ON WAGE FORMATION, WAGE DEVELOPMENT AND FLEXIBILITY: A comparison between European countries and the United States

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Abstract
We derive a non-linear wage equation from a wage bargaining model and estimate an error correction model for Germany, Spain, France, the Netherlands and the US. Based on the estimated parameters, we derive time-varying elasticities of wages with respect to its determinants labour productivity, prices, taxes, unemployment and the replacement rate. Moreover, we quantify the contribution of each determinant to the wage increase. The dominant role of prices in the wage formation in the seventies and eighties was taken over by labour productivity for the US and unemployment in Spain and the Netherlands at the end of the nineties.
Key words: wage formation, labour market flexibility
JEL codes: C22, E24, J30

1. Introduction

Considering the labour market changes that took place in the nineties in Spain (*cf.* Bover *et al.,* 2000) and the Netherlands (*cf.* Auer, 2000), the wage formation process seems to have changed considerably during the last decade. The wage developments and flexibility of these countries are compared to the counterparts of the big European countries France and Germany and the United States (US).

We extend the theoretical wage bargaining model of Graafland and Huizinga (1999) and derive a non-linear wage equation that determines the model equilibrium. The non-linear nature of the wage equation enables to compute elasticities that can vary over time, which contrasts the commonly assumed constant elasticities (*cf.* Layard *et al.*, 1991). Moreover, we quantify the time-varying contributions of the different determinants to the wage increase over the sample period of almost thirty years. We are interested in the

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determinants that turn out to be dominant during different decades for the different countries. In addition to long-term flexibility, we are also interested in short-term impulse response dynamics to infer differences among the countries.

The paper is organised as follows. Section 2 presents the theoretical model and the derivation of the non-linear wage equation. Section 3 estimates the wage equation for all the countries. The elasticities and contributions of the determinants with respect to the wage formation are presented. Section 4 analyses real and nominal wage flexibility. Finally, section 5 concludes.

2. Wage bargaining model

This section builds on Graafland and Huizinga´s (1999) Nash bargaining model to describe the wage formation process as a two-player bargain between a representative employer and a representative employee about the gross wage. Since a micro game-theoretic approach is applied to model the wage formation process at a macro level, both representative agents and the wage rate are reflected by their corresponding macro averages.
The optimal gross wage is the wage that maximises the combined objectives of the employer and the employee and reads as:

$$\Omega \equiv \Pi^{\alpha} \ \Psi^{1-\alpha} \tag{1}$$

where Π is the profit function of the employer, Ψ the utility function of the employee and α a parameter representing the bargaining power. The closer α is to 1, the more power the employer has in comparison with the employee during the negotiation process.
Profits are defined as turnover T minus costs C, so profits equals $T - C$. Turnover equals the price (P) times the number of goods sold (S). The number of goods produced differs from S by the change in inventories. Costs only consist of wage costs, *i.e.* $C = W.L$, where W is the gross wage and L the number of employees. Profits are then defined per employee as

$$\Pi \equiv P q^{\rho} - W \quad \text{where} \quad \rho \leq 1 \tag{2}$$

where sales per employee equals q^{ρ} with q being the labour productivity. In case the parameter $\rho < 1$, labour productivity gains do not fully translate into an equal increase in sales (*cf.* Bell *et al.*, 2000). A part of the inventory of goods will then be devalued or even never be sold, for example perishable food products. The representative employer´s aim in (2) is the maximisation of profits per employee π, which can be achieved at the macro level as well by adjusting employment. This adaptation translates into the unemployment rate under the assumption of a constant total labour population.

The employee bargains about the net wage, which consists of the gross wage after deduction of taxes and social contributions, *t,* in deviation of the reservation wage $\underline{W}$:

$$\Psi \equiv W\,(1-t) - \underline{W}\,. \tag{3}$$

The reservation wage represents the employee's outside opportunity wage or benefit, which is defined as a weighted average of the wage income in the official and the informal sector,

$$\underline{W} \equiv \beta\,\underline{W}_{official} + (1-\beta)\,\underline{W}_{informal} \tag{4}$$

The wage in the official sector $\underline{W}_{official}$ equals the after-tax gross average market wage $\hat{W}(1-t)$in case of no unemployment ($u=0$) and, as another extreme case, $R\hat{W}(1-t)$ if the unemployment rate would be 100% (*i.e.* $u=1$). The gross unemployment benefit equals $R\hat{W}$ as the replacement rate $0 \le R \le 1$ equals the average unemployment benefit divided by the average market wage.

$$\underline{W}_{official} \equiv uR\hat{W}\left(1-t\right)+\left(1-u\right)\hat{W}\left(1-t\right) \tag{5}$$

The wage obtained in the unofficial sector consists of avoided expenditures due to homework, such as child care, cleaning or house maintenance, and therefore depends on the consumer price P_c. Moreover, the parameter $\gamma \le 1$ allows for a relatively low labour productivity of the informal vis-à-vis the official sector.

$$\underline{W}_{informal} \equiv \gamma\,P_c\,q^{\rho} \quad . \tag{6}$$

Appendix A shows that imposing the equilibrium condition $W=\hat{W}$ results in the following equilibrium wage:

$$\begin{aligned}\log W = \log P + \rho \log q + \log\left[1+\left(\frac{\alpha\left(1-\beta\right)\gamma}{1-\alpha+\alpha\left(1-\beta\right)\gamma}\right)\left(\frac{P_c}{P\left(1-t\right)}-1\right)\right] \\ -\log\left[1+\frac{\alpha}{1-\alpha}\left[1-\beta\left(1-u\left(1-R\right)\right)\right]\right]+\log\left[1+\frac{\alpha\left(1-\beta\right)\gamma}{1-\alpha}\right]\end{aligned} \tag{7}$$

The long-run elasticities of the gross wage with respect to each of the six model determinants *P*, P_c, *q*, *t*, *u* and *R*. are derived in the appendix. Prices fully translate into the gross wage. So, a 1% increase in *P* and P_c causes an increase of the gross wage by 1% as well. Productivity does not necessarily fully translate into wage increases. A 1% increase in *q* causes an increase of the gross wage increase by $\rho \le 1$.

