Zeitschrift für Wirtschafts- u. Sozialwissenschaften (ZWS) 116 (1996), S. 167 - 183
Duncker & Humblot, Berlin

Unemployment and the Wage Wedge in Germany*

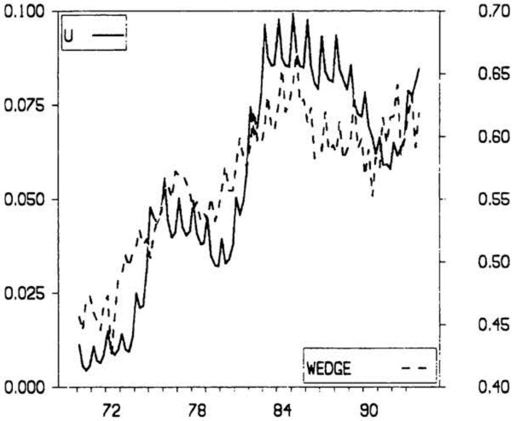
Simulations of a Small Cointegrated System

By Gerd Hansen**

1. Introduction

High unemployment in Germany now lasts for about twenty years and still increases after any new recession. Therefore it is not surprising that there are more public discussions about programs for more employment. One issue in these discussions is the effect of supplementary wage cost (the *wage wedge*) on employment and output.

The following graph shows a high positive correlation between the rate of unemployment and the logarithm of the real wage wedge per employee, defined as difference between the log of the gross real product wage and the log of the net real consumer wage per employee.



Unemployment Rate and Real Wage Wedge

* Verantwortlicher Herausgeber / editor in charge: J. W.

** I am grateful to an anonymous referee for helpful comments on an earlier version.

The supplementary wage cost are mainly used to finance the social welfare system. West-Germany has got one of the most elaborated social benefit systems in the world. The major part of it, like health care, unemployment benefits and retirement payments is financed by proportional duties on the wage bill. After the German unification social security rates and tax rates increased due to high unemployment and early retirement programs in East Germany, which were mainly financed by increasing contributions to the social benefit system and therefore by an increasing wage wedge. By means of these social benefits about 50-70 billion mark (out of 150 billion in total) are transfered each year from West to East Germany. From 1970 to 1993 the log real wage wedge increased from 0.445 to 0.62 (see graph). Net real wages as percentage of gross real labour cost per employee decreased from 64% in 1970 to 53% in 1993. Therefore the difference between gross and net real wage, usually called the „*wage wedge*“, amounts now to about 47% of total wage cost. It is surprising that under these conditions, for example, the „old age care insurance“ is again financed by additions to the wage bill, although these benefits are by no means related to employment.

Many economists believe that the resulting high gross real wages are one of the major reasons for the increasing level of unemployment in West-Germany because the economy loses its international competitiveness, especially if the revaluation of the Mark within the European Monetary System as well as the low wage level in East European countries is taken into account. Therefore the „ German social market economy“ may run into similar difficulties as, for example, Sweden with its even higher social benefits. Sweden is now seen by many economists as a warning example.

The paper analyses the quantitative effects of supplementary wage cost (additions to net wages) on growth, employment, unemployment and net and gross wages in West Germany.

This is done by specifying a simultaneous structural equation system, which can be understood as a cointegration system. Obviously this system has to be supply-oriented in order to pick the long run effects on labour demand and productivity growth. The demand side determines the long run exchange rate and trade balance versus capital inflow (or outflow).

The paper is organized as follows: In chapter 2 we discuss the theoretical structure of the static long run relations. Chapter 3 gives a short description of the cointegration methodology used to estimate the model. Chapter 4 gives some hints with respect to the data and the estimated equations whereas chapter 5 gives the simulation results and chapter 6 the conclusions.

2. The Theoretical Model

2.1 Production and Factor Demand

The structure of the cointegration relations (long run equilibrium relations) is derived from a neoclassical production model.

We start from a CES-production function (1) relating real gross national product (GNP) to capital stock (K) and the number of employees (L). In (1) $\nu, \lambda, \rho, \delta, A$ denote the elasticity to scale, the rate of neutral technical progress and the substitution-, distribution- and efficiency-parameter respectively.

$$GNP = Ae^{\lambda t}[\delta K^{-\rho} + (1-\delta)L^{-\rho}]^{-\nu/\rho} \tag{1}$$

It is well known that the Kmenta (1967) approximation (1a) provides a method of linearising equation (1). Small letters in (1a) and (1b) denote logarithmic variables.

$$gnp = \ln A + \lambda t + \delta\nu k + (1-\delta)\nu l - \frac{\nu\rho}{2}\delta(1-\delta)(k-l)^2 \ . \tag{1a}$$

The long run production function is estimated in terms of equation (1a). As $(k-l)^2$ can mainly be described by a linear trend, equation (1a) suffers from multicollinearity. This is removed by substituting a linear trend for $(k-l)^2$.

