the real wage per employee in the three neighbouring countries increased considerably less than in the three Belgian regions.

Since it is possible that the measure 'wage per employee' is biased by differences in the evolution of e.g. part time labour³, it is worth the effort to take a quick glance at another measure, namely the wage per unity of value added. This measure equals the ratio of the wage per employee and the productivity per employee, and as such it compares the evolution of both parameters. Another name for this measure is the wage share (in gross value added).

Figure 3 contains the evolution of the wage per unity value added since 1980 for each of the studied countries/regions. Again, the evolution is presented by using an index with 1980 the base year (1980 = 100). Although this figure is less clear-cut than previous ones, it is still possible to gather some information from the graph.

³ In the regional accounts the series 'number of hours worked' is not available (the series is available only at the national level).

Figure 3: Evolution of the wage per unity of value added (1980 = 100)



The numbers for the years 2006 and 2007 of the Belgian regions are model estimates.

Source: EUKLEMS, EUROSTAT, HERMREG, SVR.

Firstly, the differences in this graph are significantly smaller than in the previous graphs. So, despite a divergent evolution of the wage per employee, the differences between the countries/regions in terms of wage per unity of value added remain limited. A number of factors explain this. As quoted already earlier differences in the evolution of part time jobs do not count here. This measure also takes into account differences in the evolution of labour productivity: as such a wage increase can be neutralised by an increase in labour productivity (or a wage increase is easier to accept if it is accompanied by an increase in labour productivity). A third factor can be found in the fact that the nominal wage per employee is expressed in current prices, whereas the wage per unity of value added is expressed, by construction, in real terms and so the latter measure excludes differences in price evolutions.

Despite the increasing (nominal and real) wage per head, the wage per unity of value added decreased globally in all of the included regions and countries. In

Germany the decrease was most pronounced (decrease of about 15%), in the Flemish Region and France less (decrease of about 8%). In the beginning of this century Germany was located in the middle of the group, but from then on the wage per unity of value added dropped sharply. This is true the last years in most of the countries and regions, except France (and EU-15?). The evolution of the wage per employee in the Netherlands clearly displays the influence of an increasing importance of part time jobs. Although the Netherlands are still at the bottom of the graph concerning the wage per unity of value added, this is less the case than in the graph with respect to the (nominal or real) wage per employee.

Regarding the Belgian regions the less good evolution in the Flemish Region is remarkable. The increase of the wage per unity of value added in the early nineties is only partially wiped out afterwards. Around the turn of the century the wage per unity of value added increased again (just like in Wallonia), and then decreased substantially since 2003 so as to compensate partially for the incurred handicap. In the Walloon Region on the other hand the wage per unity of value added decreased strongly in the eighties and afterwards it remained fairly stable (aside an increase around the turn of the century and an equally big decrease afterwards): the wage per unity of value added in 2007 is situated around the same level as in 1980.

Contrary to the less favourable evolution of the wage per unity of value added in the Flemish Region during the considered period, Flanders remains relatively cheap compared to the other studied countries and regions, at least in terms of wage per unity of value added. This can also be seen in Table 1, which, besides this parameter, also contains the nominal and real wage per employee. In the year 2007 the wage per unity of value added amounts to 0.53 in the Flemish Region, compared to 0.55 in Germany, 0.55 in the Netherlands and the EU-15,

0.57 in the Walloon Region, 0.58 in France and 0.59 in the Brussels Capital Region.

Table 1: Wage per employee and wage per unity of value added

	Nominal wage per employee			Real wage per employee			Wage per unity of value added		
	1980	2007	growth (1)	1980	2005	growth (1)	1980	2007	growth (1)
Brussels	18858.59	53858.25	4.0%	34794.42	46295.97	1.1%	65.6%	58.9%	-0.4%
Flanders	15280.73	44184.76	4.0%	27433.99	37385.81	1.2%	57.9%	53.4%	-0.3%
Wallonia	15064.73	40673.29	3.7%	27241.85	34992.18	1.0%	64.5%	56.6%	-0.5%
Germany	16414.14	33509.92	2.7%	30565.91	34490.00	0.5%	64.2%	54.5%	-0.6%
EU-15	16220.71	35147.97**	3.1%	24614.28	32409.36	1.1%	60.9%	56.3%**	-0.3%
France	13304.98	40653.07*	4.4%	18668.27	22847.70	0.8%	62.6%	57.6%	-0.3%
Netherlands	19274.73	37753.27	2.5%	25524.35	28096.56	0.4%	63.4%	55.6%	-0.5%

(1): annual average growth rate

*: 2006; **: 2005

The numbers for the year 2007 of the Belgian regions are model estimates.

Source: EUKLEMS, EUROSTAT, HERMREG, SVR.

Linked with its specific characteristics, labour in the Brussels Capital Region is most expensive: both the nominal and the real wage per employee and also the wage per unity of value added are amply higher there compared to the other regions and countries.

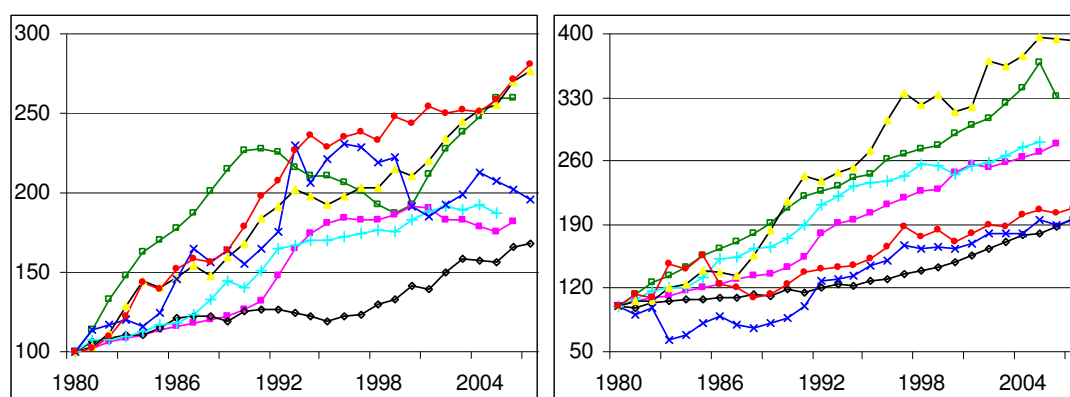
The origin of the good position of Flanders with regard to wage per unity of value added can be found mainly in its high labour productivity, since the wage per employee in Flanders is relatively high. The nominal wage per employee amounted to 44200 euros in 2007 (in real terms 37400 in 2005); by that the Flemish Region is the second most expensive from the analysed regions and countries, with the Brussels Capital Region the most expensive one.

