Comparing U.S. and Euro Area Wage and Price Inflation Dynamics

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Abstract

In this paper we formulate a baseline disequilibrium AS-AD model based on sticky wages and prices, perfect foresight of current inflation rates and adaptive expectations concerning the inflation climate in which the economy operates. The model consists of a wage and a price Phillips curves, a dynamic IS curve as well as a dynamic employment adjustment equation and a Taylor-rule-type interest rate law of motion. We estimate this theoretical model it with aggregate time series data for the U.S. and the Eurozone economies. The resulting structural parameter estimates support the specification of our theoretical model and show the important influence of the Blanchard-Katz error correction terms and the inflationary climate in the determination of wages and prices in the U.S. and the Eurozone economies.

Keywords: AS-AD disequilibrium, wage and price Phillips curves, (in-)stability, persistent fluctuations, monetary policy.
JEL CLASSIFICATION SYSTEM: **E24**, **E31**, **E32**.

1 Introduction

Over the last three decades, the pattern of the nominal wage and price inflation rates in the majority of industrialised countries and especially in the U.S. and the Eurozone economies has been of a remarkable similarity, in contrast to the divergent development of other macroeconomic variables as e.g. the aggregate unemployment rates of both economies. Nevertheless, as discussed in Fuhrer and Moore (1995), Mankiw (2001) and more recently in Eller and Gordon (2003), empirical estimations of the wage and price Phillips curves based on the New Keynesian approach developed after the work of Taylor (1980) and Calvo (1983) have had, despite of their sound microfoundations, only a poor performance in fitting the predictions of the underlying theoretical models of this approach with the empirical facts in both the United States and the euro area. As Mankiw (2001) states, "although the new Keynesian Phillips curves has many virtues, it also has one striking vice: It is completely at odd with the facts".

This paper formulates an alternative Keynesian macroeconomic model and investigates its empirical tractability for the U.S. and the Eurozone economies. It builds as recent New Keynesian macrodynamic models on gradual wage and price adjustments by employing two Phillips-curves to relate factor utilization rates with the wage and price dynamics, and also resembles macromodels of New Keynesian type in that it includes elements of forward looking behavior. Nevertheless, our theoretical framework permits non-clearing markets, underutilized labor and capital stock and a mixture of myopic perfect foresight and adaptively formed medium run expectations concerning an inflation climate of the economy. Another important difference between the wage-price module of our theoretical model and the standard New Keynesian models is that its expectations formation mechanism is of hybrid, cross-over type, with price inflation expectations in the wage Phillips curve and wage inflation expectations in the price Phillips curve. This formulation of the wage-price dynamics permits therefore an interesting comparison to New Keynesian work that also allows for both staggered price and wage setting. Indeed, concerning the IS-curve we make use of a law of motion for the rate of capacity utilization of firms that depends on the level of capacity utilization (the dynamic multiplier), the real rate of interest and finally on the real wage and thus on income distribution. New Keynesian authors, for comparison, often use only a purely forward-looking IS-curve (with only the real rate of interest effect). Since we distinguish between the rate of employment of the labor force and that of the capital stock, namely the rate of capacity utilization, we employ a linking equation between capacity utilization and employment which could be related with a dynamic form of Okun's law. Additionally we include a nominal interest rate equation of Taylor rule type.

Some of the questions to be addressed in this paper are: Up to what extent is our (D)AS-(D)AD model able to fit the behavior of wages, prices and other macroeconomic variables in the U.S. and the Eurozone economies? Are there significant differences in the wage and price inflation determination in both economies observable over the past thirty years? Which and how strong are traditional Keynesian transmission channels in the U.S. and the Eurozone economies?

The remainder of the paper is organized as follows. In section 2 we briefly discuss a simplified Keynesian disequilibrium AS-AD model in the line of Asada et al. (2005) and Chiarella, Flaschel, and Franke (2005) and highlight its main conceptual differences with respect to the New Keynesian approach. In section 3 we estimate this simplified model to find out sign and size restrictions for its behavioral equations and we study which type of feedback mechanisms may apply to the U.S. and Eurozone economies after World War II. Section 4 concludes.