For constant returns to scale ($\nu = 1$) and $(k-l)^2 = \alpha + \beta t$ we get (1b):

$$gnp = \ln A + \delta k + (1-\delta)l + \left[\lambda - \frac{\rho}{2}\delta(1-\delta)\beta\right]t \ . \tag{1b}$$

The marginal productivity of labour from (1)

$$\partial GNP/\partial L = \nu(Ae^{\lambda t})^{-\rho/\nu} GNP^{(\rho/\nu)+1}(1-\delta)L^{-(\rho+1)}$$

should equal gross real wages W/P in the long run. This gives the well-known conditional labour demand function (2)

$$L = \nu^{\sigma}(1-\delta)^{\sigma} A^{\frac{-1-\sigma}{\nu}} e^{-\lambda\frac{1-\sigma}{\nu}t} GNP^{d}(W/P)^{-\sigma} \tag{2}$$

or after taking logarithms

(2a) $$l = c - \sigma(w-p) + d\; gnp + \nu^{-1}(\sigma - 1)\lambda t$$

$$\text{with } d = \frac{1-\sigma+\nu\sigma}{\nu}\ ;\ c = \log(\nu^{\sigma}(1-\delta)^{\sigma}A^{\frac{-1-\sigma}{\nu}}) \text{ and } \sigma = 1/(1+\rho)$$

Again small letters denote logarithmic variables. A special version of (2a) is derived under constant returns to scale ($\nu = d = 1$):

$$l = c - \sigma[(w-p) - \lambda t] + [gnp - \lambda t]\,.$$

According to (2b) there are two sources of decreasing employment, namely

1. if real wages increase faster than productivity measured in terms of the rate of technical progress

2. if *gnp* grows less than this measure of productivity.

In (2a) l means the log of employees and w-p the gross real wage per employee. For simplicity we use the log of employees also in (1b) and neglect the contribution of the self employed to *gnp*. This will probably result in a slightly higher distribution parameter $(1-\delta)$ for labour in (1b).

The long run investment function is derived from Tobin's q-theory, (see e.g. *Funke* et al., (1989)) which relates gross investment I to the ratio of the marginal productivity of capital $\partial GNP/\partial K$ to the user cost of capital $UC = P^I/P(i - \Delta p^I + \delta_0)$ with P^I/P as price for investment goods relative to the price level of GNP, i the interest rate on the capital market and δ_0 as depreciation rate of capital goods. We assume that investment per unit of GNP (I/GNP) depends in the long run on $\log q = \log(\partial GNP/\partial K) - uc$ with $\log(\partial GNP/\partial K)$ approximated by $\Delta gnp - \Delta k$.

(3) $$I/GNP = \beta_0 + \beta_1(\Delta gnp - \Delta k) - \beta_2 uc$$

$$\text{with } uc = p^I - p + \ln(i - \Delta p^I + \delta_0)\ ;\ \beta_2 = \beta_1 \text{ and } \beta_i > 0\,.$$

Incorrect measures, especially of the depreciation rate δ_0, may justify violations of the restriction $\beta_2 = \beta_1$.

In order to keep the model as small as possible we do not partition GNP into subtotals for the private and the government sector. Gross fixed capital investment in (3) therefore includes government investment, although one would not expect that government investment depends on q. Gross fixed capital stock in (1) can then be obtained from the definition

$$K = K_{-1} + I - D$$

where D denotes real depreciations.

2.2 Labour Supply

Our long run labour supply function relates net real wages in consumer prices $(w^n - p_c)$ to labour productivity $(gnp - l)$ and the rate of unemployment u:

$$(4) \qquad w^n - p_c = \alpha_0 + \alpha_1(gnp - l) - \alpha_2 u - \alpha_3[(w - p) - (w^n - p_c)] \text{ with } \alpha_i < 0 \, .$$

This type of labour supply function can be derived from bargaining theory (compare *Graafland*, *Huizinga* (1988)). Usually labour supply functions are in terms of net real consumer wages. In order to test for this crucial restriction we introduce the real wage wedge $(w - p) - (w^n - p_c)$ as an additional regressor in (4). If productivity and unemployment does solely affect gross real wages (or net real wages) in the long run one would expect $\alpha_3 = 1$ (or $\alpha_3 = 0$).

The unemployment rate u in equation (4) follows from

$$\ln(L/LF) = \ln\left(1 - \frac{LF - L}{LF}\right) = \ln(1 - u) \approx -u$$

as $u = lf - l$ with lf as log labour force.