2.2. Sectoral wage evolution

In the following paragraphs the evolution of the nominal wage per employee in 13 broad sectors will be discussed. The definition of the branches can be found in

Appendix 1. To be more exact, only 12 sectors will be presented. The branch 'domestic services' is regarded to be of minor importance. As before, the evolution is presented in index form with base year 1980. For the colour scheme used throughout the following paragraphs, see e.g. Figure 3.

Figure 4: Nominal wage per employee in a) agriculture and b) energy

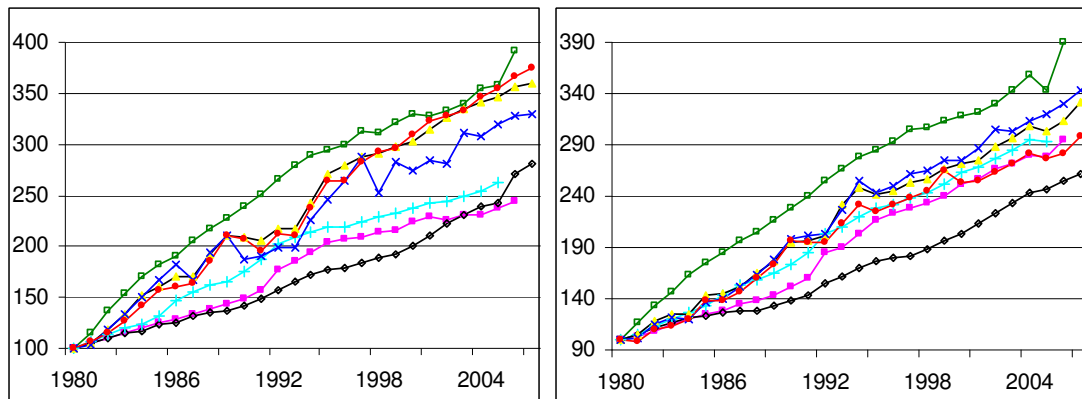


Source: EUKLEMS, HERMREG, SVR.

In 'agriculture' the nominal wage per employee rose fastest in the Walloon and Flemish Regions, followed closely by France. The increase of the nominal wage per employee in 2006 comes to roughly 170% in Wallonia and Flanders against 160% in France (see Figure 4). The increase was most limited in the Netherlands (65% in 2006) and Germany (82% in 2006).

In the 'energy' branch the Flemish Region registered the highest increase. The nominal wage per employee in 2006 is almost four times the wage of 1980 (+295%). Also in France, the nominal wage per employee rose fast (+230% in 2006). The Netherlands and the Brussels Capital Region recorded the lowest increase in that branch (respectively +88% and +90% in 2006).

Figure 5: Nominal wage per employee in a) intermediate goods and b) equipment goods



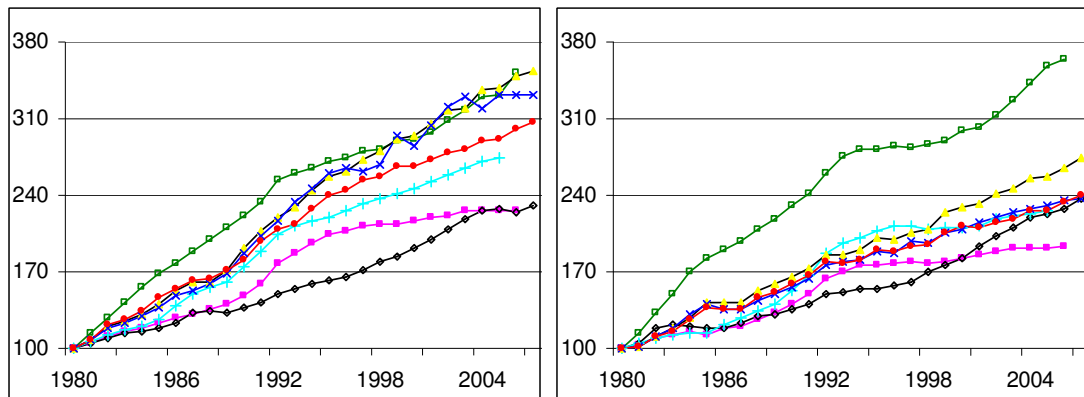
Source: EUKLEMS, HERMREG, SVR.

Unsurprisingly, both in the ‘intermediate goods’ and the ‘equipment goods’ it is France who recorded the highest increases in the nominal wage per employee (more or less +290% in 2006, see Figure 5). In the ‘intermediate goods’ France is followed by the Walloon Region and the Flemish Region (respectively +265% and +255% in 2006). Concerning the ‘equipment goods’, the Brussels Capital Region booked a slightly less high increment than France (+230% in 2006).

The growth of the nominal wage per employee in the branch ‘intermediate goods’ was most limited in Germany and the Netherlands (respectively +144% and +172% in 2006), despite a high increase in 2006 in the latter country. Also in the ‘equipment goods’ the evolution of the Netherlands was most competitive (+154% in 2006).

Concerning the ‘consumption goods’ the biggest increment of the nominal wage per employee is booked by France (+251% in 2006, Figure 6), the Flemish Region (+248% in 2006) and the Brussels Capital Region (+232% in 2006). The smallest increase took place in the Netherlands and Germany (roughly +125% in 2006).

Figure 6: Nominal wage per employee in a) consumption goods and b) construction



Source: EUKLEMS, HERMREG, SVR.