2 Keynesian Disequilibrium Dynamics: An Empirically Oriented Baseline Model

In this section we formulate a simplified closed economy, Keynesian disequilibrium AS-AD framework in the line of Asada et al. (2005) and Chiarella, Flaschel, and Franke (2005). This theoretical framework builds on gradual wage and price adjustments as recent New Keynesian macroeconomic models, but it additionally incorporates a mixture of forward and backward looking behavior by the economic agents and allows furthermore for non-clearing labor and goods markets and therefore for under-utilized labor and capital stock, not constraining our analysis only to situations where the economy is in equilibrium, as done in the mainstream general equilibrium models.

More specifically, the aggregate wage and price dynamics are modelled through separate wage and price Phillips curves, each one lead by own measures of demand pressure (or capacity bottlenecks), instead of a single one as usually done in many New Keynesian models as e.g. Galí and Gertler (1999) and Galí, Gertler, and López-Salido (2001).[1] Indeed, in many theoretical models of New Keynesian type where only a price Phillips Curve is assumed (and where the resulting price dynamics are assumed to be determined by the real marginal unit labor costs, often proxied by a measure of the output gap), a mark-up pricing strategy by the firms is implicitly

[1] The pairwise Granger causality tests discussed in section 3 will confirm our use of two different demand pressure terms in the wage and price Phillips curves.

(or explicitly) assumed.[2] This assumption is in our opinion far to restrictive since it assumes that the real wage, and therefore income distribution, remains constant over time, neglecting ab initio fluctuations in the real wage and therefore the existence of income distribution cycles of e.g. Goodwin (1967)-type. Fair (2000) has pursued a similar approach by estimating two separate wage and price equation, nevertheless using a single demand pressure term. On the contrary, by the modelling of wage and price dynamics separately from each other, each one determined by own measures of demand pressure in the market for labor and for goods, namely $e - \bar{e}$ and $u - \bar{u}$, respectively, we are able to analyse the dynamics of the real wages in an economy and to identify oppositely acting effects. We here denote by e the rate of employment on the labor market and by $\bar{e}$ the NAIRU-level of this rate, and similarly by u the rate of capacity utilization of the capital stock and $\bar{u}$ the normal rate of capacity utilization of firms. Our approach is not all-too new: Barro (1994) for example observes that Keynesian macroeconomics are (or should be) based on imperfectly flexible wages and prices and thus on the consideration of wage as well as price Phillips Curves.[3] Indeed, we think that a Keynesian model of aggregate demand fluctuations should (independently of whether justification can be found for this in Keynes' General Theory) allow for under- (or over-)utilized labor *as well as* capital in order to be general enough from the descriptive point of view.

The structural form of the wage-price dynamics are given by:

$$\hat{w} = \beta_{we}(e - \bar{e}) - \beta_{wv}(\ln v - \ln v_o) + \kappa_w \hat{p} + (1 - \kappa_w)\pi^c + \hat{z}, \tag{1}$$

$$\hat{p} = \beta_{pu}(u - \bar{u}) + \beta_{pv}(\ln v - \ln v_o) + \kappa_p(\hat{w} - \hat{z}) + (1 - \kappa_p)\pi^c. \tag{2}$$

The demand pressure terms in both the wage and price Phillips Curves are augmented by three additional terms: first, by the log of the wage share or real unit labor costs, the error correction term discussed in Blanchard and Katz (1999, p.71). The second additional term is a weighted average of corresponding expected cost-pressure terms, consisting of model-consistent, forward looking, cross-over wage and price inflation rates $\hat{w}$ and $\hat{p}$, respectively, and a backward looking measure of the prevailing inflationary climate, symbolized by π^c.[4] Here our approach differs again from the standard New Keynesian approach based on the work by Taylor (1980) and Calvo (1983). Instead of assuming that the aggregate price (and wage) inflation is determined in a profit maximizing manner solely by the expected future path of nominal marginal costs, or in the hybrid variant discussed in Galí, Gertler, and

[2] See e.g. Galí, Gertler, and López-Salido (2001, p.1244).