The non-linear wage equation (7) allows for non-constant semi-elasticities with respect to the unemployment rate *u* and the replacement rate *R*. The semi-elasticity with respect to the unemployment rate is negative. Moreover, the magnitude of this semi-elasticity depends inversely on the replacement rate. So, an increase in unemployment causes more moderation of the gross wage growth in case the unemployment benefits are sober (*R* is small) than if the unemployment benefits are abundant (*R*=1).

The replacement rate itself exerts a positive effect on the wage rate, since an increased reservation wage causes the employee to require a higher wage claim in the bargaining process. Moreover, the magnitude of this semi-elasticity depends positively on the unemployment rate. So, policy measures that affect unemployment benefits are more effective in a loose labour market (*u* is high) than in a tight one (*u* is low).

3. Estimation and empirical results

The gross wage equation (7) represents the long-term model equilibrium. In the short run, the gross wage may deviate from this equilibrium. For this reason, an Error Correction Model (ECM) is specified as

$$\Delta \log W = \sum \phi_i \, \Delta \log X_i + \eta \left(\log W_{-1} - \log W_{-1}^{*} \right). \qquad (8)$$

where $\log W^*$ equals the non-linear equilibrium (7) at time $t-1$, with the deep model parameters α, β, γ and ρ. The first terms in (8) consider the short-term effects ϕ_i of the six wage determinants $X_i \in \{P, P_c, q, t, u, R\}$.

The wage equation (8) is estimated for Germany, Spain, France, the Netherlands and the United States with annual data for the period 1970-2001. In order to correct for endogeneity between the gross wage and the price variables P and P_c, we employ an instrument variable estimator. The instruments are the three and four year lagged exogenous variables added with the lagged US consumer prices for each of the European countries or the lagged German consumer prices for the US. The inclusion of the lagged instruments shrinks the estimation sample to the period 1975-2001.
The deep model parameters are estimated directly, so all non-linear restrictions according to (7) are imposed in the long-run relationship for each of the countries. As the simultaneous estimation of the parameters β and γ does not result in a feasible optimum, we calibrate the fraction of the official wage in the total gross wage β at a value between 0.85 and 0.99 that provides the highest t-value of γ. In order to specify the short term dynamics we start with a general to specific approach with all six determinants included with no, one and two lags.
We apply the system of equations by instruments estimator, *i.e.* Three-Stage-Least Squares (3-SLS), which implies the weighting of the regressors by the covariance matrix of the residuals. The economic rational for estimating the system of equations is that the countries, and foremost the European countries, encountered common shocks during the sample period 1975-2001. However, no cross-equation parameter restrictions are imposed, so we do not assume wage co-ordination across countries[1].

[1] Belgium would be an appropriate example (but is not included in the sample). Wage negotiations in Belgium are determined by wage settlements in its neighbouring countries France, Germany and the Netherlands. See e.g. also Pichelmann (2001).