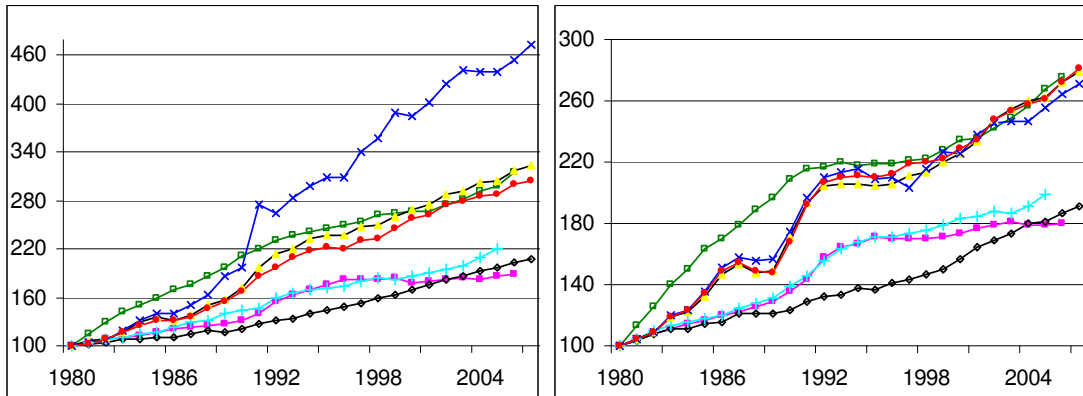
In the 'construction' branch the nominal wage per employee in France exploded compared to the neighbouring countries (+264% in 2006). The second highest increase is recorded by the Flemish Region, but at a great distance (+165% in 2006). Also in this branch the wage increase was most limited in Germany (+93% in 2006). In Figure 6 (both branches) one clearly observes a stabilisation of the nominal wage per employee in Germany at the end of the period, whereas it still increased in the other countries and regions.

The growth of the nominal wage per employee in the 'transport and communication' branch was by far the highest in the Brussels Capital Region (+355% in 2006, see Figure 7). Brussels is followed by France and the Flemish Region, but there the increase was much more modest (roughly +216% in 2006). The Netherlands and Germany registered the lowest growth in the branch 'transport and communication' (+103% and +88% in 2006).

In 'trade and catering' the spread of wage increases is less (see Figure 7). Here France, Wallonia, Flanders and Brussels had the largest increments of their nominal wages per employee (respectively +176%, +172%, +172% and +164% in

2006). Both in Germany and the Netherlands the growth was smallest (+80% and +86% in 2006).

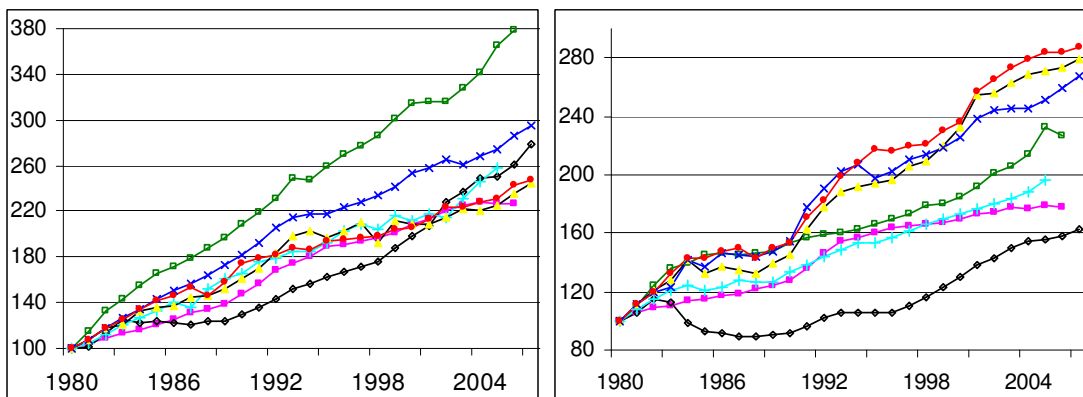
Figure 7: Nominal wage per employee in a) transport and communication and b) trade and catering



Source: EUKLEMS, HERMREG, SVR.

The nominal wage per employee in 'credit and insurances' rose the most in France (more or less +280% in 2006, see Figure 8). In the Brussels Capital Region and the Netherlands the increase was somewhat smaller (respectively +186% and +161% in 2006). On the bottom of the graph Germany and the Flemish Region are located (respectively +127% and +136% in 2006).

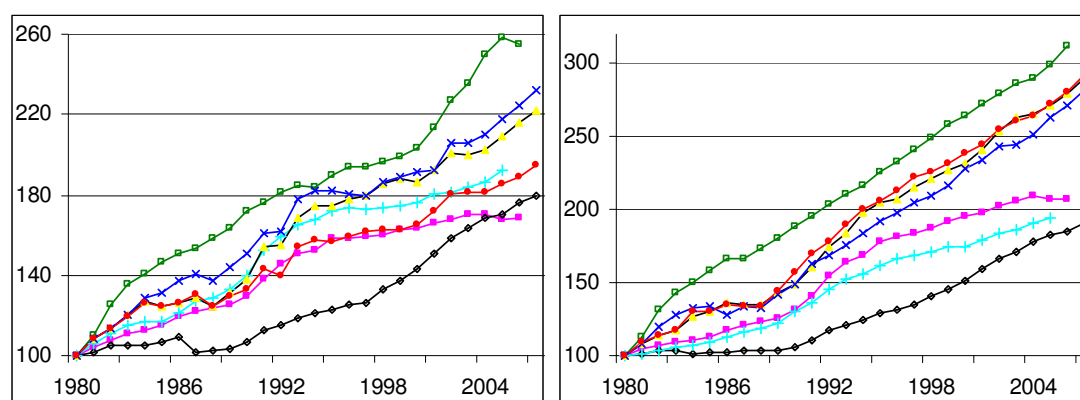
Figure 8: Nominal wage per employee in a) credit and insurances and b) other market services



Source: EUKLEMS, HERMREG, SVR.