As self employment is not included in l we get a slightly higher unemployment rate (see graph on page 1) as the official one. West Germany's labour force depends mainly on an increasing female participation rate and on immigration from East Germany and some other Southeast European countries. But there is still some feedback between unemployment and the labour force (discouraged worker effect). Increasing labour demand does not reduce unemployment by the same amount because lf increases with increasing employment or decreasing unemployment.

$$lf = a_0 - a_1 u + a_2 l \quad \text{with } a_i > 0$$

2.3 The Money and Capital-Market

Our model includes a traditional money demand equation (6) for $m = \log M1$

(6) $$m - p = \gamma_0 + \gamma_1 gnp - \gamma_2 i \quad \text{with } \gamma_i > 0 \,.$$

Under the assumption of a small country and full capital mobility, the uncovered interest parity must hold for a capital market equilibrium:

$$i = i^* + E\dot{e}$$

$E(\dot{e})$ denotes the expected rate of change of the exchange rate and i^* the foreign interest rate. To simplify we assume in the long run static expectations $E(\dot{e}) = 0$. The domestic interest rate is then exogenous by means of $i = i^*$. Given that the Bundesbank tries to let m grow at a preannounced rate, the price level p is determined by means of equation (6). Remind that the Bundesbank still may affect interest rates in the short run.

2.4 Goods Demand

Last not least there is a traditional goods demand (IS)-equation. In the open economy under flexible exchange rates and interest rates $i = i^*$ given from capital market equilibrium, the IS-curve determines the exchange rate in the long run (compare for example, *Sachs and Larrain*, (1993, pp. 338)).

Strictly speaking the IS-curve relates the given GNP from the supply side to real domestic absorption $A/P = CH + I + CG$, with CH and CG as private and government consumption respectively, and the trade balance in real terms $TB = Ex - Im$:

$$GNP = A/P + TB$$

We assume that the trade balance is positively related to the real exchange rate $(e + p_m^* - p)$ in the long run (*Sachs* and *Larrain*, 1993, p. 391), where p_m^* denotes logarithms of import prices in foreign currency:

(7) $$TB = h_0 + h_1(e + p_m^* - p) \quad \text{with } \mathrm{h_i} > 0$$

Government expenditures are not restricted by a budget constraint. Therefore tax and credit financed expenditures are assumed to be (Ricardian) equivalent.

Equation (7) determines e (or $e + p_m^*$) for given GNP and A/P. Excess government spending (as currently in Germany) leads to a reduction of TB in order to match the increased domestic absorption and thereby to an appreciation of the domestic currency.

In a multilateral world there is no single exchange rate in (7). Therefore we take (7) to explain the logarithm of import prices in mark $p_m = e + p_m^*$.

Finally there is a relation between the consumer price p_c in the labour supply function and p_m

$$p_c = \gamma p_m + (1 - \gamma)p \tag{8}$$

with γ as import share in private domestic consumption $(0 < \gamma < 1)$.

It follows from (8) that the difference between output and consumer prices depends on the trade balance according to (8a):

$$p - p_c = \gamma(p - p_m) = \gamma(p - e - p_m^*) = -\gamma(TB - h_0)/h_1 \tag{8a}$$

By means of (8a) $p - p_c$ is a negative function of the terms of trade and therefore according to (7) a function of the trade balance or the net domestic saving. It is this function which gives the feedback from goods demand to the supply side of the model.

In order to explain domestic absorption a long run function for the logarithm of real private consumption $ch - p_c$

$$ch - p_c = c_0 + c_1(gnp + p - p_c) \quad \text{with } c_i > 0 \tag{9}$$

is added to the system. Therefore the trade balance *TB* depends on the endogenous variables *GNP, CH, I* and on the exogenous government consumption *CG*.

3. Estimation of Structural Cointegrated Systems

The theoretical static model can be understood as a system of long run (cointegration) relations, which have to be augmented by some dynamic structure to avoid residual autocorrelation and large prediction errors. The main exception is the investment equation based on Tobin's q, which should incorporate the dynamics in the definition of q and in the adjustment cost. But it is wellknown from the literature that this equation also needs a dynamic augmentation to explain highly volatile investment expenditures.

As most of the variables, for example, gnp, p and l, are integrated of order one (see *Hansen,* 1993, p. 149), the estimation procedure has to take into account these data properties. Therefore we parameterize the dynamic model as a stability generating g-dimensional Error-Correction-Model (ECM) with

y as g-dimensional vector of endogenous and x as k-dimensional vector of exogenous variables and maximum lag order p:

$$B_0^* \Delta y_t = -By_{t-1} + Cx_{t-1} + C_0^* \Delta x_t + \sum_{j=1}^{p-1} (B_j^* \Delta y_{t-j} + C_j^* \Delta x_{t-j}) + u_t \tag{10}$$

B_0^* is normalised on the main diagonal. Non zero off diagonal elements in B_0^* represent possible simultaneous relations between differenced endogenous variables (compare *Boswijk*, 1994, p. 39).

System (10) can be written as the structural Error Correction Model (11):

$$B_0^* \Delta y_t = -\Lambda[\Gamma y_{t-1} + \Theta x_{t-1}] + C_0^* \Delta x_t + \sum_{j=1}^{p-1} (B_j^* \Delta y_{t-j} + C_j^* \Delta x_{t-j}) + u_t \tag{11}$$

with $\Lambda = \text{diag}\ (B_{11}, B_{22}, \dots B_{gg})$, where B_{ii} is the i-th diagonal element of B. The model in (11) implies nonlinearity between Λ and Γ, B and g cointegrating relationships (see *Hansen* (1993, p. 188 or *Boswijk*, 1994, p. 39)

$$\Gamma y_t = \Theta x_t \tag{12}$$

provided that all equations in (11) are stable. To get identified structural cointegration relations each equation in (12) has to satisfy the usual order condition that the number of a priori restrictions should not be less than $(g-1)$, the number of equations in the model less 1.