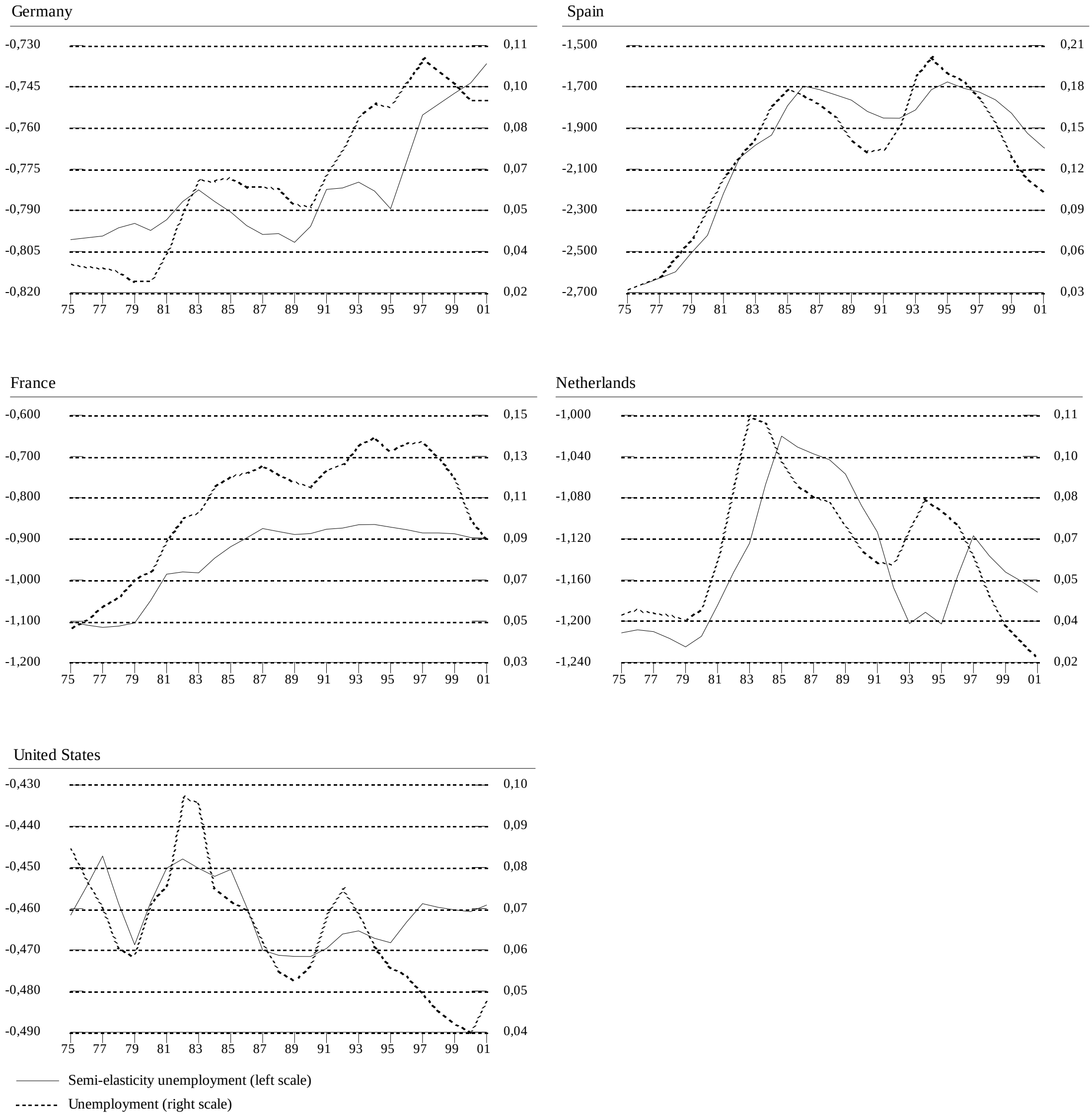
Table 1 Three-Stage-Least-Squares-estimates

	Germany	Spain	France	The Netherlands	United States
Long-term coefficients					
α	0.58 (2.44)	0.95 (13.94)	0.76 (3.10)	0.77 (9.34)	0.40 (0.93)
β	0.92	0.83	0.80	0.92	0.89
γ	0.83 (8.04)	0.98 (19.16)	0.83 (28.67)	0.95 (31.13)	0.68 (0.96)
ρ	0.88 (10.94)	0.94 (5.41)	0.38 (2.27)	0.67 (9.31)	0.93 (4.53)
η	-0.38 (3.59)	-0.36 (3.44)	-0.29 (3.70)	-0.32 (3.12)	-0.39 (2.15)
Short-term coefficients					
$\Delta \log W_{-1}$		0.26 (1.99)		0.40(3.48)	0.63(3.60)
$\Delta \log P$	1.38(8.26)			0.52(3.25)	
$\Delta \log P_c$		0.88(3.96)	0.95(10.50)		0.55(2.52)
$\Delta \log q$	0.64(4.43)				0.74(2.79)
R^2_{adj}	0.90	0.96	0.98	0.95	0.84
S.E. * 100	0.84	1.42	0.71	0.69	0.88
Jarque-Bera	0.58 [p=0.75]	0.05 [p=0.97]	0.40 [p=0.82]	0.22 [p=0.89]	0.85 [p=0.65]

Note: the parameters β are calibrated at values that provide the highest t-statistics for γ. Moreover for the US, the parameter estimates for the α and γ are not significant.

Table 1 shows the estimated equations, which have a high goodness-of-fit from about 0.84 for the US up to 0.98 for France. A few observations arise. First, the short-term elasticity with respect to prices in Germany is higher than 1. Second, labour productivity in France and the Netherlands does not fully translate into wage growth in the long run. For the Netherlands, this may reflect the wage moderation policy of the Wassenaar treaty of 1982. Third, neither α nor γ are significant for the US. Probably, US employers exert more influence on adjusting labour quantities (i.e. *u*) instead of labour prices (i.e. *W*) to clear the labour market. Moreover, the informal sector is probably less important in the US than in Europe due to the diverging social security arrangements. Graph 1 shows for all countries the semi-elasticities of the gross wage with respect to both the unemployment and the replacement rate, which are based on the parameter estimates. The semi-elasticity with respect to unemployment is highest in Spain and the Netherlands and lowest in the US. Furthermore, Graph 1a clearly shows that at the end of 20th century the elasticity increased –in absolute terms- in the Netherlands and Spain, along with the fall in the unemployment rate. In France and Germany, on the other hand, the responsiveness of the wage rate to unemployment was fairly low and diminished even further during the end of the sample period. As already pointed out, the development of the unemployment elasticity over time is driven by the replacement rate and *vice versa*.