The branch 'other market services' shows quite a different picture. Here France is located in the middle of the graph (+127% in 2006), whereas it are now the Belgian regions which are on top (Wallonia: +184%, Flanders: +173% and Brussels: +160% in 2006). Germany and the Netherlands established the lowest increases in this branch (respectively +78% and +58% in 2006).

Figure 9: Nominal wage per employee in a) health care and b) public administration and education



Source: EUKLEMS, HERMREG, SVR.

In the branches 'health care' and 'public administration and education' it is again France which registers the highest increase over the period 1980-2006 (respectively +155% and +212%, see Figure 9). In the former branch the nominal wages in Brussels and Flanders also rose strongly (respectively +124% and 116% in 2006). Germany and the Netherlands limited the wage increase in 'health care' (respectively + 68% and 76% in 2006). In 'public administration and education' France is followed by the Belgian regions (Wallonia: +181%, Flanders: +179% and Brussels: +171% in 2006). The growth of the nominal wage per employee was smaller in Germany, the Netherlands and the EU-15 (respectively +106% (2006), +85% (2006) and +96% (2005)).

Considering all branches the highest increases of the nominal wage per employee were recorded in 'transport and communications' (Brussels: +355% in 2006) and

some industrial branches, in particular 'energy' (Flanders: +295% in 2006), 'intermediate goods' (France: +291% in 2006), 'equipment goods' (France: +290%) and 'consumption goods' (France: +251% and Flanders: +248%). The lowest increments are found in the branches 'other market services' (the Netherlands: +58% and Germany: +78% in 2006), 'health care' (Germany: +68% and the Netherlands: +75% in 2006) and 'agriculture' (the Netherlands: +66% and Germany: +82%). The presence of some service branches in the lowest wage growth branches is possibly due to the fact that in these branches the number of part time jobs probably increased more.

3. Sectoral correlation between wages and employment

To investigate the relationship between wage growth and employment growth at the sectoral level the standard Pearson correlation and the non-parametric Spearman rank correlation are used in section 3.1. As before, the analysis is limited to 13 broad branches (see definition in Appendix 1). Next, the analysis is broadened by also taking into account the influence of productivity growth and a price effect (section 3.2).

3.1. Pearson correlation and Spearman rank correlation

Since the labour demand curve is negatively sloped, wages and employment are expected to be negatively correlated. Table 2 presents the standard correlation between wage growth and employment growth in 13 branches for the studied regions and countries.

Looking at the correlations in Table 2 one observes that in most cases the correlation is indeed negative: significant and insignificant numbers mixed, 79 of in total 91 cases are negative (or about 87%). Positive correlations are observed mostly in 'credit and insurances', and to a lesser extent in 'health care' and 'public administration and education'. Only considering significant correlations, 39 of in total 42 cases are negative (or about 93%). The three positive significant correlations are found in Germany ('credit and insurances' and 'health care') and France ('public administration and education').

Table 2: Pearson correlation between wage growth and employment growth (1981-2005)

	Brussels Capital Region	Flemish Region	Walloon Region	Germany	EU-15	France	The Nether- lands
Agriculture	-0.22	-0.53***	-0.37*	-0.67***	-0.59**	-0.87***	-0.56***
Energy	-0.60***	-0.54***	-0.69***	-0.44**	-0.48*	0.33	-0.28
Intermediate goods	-0.28	-0.14	-0.15	-0.24	-0.61**	-0.51***	-0.31
Equipment goods	-0.14	-0.24	-0.60***	-0.48**	-0.55**	-0.35*	-0.44**
Consumption goods	-0.08	-0.04	-0.34*	-0.23	-0.58**	-0.29	-0.20
Construction	-0.13	-0.24	-0.20	0.63***	-0.72***	-0.51***	-0.51***
Transport and communication	-0.13	-0.14	-0.36*	-0.23	-0.41	-0.24	-0.12
Trade and catering	-0.30	-0.10	-0.29	0.27	-0.55**	-0.07	-0.34*
Credit and insurances	0.11	-0.16	0.05	0.74***	-0.29	0.14	-0.43**
Health care	-0.04	-0.31	-0.42**	0.55***	-0.44	-0.14	0.29
Other market services	-0.28	-0.59***	-0.63***	0.09	-0.32	-0.41**	-0.81***
Public administration and education	-0.42**	-0.59***	-0.59***	0.10	-0.17	0.43**	-0.03
Domestic services	-0.19	-0.28	-0.20	-0.27	-0.65**	-0.90***	-0.78***

***: 1%, **: 5%, *: 10%.

In the EU-15 and the Walloon Region eight of the 13 correlations are significantly different from zero. Also in France and the Netherlands more than half of the correlations is significant. Only two correlations are significant in the Brussels Capital Region; in Flanders only four. Considering the branches, 'agriculture' scores the highest number of significant correlations: 6 out of 7 (countries/regions) are significant. In 'energy' and 'equipment goods' 5 correlations are significant. In general, more secondary branches⁴ register significant correlations compared to the (market) services (respectively about 51% and 31%). So, in general, in the secondary branches wage growth and employment growth are much more connected to one another than in the tertiary sector.

⁴ The secondary sector is composed of 'energy', 'intermediate goods', 'equipment goods', 'consumption goods' and 'construction'. Market services are 'transport and communication', 'trade and catering', 'credit and insurances', health care' and 'other market services'. 'Public administration and education' and 'domestic services (non-market services) complete the tertiary sector.

In Flanders, all correlations are negative. Only four correlations are significant: namely in the branches 'agriculture', 'energy', 'other market services' and 'public administration and education'. A higher wage growth is related to a smaller employment growth. Branches with higher employment growth display lower wage growths: e.g. 'other market services' in the Flemish Region more than tripled its employment in the period 1980-2005, whereas the total nominal wage growth in that branch (+171%, see Figure 8) was somewhat lower than the overall nominal wage growth in the Flemish economy. Another example is 'energy' which saw increase its nominal wage per employee with more or less 300% (see also Figure 4). Its employment, however, was only about 37% of the level in 1980.

Comparing the correlations across the Belgian regions, one can observe that, on average, the correlations are higher (in absolute terms) in the Walloon Region, followed by the Flemish Region and lastly the Brussels Capital Region, in which the link between wage growth and employment growth is the weakest among all studied countries and regions.