[3] See also Woodford (2003) and Sbordone (2004).

[4] This last term is an adaptive updating inflation climate expression with exponential or any other weighting schemes which incorporates medium run developments and therefore history dependence with respect to the past wage and price developments into the model.

López-Salido (2001), also by lagged inflation, we assume that not only the last period inflation, but also the inflationary climate where the economy is embedded is taken into account. Indeed, while the agents might have a myopic perfect foresight with respect to future values, there is no reason to assume that they also act myopically with respect to the past, “forgetting” whole sequences of fully observable and highly informational values.

The third additional term in both Phillips curves is the labor productivity, which is expected to influence wages in a positive and prices in a negative manner (due to the associated easing in the production cost pressure).

The microfoundations of our wage Phillips curve are thus of the same type as in Blanchard and Katz (1999), which can be nearly exactly be expressed as in eq.(1) and eq.(2) (with the unemployment gap in the place of the logarithm of the output gap) if hybrid expectations formation is in addition embedded into their approach. Concerning the price Phillips curve, a similar procedure may be applied based on desired markups of firms. Along these lines one in particular gets an economic motivation for the inclusion of – indeed the logarithm of – the real wage (or wage share) with negative sign into the wage PC and with positive sign into the price PC, without any need for loglinear approximations. We furthermore use the employment gap and the capacity utilization gap in these two PC's, respectively, in the place of a single measure (the log of the output gap). Our wage-price module is thus consistent with standard models of unemployment based on efficiency wages, matching and competitive wage determination, and can be considered as an interesting alternative to the – theoretically rarely discussed and empirically questionable – New Keynesian form of wage-price dynamics.

Somewhat alternative versions of the two Phillips curves given by eq.(1) and eq.(2) have been estimated for the U.S. economy in various ways in Flaschel and Krolzig (2004), Flaschel, Kauermann, and Semmler (2004), Chen and Flaschel (2004) and Chen et al. (2005), and have been found to represent a significant improvement over the conventional single reduced-form Phillips curve. A particular finding of those studies was that wage flexibility was greater than price flexibility with respect to their demand pressure measure in the market for goods and for labor, (for lack of better terms we associate the degree of wage and price flexibility with the size of the parameters β_{we} and β_{pu}, though of course the extent of these flexibilities will also depend on the size of the fluctuations of the excess demands in the market for labor and for goods), respectively, and workers were more short-sighted than firms with respect to their cost pressure terms.[5]

[5]Note that such a finding is not possible in the conventional framework of a single reduced-form Phillips curve.

For comparison Woodford (2003, p.225) basically makes use of the following two loglinear equations for describing the joint evolution of wages and prices (d the backward oriented difference operator).[6]

$$\begin{aligned} \mathrm{dln}(w_t) &\overset{WPC}{=} \beta E_t(\mathrm{dln}(w_{t+1})) + \beta_{wy}(\hat{Y}_t) - \beta_{w\omega} \ln \omega_t, \\ \mathrm{dln}(p_t) &\overset{PPC}{=} \beta E_t(\mathrm{dln}(p_{t+1})) + \beta_{py}(\hat{Y}_t) + \beta_{p\omega} \ln \omega_t, \end{aligned}$$

where all parameters are assumed to be positive and $\hat{Y}_t$ represents the output gap, usually calculated as the deviation of the growth rate of output from its long-term trend, and ω represents the deviation of the real wage from its "natural" level. As it can easily be observed the expected next period wage inflation does not influence in a direct manner the price inflation and viceversa, as in eqs.(1) and (2).