Graph 1e Semi-elasticity of wages with respect to unemployment and unemployment

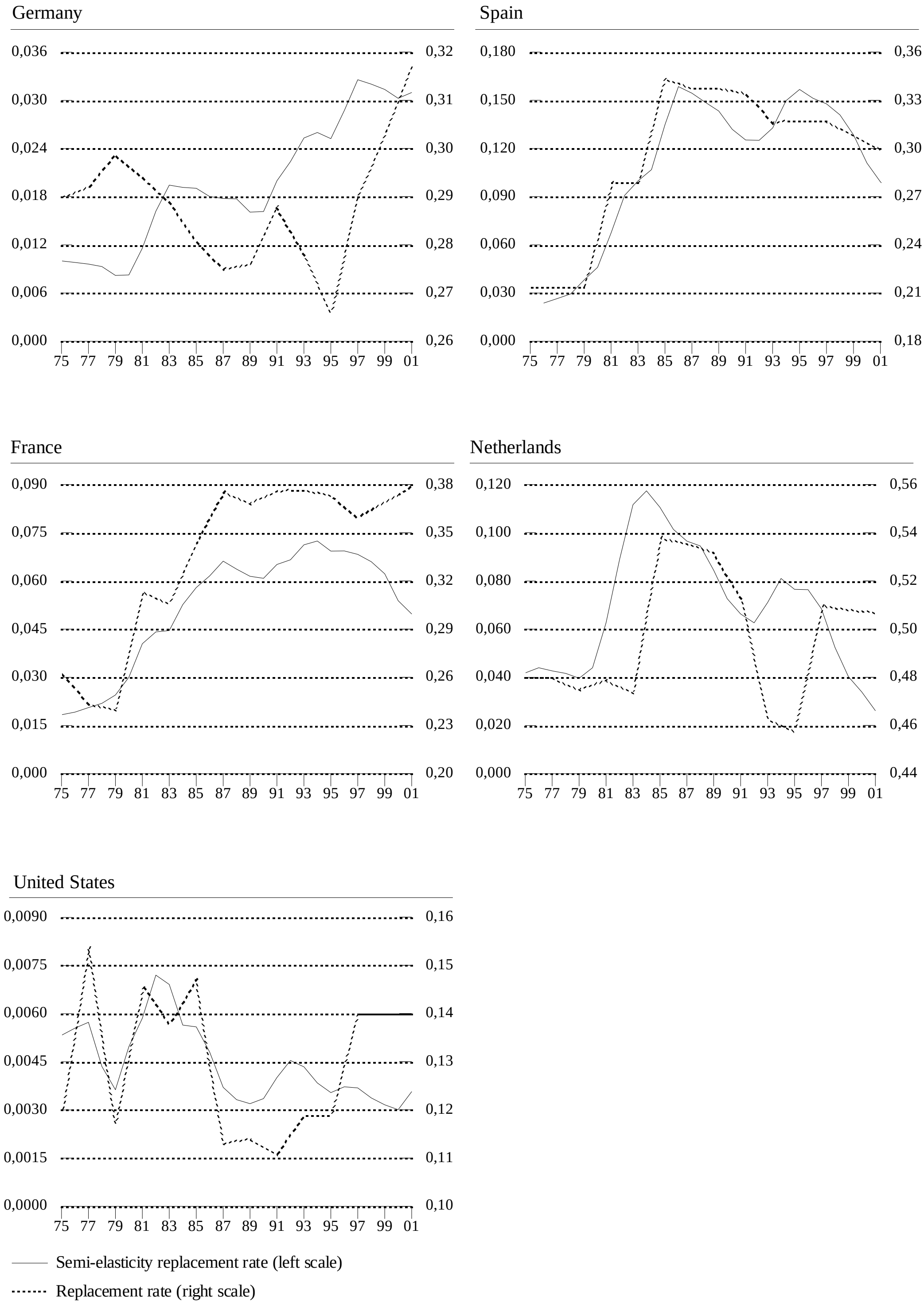


Based on the wage equation (7), the long-run model contributions of all determinants to the gross wage growth can be quantified using the elasticities as follows:

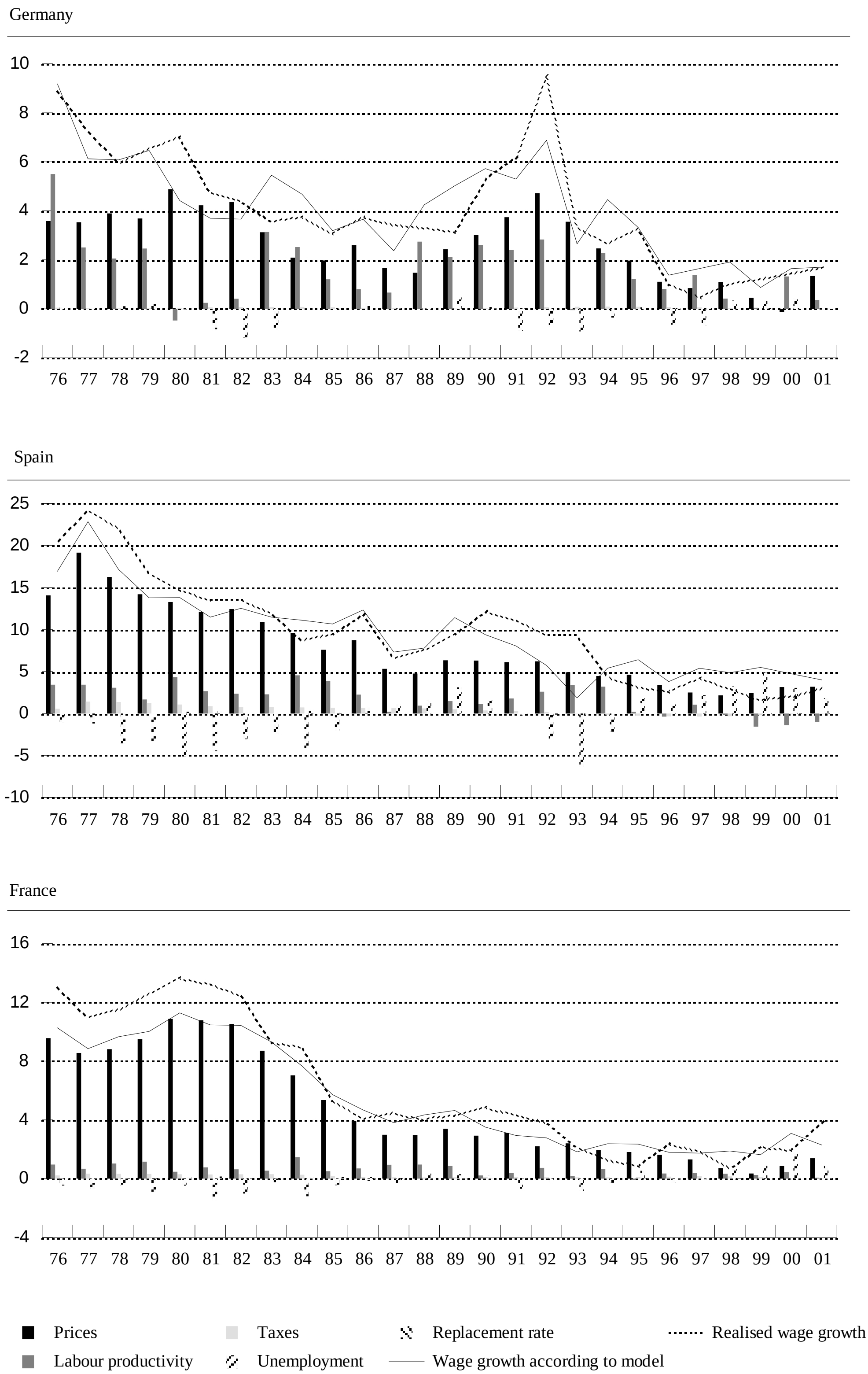
$$\Delta \log(W) = \sum_{x_i \in \{P, P_c, q, t, u, R\}} \in_{x_i} \frac{\Delta x_i}{x_i} \qquad (9)$$

where $\Delta \log W$ represents the gross wage growth according to the model. For the semi-elasticities of t, u and R, multiplication by Δx_i instead of $\frac{\Delta x_i}{x_i}$ is performed.

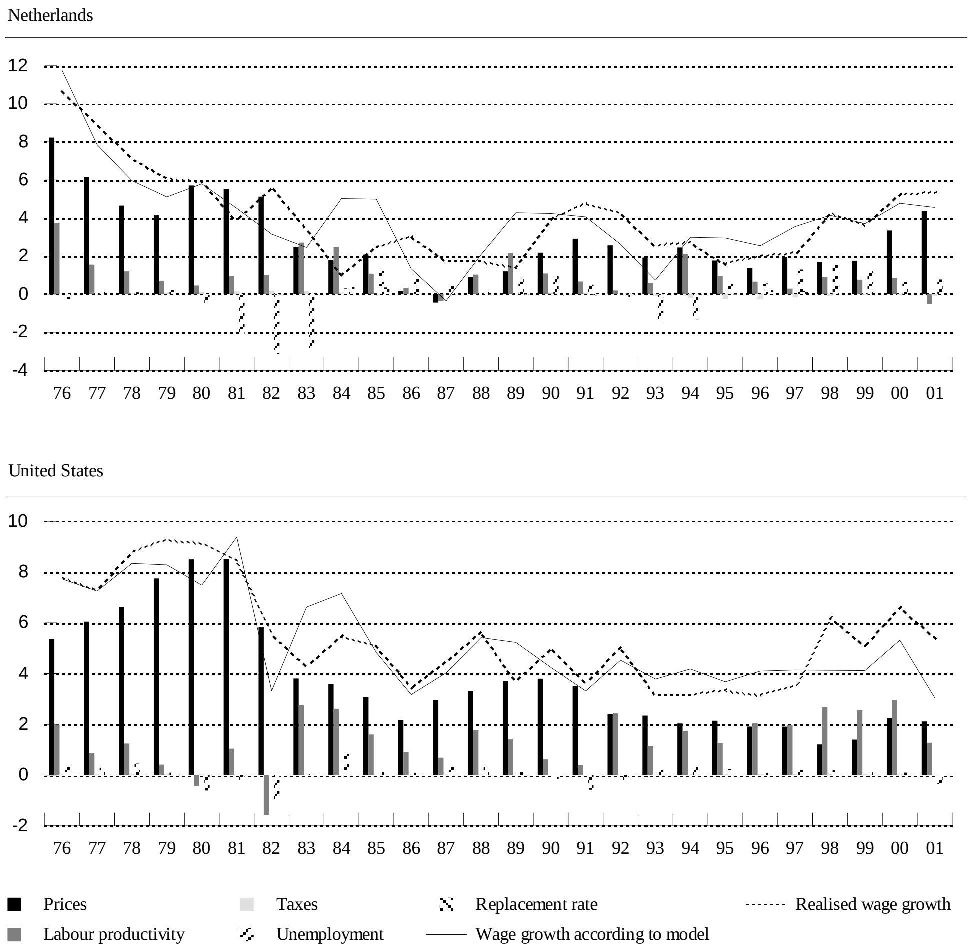
Graph 1f Semi-elasticity of wages with respect to replacement rate and replacement rate