In order to investigate the robustness of the results in Table 2, the relation between wage growth and employment growth was also analysed using the non-parametric Spearman rank correlation. Results are presented in Table 3.

In general, Table 3 contains less significant correlations than Table 2. At the country or region level, only the Flemish Region now registers more significant correlations than in Table 2. The branches 'agriculture', 'energy', 'other market services' and 'public administration and education' are now accompanied by 'transport and communication' and 'domestic services'. Both in the Walloon Region and the Brussels Capital Region the number of significant correlations decreases. Using the Spearman rank correlation, there are no significant

correlations left in Brussels, which underlines the weak relationship between employment growth and wage growth in Brussels.

By comparing Table 2 and Table 3 one also can observe other differences. The results for the EU-15, Germany and the Walloon Region are less stable. Their number of significant correlations drops, and there also other branches which become significant now. In Wallonia for instance, 'energy', 'transport and communication' and 'health care' do not display significant Spearman rank correlations; 'trade and catering' on the other hand now displays a significant correlation. Whereas the Flemish Region had very few significant Pearson correlations, it is now located in the upper half. Only France and the Netherlands have more significant Spearman rank correlations (both 7, compared to 6 in Flanders). Looking at the branches, across all regions and countries, the Spearman rank correlation finds less significant relations between wage growth and employment growth in the secondary branches.

Table 3: Spearman rank correlation between wage growth and employment growth (1981-2005)

	Brussels Capital Region	Flemish Region	Walloon Region	Germany	EU-15	France	The Nether- lands
Agriculture	-0.31	-0.40**	-0.37*	-0.09	-0.31	-0.87***	-0.52***
Energy	-0.25	-0.36*	-0.07	-0.17	-0.51*	0.23	-0.26
Intermediate goods	-0.30	-0.21	-0.12	0.09	-0.53**	-0.54***	-0.24
Equipment goods	-0.07	-0.24	-0.58***	-0.16	-0.52*	-0.48**	-0.53***
Consumption goods	-0.08	-0.08	-0.42**	-0.10	-0.28	-0.31	-0.27
Construction	0.01	-0.07	0.02	0.62***	-0.80***	-0.43**	-0.30
Transport and communication	-0.17	-0.34*	-0.28	-0.17	-0.39	-0.13	-0.08
Trade and catering	-0.29	-0.11	-0.38*	0.17	-0.42	-0.12	-0.34*
Credit and insurances	0.22	-0.17	0.16	0.70***	-0.29	0.12	-0.34*
Health care	-0.03	-0.21	-0.28	0.49**	-0.35	-0.31	0.53***
Other market services	-0.29	-0.56***	-0.54***	0.10	-0.22	-0.41**	-0.62***
Public administration and education	-0.21	-0.50**	-0.55***	0.40**	-0.08	0.44**	0.03
Domestic services	-0.22	-0.38*	-0.30	-0.25	-0.49*	-0.89***	-0.68***

***: 1%, **: 5%, *: 10%.

3.2. A simple regression framework

The previous section gave a first insight into the relation between wage growth and employment growth at the sectoral level. Although this relation was found to be negative in most cases, correlations were not always significant. Whereas section 3.1 was concerned with a univariate analysis, section 3.2 extends this to a multivariate analysis. A start of explanation of the wage evolution, as discussed in section 2, will be given by using a simple regression framework. Besides employment growth, also other explanatory variables for the growth of the nominal wage per employee are taken into account. In particular, also real productivity growth and a price variable are used. For the latter variable the value added deflator is taken. Estimation is done by OLS over the period 1981-2005, except for the EU-15 for which the estimation period is limited to 1996-2005 due to missing data. Table 4 shows the R-squared of each regression. Table 5, 6 and 7 present the estimated coefficients of respectively employment growth, productivity growth and the deflator.

Table 4: Wage equations: R² (1981-2005)

	Brussels Capital Region	Flemish Region	Walloon Region	Germany	EU-15 (1)	France	The Nether- lands
Agriculture	12.7	39.3	29.4	68.9	72.1	84.0	40.1
Energy	39.2	49.4	67.3	46.2	68.1	63.1	15.4
Intermediate goods	15.4	75.9	58.2	41.6	64.7	84.9	23.8
Equipment goods	39.6	72.4	42.3	56.5	39.3	77.9	39.0
Consumption goods	26.2	63.1	59.7	68.9	71.7	88.9	4.8
Construction	58.9	80.3	69.5	79.5	65.1	84.8	62.9
Transport and communication	23.4	31.1	29.0	70.6	70.6	86.6	14.8
Trade and catering	68.8	73.3	71.0	69.5	40.0	80.2	23.0
Credit and insurances	63.8	31.5	37.9	70.3	62.5	78.5	44.5
Health care	55.7	53.2	62.6	69.2	74.9	84.6	50.3
Other market services	31.9	61.5	79.5	62.1	27.6	60.0	80.8
Public administration and education	82.4	82.4	85.4	97.3	87.8	92.7	97.2
Domestic services	37.5	88.9	54.1	99.9	99.5	100.0	74.5

(1) EU-15: 1996-2005

As can be seen in Table 5, the quality of the regressions varies somewhat. The R-squared goes from a mere 5% for the branch 'consumption goods' in The Netherlands to a perfect 100% for the branch 'domestic services' in France. On average, the best fit is achieved in France, the worst fit in the Brussels Capital Region and the Netherlands. Across countries and regions, it is 'public administration and education' which has on average the best fit. Other branches with in general high R-squareds are 'domestic services' and 'construction'.

Let us now have look at the estimated coefficients. In Table 5 the coefficients for employment growth are displayed. Since now the relevance of employment growth is corrected for the influence of other variables, less coefficients are significant compared to the univariate case (see Table 2). In total, 27 estimated coefficients are significantly different from zero, from which 22 display a negative sign. Looking at the Flemish Region, employment growth is a significant variable in explaining the evolution of wage in 'agriculture' and 'public administration and education'.