It is in favour of this parametrisation that restrictions on Γ and Θ and the plausibility of parameter values can be derived from economic theory.

The structural cointegration analysis can start with testing for weak exogeneity of the k-dimensional vector x_t (compare *Boswijk*, 1991 or 1994). This refers mainly to test if the cointegration relations (12) do affect the presumably exogenous variables x_t. This can be done by means of likelihood-ratio-tests of $H_0: \alpha = 0$ within the k-dimensional system of seemingly unrelated regressions (13):

$$E_0^* \Delta x_t = D_0^* \Delta y_{t-1} + \alpha[\Gamma y_{t-1} - \Theta x_{t-1}] + \sum_{j=1}^{p-1} (E_j^* \Delta y_{t-j} + D_j^* \Delta x_{t-j}) + v_t \tag{13}$$

We assume here that these conditions are fulfilled. System (12) gives then a structural cointegration system for the variables

$$y_t^{'} = (gnp, p - p_c, l, (w^n - p_c), I/GNP, p, ch, lf) \ .$$

In adddition there are some definitional equations like e.g. $u = lf - l$ and the exogenous variables

$$x_t^{'} = (t, w - w^n, m, i, CG, D) \ .$$

According to *Engle/Granger* (1987) the structural cointegration relations can be estimated by means of OLS (the first step of the Engle-Granger procedure). It is well known that the OLS-estimator of the static cointegration relation is superconsistent but may be biased in small samples. Alternatively parameter can be estimated by applying least squares (LS) to each equation in (10) or (11). Estimating (11) requires nonlinear least squares (NLS). The long run parameters Γ, Θ in (11) can alternatively be estimated by means of an instrumental variable (IV-)estimator of the Bewley-transformation of each equation in (11) (compare *Wickens, Breusch*, 1988). This gives the same estimator for Γ and Θ as NLS.

It is now wellknown that LS applied to each equation in (10) gives superconsistent estimators of the long-run (level variable) parameters. These estimators are asymptotically independent of LS estimators of the parameters of differenced variables. Given weakly exogenous x-variables and valid cointegration the t-statistics are asymptotically standard normal and can be used to test for parameter restrictions. Cointegration can be tested, by means of the t-statistic of the diagonal elements of B in equation (10) (compare *Banerjee* et. al., 1993 for the appropriate critical values).

4. Data and Estimation Results

Data for $gnp, l, I, w, w^n, ch, CG, D, p_c, p, p_m$ and lf are quarterly, seasonally unadjusted data from the April 1994 disk of the national account data published by the German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung = DIW, Vierteljahreshefte zur Wirtschaftsforschung, Heft 1/2, 1994, pp 148, Berlin). Labour l is measured as logarithmic number of employees, w and w^n as log of gross and net compensation per employee. Prices p, p_c, p_m are the implicit price deflators of *GNP*, private consumption and imports respectively with base year 1991. *I, CH, CG* and D are gross fixed investment, real private consumption, real government consumption and real capital depreciation respectively. The fixed capital stock is calculated from the definition

$$K = K_{-1} + I - D,$$

given an initial capital stock for 1969_{IV} from the DIW. The log money stock $\log M1 = m$ and the interest rate i for bonds with five years to maturity are taken from the monthly report of the Bundesbank. The estimation period is 1970,1 to 1990,2.

Despite the fact that cointegration parameter estimates are *asymptotically* independent of the parameter estimates of the differenced variables, there is usually a high sensitivity with respect to the specification of the short run dynamics in *finite samples*. Time series analysts would use information criteria to specify the optimal lag length. We used the stepwise regression in RATS to get a more parsimonious specification with respect to the significance of the short run parameters.

If the test statistic for cointegration could be improved by minor respecifications of the short run dynamics this was done. As test statistic for residual autocorrelation we present the DW-statistic and the marginal significance of the Ljung-Box Q-statistic $SL[Q$ (degress of freedom)]. We obtain the following equations (equation numbers refer to those of chapter 2) with $S_i (i = 1, 2, \ldots, 4)$ as seasonal dummy variables and t-values of the coefficients in brackets. Insignificant seasonal dummies are neglected.