Graph 2 Observed wage rise, model based wage rised and the constituting determinants 'parts'



Graph 2 Observed wage rise, model based wage rised and the constituting determinants 'parts (continued)



The six individual contributions of (9) and the observed and model based wage growth are provided in Graph 2 for each country in the empirical analyses. A few observations arise. First, during the seventies and early eighties all countries show the transmission of high prices spiralling into high wages. Wage growth diminishes at the end of the 20tn century, but the contribution of prices remains relatively high. Second, particularly in Germany and in the US at the end of the period the contribution of labour productivity is substantial. For the US in the nineties, the contribution of labour productivity becomes even the most substantial contributor. Guisan and Aguayo (2007) find that the higher labour productivity in the US is the result of human capital as measured by education and R&D expenditures. [2] Third, the role of unemployment in wage determination is most dominant in Spain and the Netherlands. At the beginning of the eighties and nineties, the

[2] Note that the semi-elasticity of labour productivity is not time-varying, see the appendix. So, the relatively high contribution in (9) in the nineties is only due to the increased labour productivity.

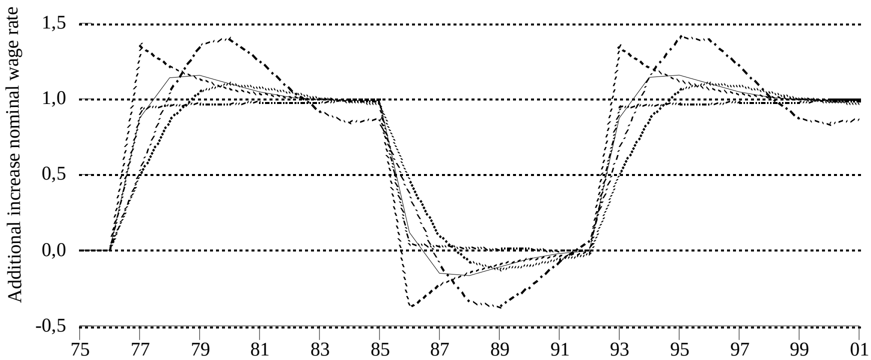
increase in domestic unemployment moderates wage growth considerably. At the end of the nineties, the decrease in unemployment contributes, on the contrary, positively to wage growth. The unemployment in Spain becomes then even the most substantial contributor. Labour market and social security reforms in both countries then lowered the replacement rates, which affected the unemployment elasticity. So fourth, although the direct contribution of the replacement rate seems rather limited, its indirect effect on the unemployment elasticity elevates the unemployment contributions.

4. On wage flexibility

Reactions of nominal wages to unemployment changes reflect labour market flexibility more than reactions to price changes. According to the model, prices are fully transmitted into wages in the long run. So, only the short term dynamics towards this long run equilibrium matters. The responsiveness of wages to unemployment changes turns out to be quite different over countries and over time, both in the short term dynamics as well as in the long run equilibrium. Table 2 summarises the wage elasticities with respect to unemployment in this study compared to Layard, Nickell and Jackman (1991). Although the latter elasticities do not cover the nineties, the US turns out to be the least flexible according to both studies.
Along with the level of the long-run elasticities of the determinants, the adjustment process towards the long run is also of importance in the measurement of flexibility. To analyse the short-term adjustment process, we perform two shocks in the estimated wage model that is reported in Table 1. The first shock concerns a price shock, being a 1% shock to both value added and consumer prices, and the second shock concerns a 1% decrease in unemployment. As the model is non-linear, the sign of the shock as well as the timing of the shock matters. The price and unemployment shocks are imposed at the end of the seventies, in 1977-1986, when unemployment was relatively low and inflation relatively high. Both shocks are also imposed in the nineties, in 1993-2001, when the relatively high unemployment started declining and inflation was relatively low. The period 1987-1993 is not subdued to any shock and therefore only reflects the short run adjustment towards the baseline. The simulation results tell us what would have happened to the wage increases according to the model if prices or unemployment would have been 1% higher. The results of the simulation are shown in Graph 3a for the two price shocks and in Graph 3b for the two unemployment shocks. The presented figures display the development as deviation from the baseline of the nominal wage due to the additional rise in prices or unemployment.

Graph 3a shows clearly the long-run unit elasticity of prices. Almost all countries overshoot initially and most countries are close to long run equilibrium within a couple of years. Germany overshoots the 1% after one year. France adjusts wages almost fully in the second year, while Spanish wages adjust only slowly. The Netherlands and the US overshoot the 1% after some years due to the persistence in the wage equation. A comparison between the shocks performed in the seventies with the shock in the nineties per country shows only slightly different results.