Table 5: Wage equations: regression coefficients for employment growth (1981-2005)

	Brussels Capital Region	Flemish Region	Walloon Region	Germany	EU-15 (1)	France	The Nether- lands
Agriculture	-0.20	-0.81**	-0.21	-0.33***	0.00	-1.30***	-0.70***
Energy	-0.51***	0.10	-0.13	-0.73***	-0.35	-0.02	-0.55*
Intermediate goods	-0.58	-0.11	0.32	-0.11	0.03	-0.38*	-0.24
Equipment goods	-0.02	-0.15	-1.18***	-0.20	0.13	-0.43*	-0.22*
Consumption goods	0.12	0.04	-0.36	-0.03	0.02	-0.41*	-0.16
Construction	0.03	-0.04	-0.04	0.11	-0.31	-0.27*	-0.17
Transport and communication	0.31	0.12	-0.23	-0.31*	-0.10	-0.46*	-0.02
Trade and catering	-0.06	-0.24	-0.20	0.36*	-0.27	0.02	-0.13
Credit and insurances	0.14	-0.36	0.00	0.49**	-0.51	-1.63***	-0.35
Health care	0.25	-0.22	-0.30	0.36	-0.41	-0.48	-0.19
Other market services	-0.23	-0.10	-0.21*	0.28**	0.01	-0.41*	-0.23*
Public administration and education	-0.01	-0.55**	-0.67**	-0.09	0.29	0.09	0.18***
Domestic services	0.01	0.10	-0.01	0.00	0.05	0.03**	-0.88***

(1) EU-15: 1996-2005
 ***: 1%, **: 5%, *: 10%.

A more important variable in determining nominal wage growth per employee in the period 1981-2005 seems to be real productivity growth (see Table 6). If productivity rises, there is more room for wage growth since this boils down to a higher value added per employee. Employees also will try to demand part of this higher value added.

Productivity growth is found to be significant in 56 (out of 91) branches. In line with theory, productivity growth has a positive effect on wage growth. Certainly for the Belgian regions it is a key variable in explaining the wage evolution over the 25 year period. In the Flemish Region, productivity growth is a significant factor in 11 branches. It is not significant in the branches 'agriculture' and 'credit and insurances'. Also in the Walloon Region productivity growth is found to be significant in 10 branches; in Brussels there are 8 significant cases.

Table 6: Wage equations: regression coefficients for productivity growth (1981-2005)

	Brussels Capital Region	Flemish Region	Walloon Region	Germany	EU-15 (1)	France	The Nether- lands
Agriculture	-0.02	-0.03	-0.12	0,09**	0,28***	0.10	-0.07
Energy	-0.14	0,60***	0,64***	0.00	0,54**	0,14**	-0.06
Intermediate goods	-0.06	0,48***	0,51***	0.14	0,40**	0.12	-0.04
Equipment goods	0,42***	0,56***	0.20	0,44***	0,50*	0.10	0.08
Consumption goods	0,21*	0,70***	0,29***	0.26	0,44**	0,47***	0.02
Construction	0,41***	0,65***	0,69***	0,44***	0.35	0.11	0,63***
Transport and communication	0,85**	0,33**	0,23*	-0.11	0,60**	0.03	0.17
Trade and catering	0,76***	1,01***	0,88***	0.13	0.44	0.07	0.09
Credit and insurances	0.00	0.14	0.02	-0.05	0,46*	-0.01	0.10
Health care	0,48***	0,68***	0,72***	0,23*	0,91**	0,64***	0,71***
Other market services	0.50	1,08***	0,92***	0,31*	0.57	-0.31	0,61***
Public administration and education	0,91***	0,77***	0,91***	1,15***	1,01***	0,95***	1,26***
Domestic services	0,33**	0,86***	0,58***	1,02***	1,03***	1,05***	0,84***

(1) EU-15: 1996-2005
***: 1%, **: 5%, *: 10%.

Across regions and countries, productivity growth seems not to be a determining factor for the wage growth in ‘credit and insurances’⁵. Also in ‘agriculture’ productivity growth seems to be less important: only in Germany and the EU-15 it is found to have a positive significant effect.

Since it is the evolution of the nominal wage growth which is explained, the growth of the value added deflator is found to be significant in 66 branches (see Table 7). Only for the EU-15 it is less important (only 3 branches), but this is probably linked to the difference in sample (EU-15: 1996-2005, other: 1981-2005). Unsurprisingly, the deflator has a positive sign in all equations in which it is significant.

Table 7: Wage equations: regression coefficients for the deflator (1981-2005)

	Brussels Capital Region	Flemish Region	Walloon Region	Germany	EU-15 (1)	France	The Nether- lands
Agriculture	1.50	0.92*	1.26**	1.01***	0.58	0.57**	0.55*
Energy	0.62	0.20	0.27	1.13***	1.22	0.73***	0.53
Intermediate goods	0.92	0.67**	1.20**	1.11***	0.15	1.18***	0.27
Equipment goods	0.54	0.81**	0.48	0.97***	1.07	1.12***	0.57**
Consumption goods	0.81*	1.04***	0.86***	1.35***	0.92**	0.93***	0.12
Construction	1.20***	0.97***	0.89***	0.99***	0.69	1.17***	0.85***
Transport and communication	0.84	0.47	0.37	1.32***	0.84	1.03***	0.26
Trade and catering	1.21***	0.99***	0.83**	1.21***	-0.23	1.05***	0.37*
Credit and insurances	1.15***	1.11**	1.21***	0.58***	-1.67	1.24***	1.03***
Health care	1.22***	1.04***	0.76**	0.80***	0.64	0.76***	1.08***
Other market services	1.02*	0.65*	0.76***	0.74***	-0.15	0.65***	1.26***
Public administration and education	0.99***	0.86***	0.92***	1.10***	0.91***	0.89***	1.17***
Domestic services	0.92***	1.10***	0.69**	0.99***	0.90***	1.10***	0.50

(1) EU-15: 1996-2005
 ***: 1%, **: 5%, *: 10%.

⁵ Only in the EU-15, productivity growth is significant in ‘credit and insurances’. The sample for the EU-15 is, however, restricted to 10 years (1996-2005).