Note that we assume model-consistent expectations with respect to short-run wage and price inflation, nevertheless incorporated in the above Phillips Curves in a cross-over manner, with perfectly foreseen price- in the wage- and wage inflation in the price Phillips curve. We stress that we include forward-looking behavior here, without the need for an application of the jump variable technique of the rational expectations school in general and the New Keynesian approach in particular as will be shown in the next section.[7]

The corresponding across-markets or reduced form PC's are given by:

$$\begin{aligned} \hat{w} = &\quad \kappa[\beta_{we}(e-\bar{e}) - \beta_{wv}(\ln v - \ln v_o)) + \kappa_w(\beta_{pu}(u-\bar{u}) + \beta_{pv}(\ln v - \ln v_o))] + \pi^c + \hat{z}, \\ \hat{p} = &\quad \kappa[\beta_{pu}(u-\bar{u}) + \beta_{pv}(\ln v - \ln v_o) + \kappa_p(\beta_{we}(e-\bar{e}) - \beta_{wv}(\ln v - \ln v_o))] + \pi^c, \end{aligned}$$

which represent a considerable generalization of the conventional view of a single-market price PC with only one measure of demand pressure, namely the one in the labor market.

Note that for our current version of the wage-price spiral, the inflationary climate variable does not matter for the evolution of the real wage $\omega = w/p$, the law of motion of which is given by (with $\kappa = 1/(1-\kappa_v\kappa_p)$):

$$\begin{aligned} \hat{\omega} &= \kappa\left[(1-\kappa_p)(\beta_{we}(e-\bar{e}) - \beta_{wv}(\ln v - \ln v_o)) - (1-\kappa_w)(\beta_{pu}(u-\bar{u}) \right. \\ &\quad \left. + \beta_{pv}(\ln v - \ln v_o))\right] + \hat{z}. \end{aligned} \tag{3}$$

Eq.(3) clarifies the ambiguous stability properties of the real wage channel discussed by Rose (1967) which arises if indeed specific measures of demand and cost pressure

[6] We make use of this convention throughout this paper and thus define the real interest rate at $t-1$ as $i_{t-1} - \mathrm{dln}(p_t)$.

[7] For a detailed comparison with the New Keynesian alternative to our model type see Chiarella, Flaschel, and Franke (2005).

on both the labor and the goods markets are taken into account. As sketched in figure 1, a real wage increase can act itself in a stabilizing or destabilizing manner, depending on whether consumption reacts more strongly than investment *and* whether price flexibility is greater than nominal wage flexibility with respect to its own demand pressure measure.

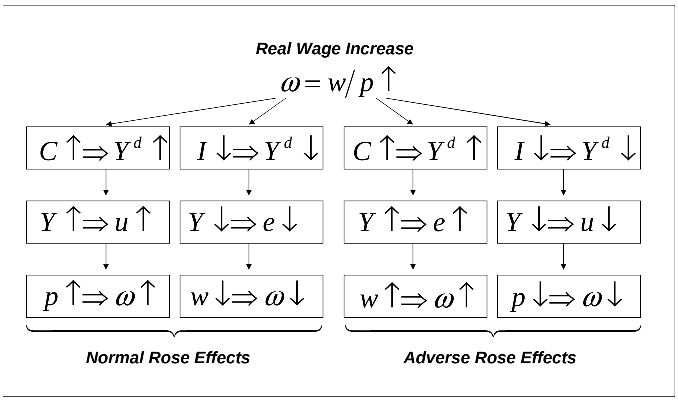


Figure 1: Normal (Convergent) and Adverse (Divergent) Rose Effects: The Real Wage Channel of Keynesian Macrodynamics

Concerning again the inflationary expectations over the medium run, π^c, i.e. the inflationary climate in which current inflation is operating, they may be formed adaptively following the actual rate of inflation (by use of some linear or exponential weighting scheme), may be based on a rolling sample (with hump-shaped weighting schemes), or on other possibilities for updating expectations. For simplicity of the exposition we shall make use of the conventional adaptive expectations mechanism in the theoretical part of this paper, namely

$$\dot{\pi}^c = \beta_{\pi^c}(\hat{p} - \pi^c).$$

With respect to the goods markets dynamics, we model them by means of a law of motion of the type of a dynamic IS-equation, see also Rudebusch and Svensson (1999) in this regard, here represented by the growth rate of the capacity utilization rate of firms:

$$\hat{u} = -\alpha_u(u - \bar{u}) \pm \alpha_v(v - v_o) - \alpha_i((i - \hat{p}) - (i_o - \bar{\pi})), \tag{4}$$