Graph 3a Simulation of a price shock



Graph 3b Simulation of a unemployment shock

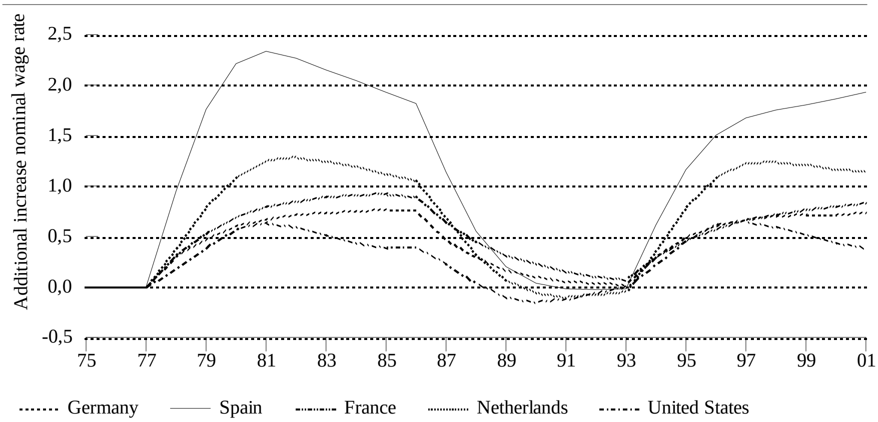


Table 2 Wage increase (%) due to a 1 percentage point decrease in unemployment in the long term

	This study 1975-2001	Layard, Nickell and Jackman (1991)
Germany	0.74 to 0.81	1.01
Spain	1.60 to 2.60	1.21
France	0.85 to 1.15	4.35
Netherlands	1.00 to 1.25	2.28
The United States	0.44 to 0.48	0.94

The adjustment of wages due to a shock in unemployment is quite different since the long-run elasticities differ between countries and over time. The additional wage increase for Germany, Spain and France is lower in absolute terms in the nineties than in the seventies[3], while the additional wage increase for the Netherlands and the US is slightly higher. Moreover, wages in the Netherlands and the US do not return to base immediately, but increase for some time due to short-term persistence. The low responsiveness of wages to unemployment in the US might be rationalised by the functioning of its labour market. This market may adjust towards equilibrium more by quantity adjustments (*ie*. unemployment *u*) than by price adjustment (*ie.* wage *W*).

5. Conclusions

A non-linear wage equation is derived from a theoretical framework describing the wage bargaining process between employers and employees. The wage rate is determined by labour productivity, the value added price and the consumer price, the marginal and average tax rates and further, interrelatedly, the unemployment and replacement rates. This wage equation is estimated by means of an Error-Correction Model using annual time series of the last three decades for Germany, Spain, France, the Netherlands and the US. Three-Stage-Least-Squares is applied to estimate the model consistently and efficiently in view of the endogeneity of prices in the short-term and common shocks respectively. The estimated coefficients are used to compute the (non-constant) elasticities and contributions of the wage determinants to wage growth. Finally, real and nominal wage flexibilities are assessed for the individual countries.

The main empirical results are the following. Price increases contributed most to wage growth in the seventies and eighties. For Germany and the US, the elasticity of labour productivity is relatively high and the contribution of labour productivity to the wage growth even dominates the other determinants' contributions in the US at the end of the nineties. During the same period, the unemployment elasticity increased in absolute terms to the highest levels of all countries for both Spain and the Netherlands and unemployment fell drastically. For Spain, the unemployment was even the most dominant contributor to the wage increase in the nineties.
Similar to the labour market study results of Layard *et al*. (1991) and Pichelmann *et al*. (2005), we also find that wage formation in the US cannot be called more flexible than in the three largest continental European countries or the Netherlands. The flexibility, that is the reaction of wages to unemployment changes, is by far smaller for the US than for these countries as is particularly shown in the simulation analysis. Moreover, the short run adjustment in the US of wages to price changes reveals some stickiness.

3 . The additional wage increase in 2001 compared to 1985 is 0.76 vs. 0.79 for Germany, 1.82 vs. 1.90 for Spain, 0.83 vs. 0.92 for France. While for the Netherlands, 1.21 vs. 1.18, and the US, 0.53 vs. 0.52, the additional wage increase is slightly higher.

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APPENDIX A: DERIVATION OF WAGE EQUATION, WAGE ELASTICITIES AND CONTRIBUTIONS

In comparison with the wage model used in Graafland and Huizinga (1999), the model specified in section 2 takes into account the possibility of production deviating from sales. Below follows the derivation of the wage equation.

In order to derive the optimal wage the objective function

$$\Omega \equiv (Pq^{\rho} - W)^{\alpha} (W - T(W) - \underline{W})^{1-\alpha} , \qquad (1)$$

where $T(W)$ is the taxes paid by the employee as a function of W, is differentiated with respect to W:

$$\frac{\partial \Omega}{\partial W} \equiv -\alpha (Pq^{\rho} - W)^{\alpha - 1} (W - T(W) - \underline{W})^{1-\alpha} + (Pq^{\rho} - W)^{\alpha} (1-\alpha)(W - T(W) - \underline{W})^{-\alpha} (1 - \frac{\partial T}{\partial W}) = 0 \quad \Leftrightarrow$$

$$-\alpha (W - T(W) - \underline{W}) + (Pq^{\rho} - W)(1-\alpha)(1 - \frac{\partial T}{\partial W}) = 0 \quad \Rightarrow$$

$$W \left[\alpha \frac{1-t}{1-t_m} + (1-\alpha) \right] = (1-\alpha) P q^{\rho} + \frac{\alpha}{1-t_m} \underline{W} \qquad (A1)$$

where $t_m \equiv \frac{\partial T}{\partial W}$ and $W - T(W) = W(1-t)$.