4. Regional Phillips curves

This section deals with the Phillips curve (Phillips, 1958) which describes a negative effect of unemployment on wage growth. In section 4.1 the Phillips curve is shortly discussed. Section 4.2 presents the estimated Phillips curves.

4.1. The Phillips curve

For decades the Phillips curve is a much used instrument for analysis, e.g. by central banks for assessing the inflation evolution. Last year, the Phillips curve celebrated its fiftieth anniversary and therefore it was the main theme at numerous economic conferences⁶.

The original Phillips curve postulates an inverse relation between the unemployment rate and nominal wage growth. In Samuelson and Solow (1960), this relationship was baptised “the Phillips curve”. The theory goes as follows: higher unemployment leads to lower nominal wage growth because in a climate of increasing unemployment workers will have lower wage expectations. Phillips (1958) confirmed this relation empirically for the period 1861-1957 in the United Kingdom.

Since wages are an important price component, the Phillips curve was later reinterpreted as a negative relation between unemployment and (price) inflation. Also other measures to indicate the state of the business cycle are used: e.g. Melihovs and Zasova (2007) use the output gap. The inverse relationship between wage growth and unemployment rate can also be considered at the

⁶ Examples: 53rd Economic Conference: A Phillips Curve Retrospective, Federal Reserve Bank, Boston, June 2008 and ESAM08 Markets and Models: Policy Frontiers in the AWH Phillips Tradition, Wellington, July 2008.

individual level. In Baltagi et al (2007) for instance, individual data are used in a panel study to estimate a wage equation. They find a significant negative effect of unemployment on nominal wage growth.

Due to lacking data at the regional level, e.g. the absence of price information or output gap estimates, in this paper the choice has been made to work with the original Phillips relationship, i.e. the inverse relation between unemployment and nominal wage growth (see section 4.2).

The original Phillips curve can be presented as follows (Heylen, 1999)⁷:

$$(1) \quad \dot{w} = \alpha - \beta u ,$$

with \dot{w} the nominal wage growth, u the unemployment rate and α and β parameters. Although Phillips & Co demonstrated this relationship empirically, reality is not always favourable to it. In the 1970s for instance, a number of countries faced stagflation, i.e. high unemployment rates combined with high inflation. Clearly, this is not what the Phillips curve suggests. Attempts to explain this stagflation led to a further evolution of the Phillips curve. There might be factors which disturb the original Phillips curve, without really refuting the inverse relationship between the unemployment rate and wage growth.

A first extension of the original Phillips curve concerns inflation expectations. When negotiating wages, both parties will form expectations about future inflation. The higher these expectations are for instance, the higher the wage demands from the workers will be. Equation (1) becomes:

⁷ For simplicity the subscript t is dropped (t denoting the year). If a certain variable refers to another year than t , a subscript will be added.

$$(2) \quad w = \alpha + \delta \dot{p}^e - \beta u,$$

where \dot{p}^e is the expected inflation.

In addition, the Phillips curve can be extended with labour productivity and some 'push' variables. A higher labour productivity actually means a higher value added per employee. On the one hand employees will try to demand part of this extra value added and, on the other hand, employers will tend to pay more productive employees higher wages.

A first push variable concerns the taxes on employees: the more employees are taxed, the higher the demanded gross wages will be, to have left net the same amount. Another push variable is the degree of active labour market policy. An active labour market policy is a policy which aims at lower unemployment benefits, unemployment benefits which decrease with time, more job mediation and more retraining. Such a policy encourages lower wage demands. A last push variable relates to the power and preferences of the unions. The higher the power of the unions, and the more they prefer purchasing power (rather than employment), the higher the wage demands will be.

Equation (2) then becomes:

$$(3) \quad w = \alpha + \delta \dot{p}^e - \beta u + \gamma \dot{q} + \xi,$$

where \dot{q} is the labour productivity growth and ξ the push variables.

The last but one extension is that the assumption of an open economy has to be taken into account. Exchange rate depreciations and foreign price increases lead

to higher domestic wage demands, since both increase the import and consumption prices:

$$(4) \quad \dot{w} = \alpha + \delta \dot{p}^e - \beta u + \gamma \eta + \phi(\dot{p}_f - \dot{e}) + \xi,$$

with \dot{p}_f the foreign inflation and \dot{e} the exchange rate growth (if \dot{e} is positive this means an appreciation of the domestic monetary unit).

Finally, to come to a final equation adjustment costs and inertia are included. In reality full nominal wage flexibility is not always true due to the presence of adjustment costs. For wages in particular there are e.g. negotiation costs, which prevent the direct adaptation of wages to changes in one or more of the determinants. The consequence of negotiation costs is the closure of long term contracts. Macro-economically this implies inertia, or the current nominal wage growth will also depend on the previous nominal wage growth (since e.g. not all contracts are adapted):

$$(5) \quad \dot{w} = \alpha + \delta \dot{p}^e - \beta u + \gamma \eta + \phi(\dot{p}_f - \dot{e}) + \lambda \dot{w}_{-1} + \xi,$$

where \dot{w}_{-1} is the nominal wage growth in the previous period.

Summarizing, wage growth is expected to be higher not only when the unemployment rate is lower as in the original Phillips curve, but also when inflation expectations rise, labour productivity increases and e.g. when the exchange rate decreases.

Returning to equation (1), an equilibrium unemployment rate can be defined for which $\dot{w} = 0$, i.e. there is no nominal wage growth. It is not difficult to see that

$$(5) \quad u^* = \frac{\alpha}{\beta}.$$

This equilibrium unemployment rate u^* is still valid in equation (5). Now, however, there will be (wage) inflation depending on the values of \dot{q} , \dot{e} , ..., but the wage growth will be stable. Therefore u^* is called the 'non-accelerating inflation rate of unemployment' (NAIRU): the unemployment rate which is consistent with stable inflation.

Wages are said to be flexible if they respond to the labour market situation. The parameter β in equation (5) can be seen as a measure of wage flexibility, since it tells us the extent to which wage growth reacts on changes in unemployment. Note also that the NAIRU will be smaller for higher β 's, i.e. when wages are more flexible.