(1b)
$$\Delta gnp - \Delta l = \underset{(-4.17)}{-0.360}[gnp_{-1} - \underset{(2.40)}{0.244}k_{-1} - \underset{(7.80)}{0.756}l_{-1} - \underset{(2.65)}{0.00185}t] - \underset{(1.24)}{0.424}(\Delta k - \Delta l) - \underset{(3.24)}{0.923}(\Delta k - \Delta l)_{-1}$$
$$-\underset{(3.05)}{0.304}(\Delta gnp - \Delta l)_{-2} - \underset{(2.18)}{0.226}(\Delta gnp - \Delta l)_{-3} - \underset{(3.85)}{1.286}\, S_1 - \underset{(4.12)}{1.321}\, S_2$$
$$DW = 1.94,\ SL[Q(20)] = 0.19$$

(2a)
$$\Delta l = \underset{(-6.33)}{-0.140}[l_{-1} + \underset{(3.91)}{0.445}(w - p)_{-1} - 1.00 gnp_{-1} - \underset{(18.9)}{0.00200}t] - \underset{(3.79)}{0.251}\Delta l_{-3}$$
$$+\underset{(6.51)}{0.473}\Delta l_{-4} + \underset{(2.94)}{0.033}\Delta(w - p) + \underset{(4.59)}{0.088}\Delta gnp_{-3} - \underset{(3.04)}{0.053}\Delta gnp_{-4}$$
$$DW = 1.6,\ SL[Q(21)] = 0.34$$

Equation (1b) and (2a) imply both constant returns to scale in the long run.

(3)
$$\Delta(I/GNP) = \underset{(-4.45)}{-0.140}[(I/GNP)_{-1} - \underset{(-3.18)}{0.852}(\Delta gnp - \Delta k)_{-1} - uc_{-1}] + \underset{(3.95)}{0.386}\Delta(I/GNP)_{-1}$$
$$+\underset{(2.60)}{0.109}\Delta uc + \underset{(5.14)}{0.040}S_1 + \underset{(5.20)}{0.036}S_2 + \underset{(5.03)}{0.041}S_3 + \underset{(5.13)}{0.041}S_4$$
$$DW = 1.91,\ SL[Q(19)] = 0.24$$

$$
\begin{aligned}
(4)\quad \Delta(w^n - p_c) = {} & \underset{(-4.12)}{-0.149}[(w^n - p_c)_{-1} + \underset{(3.31)}{2.172}u_{-1} - \underset{(5.26)}{0.828}(gnp - l)_{-1}] + \underset{(4.22)}{0.406}\Delta(gnp - l) - \underset{(9.62)}{0.438}\Delta(w^n - p_c)_{-2} \\
& \underset{(3.88)}{-0.303}\Delta(w - p)_{-1} - 1.00\Delta[(w - p) - (w^n - p_c)] - \underset{(2.61)}{0.840}S_1 - \underset{(3.16)}{1.008}S_2 - \underset{(2.79)}{0.892}S_3 - \underset{(3.06)}{0.984}S_4 \\
& DW = 2.34,\ SL[Q(21)] = 0.10
\end{aligned}
$$

The estimated coefficient $-.988$ of $\Delta[(w-p)-(w^n-p_c)]$ is restricted to -1.0 with marginal significance level .88.

$$
\begin{aligned}
(5)\quad \Delta lf = {} & \underset{(-6.86)}{-0.3015}[lf_{-1} - \underset{(32.82)}{1.002}l_{-1} + \underset{(28.9)}{0.904}u_{-2}] - \underset{(-2.58)}{0.177}\Delta lf_{-2} - \underset{(-3.99)}{0.243}\Delta lf_{-5} + \underset{(9.10)}{0.406}\Delta l_{-4} \\
& \underset{(-5.72)}{-0.035}\Delta(w - p)_{-3} - \underset{(-3.97)}{0.034}\Delta(w - p)_{-4} \\
& DW = 1.72,\ SL[Q(20)] = 0.31
\end{aligned}
$$

$$
\begin{aligned}
(6)\quad \Delta m - \Delta p = {} & \underset{(-3.47)}{-0.054}[(m - p)_{-1} - \underset{(5.529)}{0.668}gnp_{-1} + \underset{(3.99)}{1.287}i_{-1}] \\
& \underset{(4.96)}{+0.206}\Delta gnp_{-4} - \underset{(2.68)}{0.072}\Delta i + \underset{(3.19)}{0.232}(\Delta m - \Delta p)_{-2} - \underset{(4.65)}{0.021}S_1 \\
& DW = 2.07,\ SL[Q(20)] = 0.28
\end{aligned}
$$

$$
\begin{aligned}
(8a)\quad \Delta(p - p_c) = {} & \underset{(-4.63)}{-0.333}[(p - p_c) + \underset{(5.46)}{0.00136}TB]_{-1} + \underset{(3.01)}{0.468}\Delta^4(p - p_c)_{-1} \\
& DW = 1.68,\ SL[Q(17)] = 0.07
\end{aligned}
$$

$$
\begin{aligned}
(9)\quad \Delta^4(ch - p_c) = {} & \underset{(-4.22)}{-.191}[ch - p_c) - \underset{(4.47)}{0.904}(gnp + p - p_c]_{-4} \\
& \underset{(4.54)}{+.396}\Delta^4 ch_{-1} + \underset{(5.05)}{0.396}\Delta^4 gnp + \underset{(2.42)}{0.035}S_1 \\
& DW = 1.71,\ SL[Q(21)] = 0.11
\end{aligned}
$$

All t-statistics of the loading parameter of the cointegration relations are significant in terms of the critical values from *Banerjee* et al. (1993). Therefore these equations are valid cointegration relations. Furthermore, the cointegration coefficients are plausible and significant.