The wage earned in the official sector

$$\underline{W}_{official} \equiv uR\hat{W}(1-t) + (1-u)\hat{W}(1-t) \qquad (4)$$

and the informal wage

$$\underline{W}_{informal} = \gamma \, P_c \, q^{\rho} \qquad (5)$$

can be substituted into the reservation wage equation

$$\underline{W} = \beta \, \underline{W}_{official} + (1-\beta) \, \underline{W}_{informal} \qquad (3)$$

such that the reservation wage equals

$$\underline{W} = \hat{W}(1-t)\beta(1 - u(1-R)) + (1-\beta)\gamma P_c q^{\rho} \qquad (A2)$$

Substitution of (A2) into (A1) and using $W = \hat{W}$ gives

$$W\left[\alpha\,\frac{1-t}{1-t_m}+(1-\alpha)\right]=(1-\alpha)\,P\,q^{\,\rho}+\frac{\alpha}{1-t_m}\Big[W\,(1-t)\,\beta\,(1-u\,(1-R))+(1-\beta)\,\gamma\,P_c\,q^{\,\rho}\Big]\quad\Leftrightarrow$$

$$W\left[1+\frac{\alpha}{1-\alpha}\,\frac{1-t}{1-t_m}[1-\beta\,(1-u\,(1-R))]\right]=P\,q^{\,\rho}+\frac{\alpha\,(1-\beta)\,\gamma}{1-\alpha}\,\frac{P_c\,q^{\,\rho}}{1-t_m}\quad\Leftrightarrow$$

$$W\left[1+\frac{\alpha}{1-\alpha}\,\frac{1-t}{1-t_m}[1-\beta\,(1-u\,(1-R))]\right]=P\,q^{\rho}\left[1+\frac{\alpha\,(1-\beta)\,\gamma}{1-\alpha+\alpha(1-\beta)\gamma}\left(\frac{P_c}{P(1-t_m)}-1\right)\right](1+\frac{\alpha(1-\beta)\gamma}{1-\alpha})$$

In this last step an arrangement is made to separate the term Pq^{ρ} and the constant term, virtues that follow from the wage equation expressed in logarithms below.

Because, taking logarithmes the wage equation equals

$$\log W=\log P+\rho\log q+\log\left[1+\left(\frac{\alpha\,(1-\beta)\gamma}{1-\alpha+\alpha\,(1-\beta)\gamma}\right)\left(\frac{P_c}{P(1-t_m)}-1\right)\right]$$
$$-\log\left[1+\frac{\alpha}{1-\alpha}\,\frac{1-t}{1-t_m}\Big[1-\beta\big(1-u\big(1-R\big)\big)\Big]\right]+\log\left[1+\frac{\alpha\,(1-\beta)\,\gamma}{1-\alpha}\right]\qquad(7)$$

In the econometric analyses $t=t_m$ is imposed due to lack of data on the marginal tax rates for all countries. From this equation the elasticities (see Graph 1) can be calculated. It follows that the sum of the wage elasticities of value added prices and consumer prices, defined as $\in_P$ and $\in_{P_c}$ respectively, add to one as it can be derived that

$$\in_P+\in_{P_c}\equiv\frac{\partial\log W}{\partial\log P}+\frac{\partial\log W}{\partial\log P_c}=1\,.$$

The elasticity of wages with respect to productivity, the *semi*-elasticities of wages with respect to unemployment and the replacement rate are respectively

$$\in_q\equiv\frac{\partial\log W}{\partial\log q}=\rho\qquad\text{(A3)}$$

$$\in_u\equiv\frac{\partial\log W}{\partial\,u}=-\frac{\alpha}{1-\alpha}\,\frac{\beta\,(1-R)}{1+z}\qquad\text{(A4)}$$

$$\in_R\equiv\frac{\partial\log W}{\partial R}=\frac{\alpha}{1-\alpha}\,\frac{\beta\,u}{1+z}\qquad\text{(A5)}$$

where $z\equiv\frac{\alpha}{1-\alpha}[1-\beta\,(1-u\,(1-R))]$.

The differential equation $\partial\log(W)=\sum_{x_i\in\{P,P_c,q,t,u,R\}}\frac{\partial\log(W)}{\partial\log(X_i)}\frac{\partial x_i}{x_i}$ equals approximately

$$\Delta \log(W) = \sum_{x_i \in \{P, P_c, q, t, u, R\}} \in_{x_i} \frac{\Delta x_i}{x_i} \qquad (9)$$

where $\Delta \log W$ represents the change of the the gross wage W. In case of semi-elasticities, multiplication by Δi instead of the $\frac{\Delta i}{i}$ is taken. The six individual contributions in (A6) and the wage growth according to the model are provided in Graph 2 for each country in the empirical analyses.

APPENDIX B DATA SOURCES

The time series for W, P, P_c, q, t, u are obtained from EUROMON, the multi-country model of De Nederlandsche Bank (cf. Demertzis *et al*., 2006). Wages, prices, production and employees (in the whole economy) come from the Economic Outlook and National Accounts of the OECD. The nominal wages *W* are denominated in dollars for the US and in euros for the euro area countries. The time series prior to the introduction to the euro in 1999 are calculated using the respective euro conversion rates. The gross wage, prices and the productivity are indexed at 100 in the year 1969. The unemployment rate *u* is defined as a percentage of the labour force. The productivity *q* is measured in euros respectively dollars per employee. The tax rate *t* represents the wedge, i.e. the sum of the taxes and social contributions paid by both the employer and the employee. The tax rate *t* is measured as a percentage of the nominal gross wage *W*. The gross replacement rates are measured as a relative rate, i.e. $0 \leq R \leq 1$. The gross replacement rates are two-year annual series from 'Benefits and wages, that were interpolated, from the OECD Indicators', from the OECD (2002).