4.2. Empirical results

In this section the results from estimating equation (5) for the considered regions and countries are reported. The equation is estimated by using data from the period 1980-2005 and by using ordinary least squares. Since there are missing data for the EU-15, the equation is not estimated for this region (the sample would be restricted to 1995-2005, which is regarded to be too small).

Concerning the data, effective exchange rates are found on the EUROSTAT website. Unemployment rates come from the IMF for the countries and HERMREG for the Belgian regions. Nominal wage growth and labour productivity are provided by EUKLEMS (countries) and HERMREG (regions).

With respect to the inflation expectations, a common hypothesis is adopted, i.e. $\dot{p}_t^e = \dot{p}_{t-1}$. The data for this variable are collected from the AMECO database. With respect to the exchange rate and the price inflation, the Belgian values are taken for the Belgian regions. Since there are no 'regional' currencies in Belgium, at least up to now, for the former variable this is not of big concern. Regarding consumer price inflation this is the best option available since regional price data are lacking. This is, however, a reasonable assumption in the Belgian context (where wages are tied to the evolution of a (national) consumer price index).

Table 8 reports the estimation results. All equations are checked for serial correlation by the Ljung-Box test with several lag lengths. If a variable proved to be insignificant it was dropped from the equation. Although in the equations for the Flemish Region, the Walloon Region, Germany and the Netherlands the exchange rate growth is significant, it is dropped from the equation since the sign is negative, whereas theory suggests a positive sign (see equation (5)).

Table 8: Phillips curve: estimation results

	Brussels Capital Region	Flemish Region	Walloon Region	Germany	France	The Nether- lands
C	0.0864***	0.0728***	0.0736**	0.0809***	0.0781***	0.0417***
UR	-0.0033**	-0.0074***	-0.0034*	-0.0096***	-0.0061***	-0.0056***
PROD	-	0.5775***	0.4776*	0.5891*	-	-
CPI(-1)	0.3452*	0.6298***	0.4359**	-	0.6634***	0.6478***
ER	0.2281**	-	-	-	0.1063**	-
W(-1)	-	0.4705***	-	0.3646**	-	-
R2	0.59	0.81	0.63	0.69	0.95	0.68
NAIRU	27.1	9.8	21.5	8.5	12.7	7.4

For all countries the unemployment rate and the constant are significant variables in explaining the nominal wage growth over the period 1981-2005. The exchange rate growth is significant in all regions and countries, but as said before it is dropped in the equations for the Flemish Region, the Walloon Region,

Germany and the Netherlands. Also the lagged inflation rate (consumer price index) is most of the times significant, except for Germany it is insignificant. Real productivity growth only plays a role in the Flemish Region, Germany and the Walloon Region. The explanation power of the equations ranges from 59% in the Brussels Capital Region to a very good fit in Germany (R-squared being equal to 95%).

The NAIRU is the highest in the Brussels Capital Region (about 27%), followed by the Walloon Region (21.5%). The NAIRU of the Flemish Region not that high compared with the included European countries: 9.8% versus 7.4% in the Netherlands and 12.7% in France.

As described above, the coefficient of the unemployment rate in the estimated equation is a measure of wage flexibility. The higher the absolute value of β , the more flexible wages are. Using this measure, wages are most flexible in Germany, followed by the Flemish Region. Wages seem least flexible in the Brussels Capital Region and the Walloon Region. Both also display higher NAIRU's.

For the Belgian regions the Phillips curve is re-estimated with other unemployment data, in particular unemployment rates without 'older' unemployed people. Results can be found in Appendix A.2. The NAIRU's are obviously somewhat lower in this case, namely for the Flemish Region it equals 6.2%, for the Walloon Region 18.1% and for the Brussels Capital Region 22.5%.

5. Conclusion

In the past quarter century, the evolution of the nominal wage per employee in the Flemish Region was not favourable for its competitive power. Of all included regions and countries (the Brussels Capital Region, the Walloon Region, France, Germany, the Netherlands and the EU-15) it registered the second highest wage growth over the period 1980-2006, after France. Also when considering the wage per unity of value added, the evolution in the Flemish Region was not advantageous for its economy. At the sectoral level, the highest increases of the nominal wage per employee are recorded by industrial branches, such as 'energy', 'intermediate goods' and 'consumption goods'.

Despite this unfavourable evolution, the Flemish Region still displayed the lowest wage per unity of value added in 2006. Since its wage per employee is relatively high, the reason for the lower wage per unity of value added is found in the high labour productivity of the Flemish economy.

From the sectoral correlation analysis and the sectoral wage equation, it can be concluded that although employment growth plays a role in explaining the sectoral evolution of wages, it is mostly labour productivity growth which determined sectoral wage growth.

At the macro-economic level, nominal wages clearly depend on the evolution of the labour market situation. The Phillips curves show us that a decreasing unemployment increases the wage expectations and has a positive impact on nominal wage growth. This impact seems to be relatively high in Flanders compared to the other regions and countries. The NAIRU is relatively low in the Flemish region.

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Appendix 1: Branch definitions

Table A.1: Branch definitions

Branch name	ESA 95
Agriculture	AA+BB
Energy	CA+DF+EE
Intermediate goods	CB+DG+DI+DJ
Equipment goods	DK+DL+DM
Consumption goods	DA+DB+DC+DD+DE+DH+DN
Construction	FF
Transport and communication	II
Trade and catering	GG+HH
Credit and insurances	JJ
Health care and social action	NN
Other market services	KK+OO
Public administration and education	LL+MM
Domestic services	PP

Appendix 2: Additional Phillips curves

Table A.2: Phillips curves with elderly excluding unemployment rates

	Brussels Capital Region	Flemish Region	Walloon Region
C	0.0898***	0.0335***	0.0749**
UR	-0.0040***	-0.0054***	-0.0041*
PROD	-	0.6736***	0.5513*
CPI(-1)	0.4453**	0.6663***	0.5222**
ER	0.2257*	-	-
W(-1)	-	0.5783***	-
R2	0.60	0.78	0.62
NAIRU	22.5	6.3	18.1