In equation (1b) tests gave evidence for constant returns to scale in the short and long run. Correspondingly long run constant returns to scale are also found in equation (2a). In (3) the restriction $\beta_1 = \beta_2$ (same coefficient for marginal productivity of capital and user cost) was also accepted. In the wage equation (4) the long run parameter of the real wage gap $w - p - (w^n - p_c)$ turns out to be insignificant, but there is an effect of $\Delta(w - p) - \Delta(w^n - p_c)$. This means that in the long run only net real wages matter for labour supply, which confirms the traditional view.

The consumption function suffers from high seasonality in the fourth quarter. We therefore estimated (9) in terms of fourth differences to remove this seasonality. The model is completed by means of the definitional equations

(14) $$u = lf - l$$

(15) $$TB = GNP - CH - I - CG, \quad \text{with } CG = \text{government consumption}$$

(16) $$uc = p^I - p + \ln(i + \delta_0 - \Delta p^I) \quad \text{with } \delta_0 = 0.05$$

(17) $$K = I + K_{-1} - D \quad \text{with } D = \text{ exogenous real depreciation}$$

Other definitional equations refer to the differencing of variables.

5. Simulations

5.1 Ex-Post- and Ex-Ante Forecast-Performance

In order to analyse the forecasting performance of the model we performed dynamic simulations of the system from 1980,1 to 1993,2 with historical values for the exogenous variables. This simulation is the control solution for the following experiment.

In any case the period after the unification is hard to forecast, because the West-German economy is strongly affected by the German economic and monetary union in July 1990.

First, there is a structural break in the money stock due to the German monetary union. Real variables are still published separately for West and East-Germany. We therefore generated a series of West-German money stock by assuming

1. that West-German M1 was in 1990_{III} and 1990_{IV} 1.5% and 3.0% higher than in 1990_{II} and

2. that West-German M1 was from 1991 to 1993 80% of total M1 in West- and East-Germany.

It can be seen from figures 1-6 that there is a fairly good reproduction of the six variables within the sample period 1980,1 to 1990,2 except for an underestimation of employment between 1985 and 1988. Furthermore the rate of unemployment is underestimated from 1982 to 1989.

In the following graphs the notation *YC* means forecasts of y and Y1 shock forecasts of *y*. All variables except the unemployment rate are in logarithmic terms denoted by *LGNP, L, LWP* etc. It can also be seen from figures 1-6 that our out of sample forecasts for 1990-1993 are affected by the German unification. *GNP* and employment increased faster as predicted by the model due to a short run demand shock for West-Germany, which was financed by an increase in the budget deficit and met by a short run increase in *GNP* as well as by a reduction in the trade balance *TB*. The effect of the trade balance on $(p - p_c)$ is the only effect of a demand shock in the system and it is only a long-run effect. As the model reflects mainly a long-run neoclassical structure it cannot fully pick this short-run demand effects on *GNP* and employment. The recession in 1993 gives evidence that the German unification did not affect the long run growth perspectives especially for West-Germany. Probably long run growth will be reduced due to a reduction of the growth of the capital stock. In this respect the *GNP*- and employment predictions of the model for 1993 look much better than those for 1991-1992.

On average the absolute forecasting errors from 1980,1 to 1993,2 are 1.8% for *GNP*, 1.1% for employment, 0.6% for the rate of unemployment, 2.3% for gross and net real wages and 1.3% for private consumption. These are very reasonable results for such a long prediction period.

5.2 Effects of a 10% Reduction in the Wage Wedge

The next figures 7-12 give the effects of a permanent 10% reduction in the nominal wage wedge $(w - w^n)$ compared with the control solution. These graphs refer to simulations with endogenous labour force according to equation (5). As variables are in log, the differences denote percentage deviations.

At first there is an average increase in *GNP* of 6.7% over the period 1980,1 to 1993,2. The corresponding average increase in the level of employment is 7.9%, which causes a sharp decrease in the rate of unemployment of 2.4%-points.

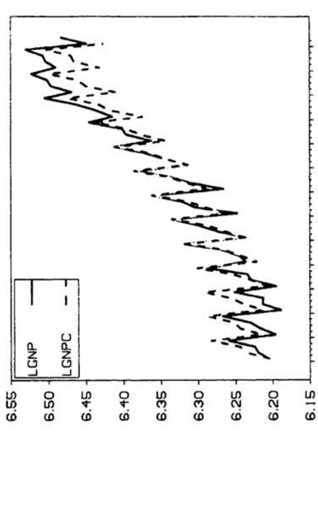


Figure 1: Gross National Product

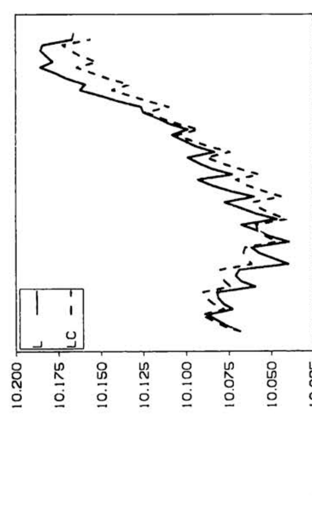


Figure 2: Employment

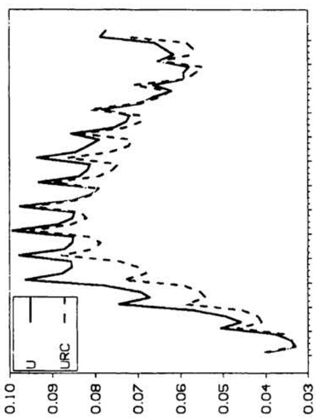


Figure 3: Unemployment Rate

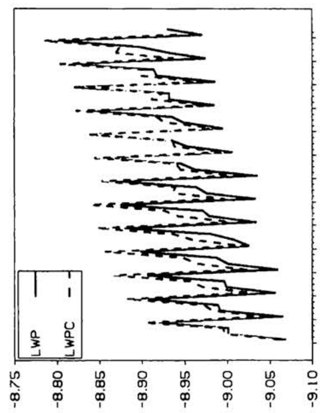


Figure 4: Gross Real Wages

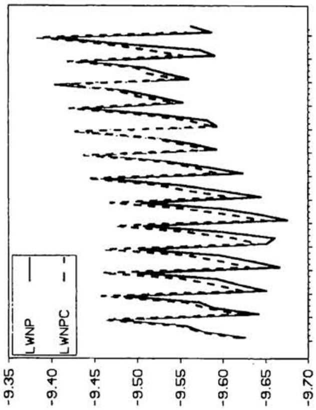


Figure 5: Net Real Wages

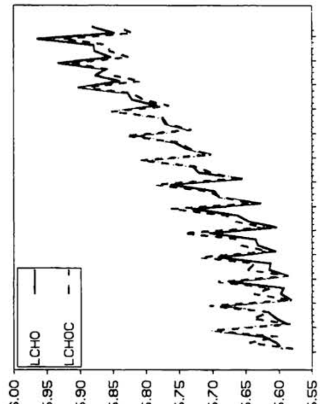


Figure 6: Private Consumption

Figure 1-6: Ex-post simulation

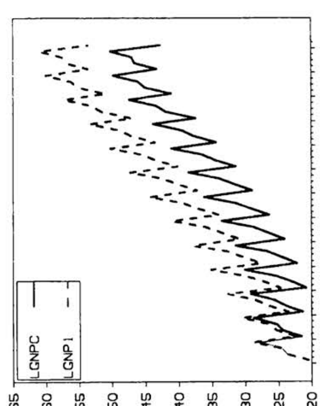


Figure 7: Gross National Product

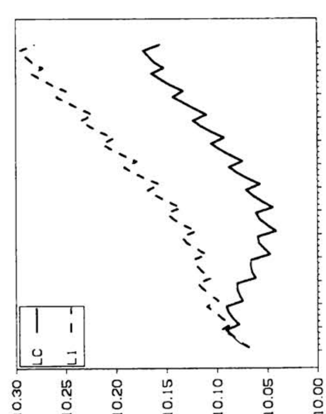


Figure 8: Gross National Product

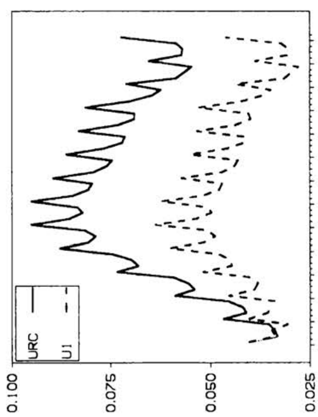


Figure 9: Unemployment Rate

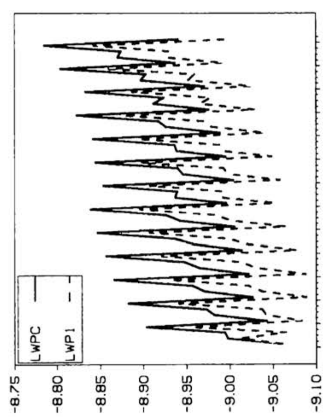


Figure 10: Unemployment Rate

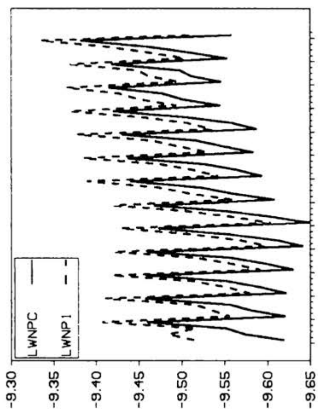


Figure 11: Net Real Wages

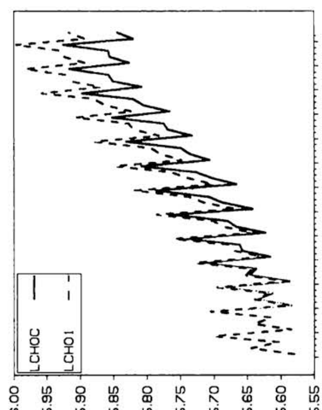


Figure 12: Net Real Wages

Figure 7-12: Shock-simulation wage wedge – 10%

On the other hand gross real wages decrease by 5.6% on average and net real wages increase by 5%. Private consumption as a simple measure of social welfare increases on average by 3.2%. Therefore, in total there are benefits in terms of higher growth, more employment and higher consumption from a reduction of the wage wedge.

6. Conclusion

Simulations of our supply-oriented neoclassical model of eight structural equations show a reasonable long run prediction performance of the dynamic macroeconometric model. Simulations of the effects of a reduction in the supplementary labour cost (in the wage wedge) show that the wage wedge is an important determinant of the level of output, employment and unemployment and therefore especially suited for an active employment policy by the government.

Therefore, in order to increase employment and to reduce unemployment politicians should think about possibilities to reduce the wage wedge.

References

Banerjee, A. / *Dolado*, J. J. / *Mestre*, R. (1993): On Some Simple Tests for Cointegration: The Cost of Simplicity. Paper presented at ESEM 93, Uppsala (Sweden), 22.-26. 8. 93.

Boswijk, H. P. (1991): The LM-Test for Weak Exogeneity in Error Correction Models, University of Amsterdam, Report AE 13/91.

– (1994): Testing for an Unstable Root in Conditional and Structural Error Correction Models, Journal of Econometrics, Vol.63, No.1, 37-60.

Deutsches Institut für Wirtschaftsforschung (1994): Vierteljahreshefte zur Wirtschaftsforschung, Heft 1/2, Berlin, 148 p.p.

Engle, R. F. / *Granger*, C. W. J. (1987): Cointegration and Error Correction, Representation, Estimation, Testing, Econometrica, 251-276.

Funke, M. / *Wadewitz*, S. / *Willenbockel*, D. (1989): Tobin's Q and Sectoral Investment in West Germany and Britain, Zeitschrift für Wirtschafts- und Sozialwissenschaften, 399-420.

Graafland, J. J. / *Huizinga*, F. (1988): Modelling a Wage Equation for Netherlands: A Cointegration Approach; Discussion paper No.51, Central Planning Bureau, The Hague.

Hansen, G. (1993): Quantitative Wirtschaftsforschung, München.

Kmenta, J. (1967): On the Estimation of the CES-Production Function, International Economic Review, 182-189.

Sachs, J. D. / *Larrain*, F. (1993): Macroeconomics in the Global Economy, New York.

Wickens, M. R. / *Breusch*, T. S. (1988): Dynamic Specification, the Long-run and the Estimation of Transformed Regression Models, Economic Journal, 98, 189-205.

Zusammenfassung

In der gegenwärtigen Diskussion über Beschäftigungsprogramme scheint Konsens darüber zu bestehen, daß die Lohnnebenkosten in Deutschland gesenkt werden müssen. Dieser Beitrag analysiert die quantitativen Effekte der Lohnnebenkosten für Wachstum, Beschäftigung, Arbeitslosigkeit sowie Brutto- und Nettolöhne in Westdeutschland anhand eines dynamischen strukturellen simultanen Gleichungssystems, das als ein cointegriertes System verstanden werden kann. Um die langfristigen Effekte auf die Arbeitsnachfrage und die Produktivität zu erfassen, wird ein angebotsorientiertes Modell spezifiziert. Die Nachfrageseite determiniert den Wechselkurs bzw. den Handelsbilanzsaldo. Unsere Simulationen zeigen, daß die Lohnnebenkosten eine wesentliche Determinante des Wachstums und der Beschäftigung sowie der Arbeitslosigkeit sind und insofern ein geeignetes Instrument der Beschäftigungspolitik darstellen.

Abstract

There seems to be a consensus in current public discussions that supplementary wage cost in Germany have to be reduced. The paper analyses the quantitative effects of supplementary wage cost (additions to net wages) on growth, employment, unemployment and net and gross wages in West Germany. This is done by means of a dynamic structural equation system, which can be understood as a cointegration system. Obviously this system has to be supply-oriented in order to pick the long run effects on labour demand and productivity growth. The demand side determines the long run exchange rate versus the trade balance. Our simulations show that the supplementary wage cost are an important determinant of the level of output, employment and unemployment and are therefore especially suited for an active employment policy by the government.

JEL-Classifikation: C 3, C 5, H 2, J 3, J 6