Eq.(4) has three important characteristics; (i) it reflects the dependence of output changes on aggregate income and thus on the rate of capacity utilization by assuming a negative, i.e., stable dynamic multiplier relationship in this respect, (ii) it shows the joint dependence of consumption and investment on the real wage (which in the aggregate may in principle allow for positive or negative signs before the parameter α_v, depending on whether consumption or investment is more responsive to real wage changes), and (iii) it shows finally the negative influence of the real rate of interest on the evolution of economic activity. Note here that we have generalized this law of motion in comparison to the one in the original baseline model of Asada et al. (2005), since we now allow for the possibility that also consumption, not only investment, depends on income distribution as measured by the real wage.

Concerning the labor market dynamics, we assume a simple production function which links the rate of capacity utilization and employment (in hours) in the following way

$$e_h/\bar{e}_h = (u/\bar{u})^b.$$

Obviously, the growth rate of employment (in hours) is then given by

$$\hat{e}_h = b\,\hat{u}. \tag{5}$$

Employment in hours is in fact the relevant measure for the labor input of the firms and therefore for the aggregate production function in the economy. Nevertheless, due to the lack of available time series of this variable for the Eurozone (this series is available for the U.S.) and for the sake of comparability of the parameter estimates of the next section, we will assume that the dynamics of employment in hours and actual employment are quite similar, so that eq.(5) in fact describes the dynamics of actual employment e, so that $\hat{e} = b\hat{u}$.

The above three laws of motion therefore reformulate in a dynamic form the static IS-curve (and the rate of employment this curve implies) that was used in Asada et al. (2005). They only reflect implicitly the there assumed dependence of the rate of capacity utilization on the real wage, due to on smooth factor substitution in production (and the measurement of the potential output this implies in Asada et al. (2005)), which constitutes another positive influence of the real wage on the rate of capacity utilization and its rate of change. This simplification helps to avoid the estimation of separate equations for consumption and investment C, I and for potential output Y^p.

These relatively straightforward modifications of the New Keynesian approach to expectations formation will imply for the dynamics of what we call a matured traditional Keynesian approach radically different solutions and stability features, with in particular no need to single out the steady state as the only relevant situation for economic analysis in the deterministic set-up here considered.

Finally, we no longer employ here a law of motion for real balances (a LM Curve) as it was still the case in Asada et al. (2005). Instead we endogenize the nominal interest rate by using a type of Taylor rule as usually done in the literature, see e.g. Svensson (1999). Indeed, as Romer (2000, p.154-55) states, "Even in Germany, where there were money targets beginning in 1975 and where those targets payed a major role in the official policy discussions, policy from the 1970s through the 1990s was better described by an interest rate rule aimed at macroeconomic policy objectives than by money targeting."[8] The target rate of the central bank and the law of motion of the resulting nominal interest rate are thus defined as

$$\begin{aligned} i^* &= (i_o - \bar{\pi}) + \hat{p} + \alpha_{ip}(\hat{p} - \bar{\pi}) + \alpha_{iu}(u - \bar{u}) \\ \dot{i} &= \alpha_i(i^* - i). \end{aligned}$$

The target rate of the central bank i^* is here made dependent on the steady state real rate of interest $i_o - \bar{\pi}$ augmented by actual inflation back to a nominal rate, and is as usually dependent on the inflation gap and the capacity utilization gap (as a measure of the output gap). With respect to this target there is also an interest rate smoothing term with strength α_i. Inserting i^* and rearranging terms we obtain from this expression the following form of the Taylor rule

$$\dot{i} = -\gamma_{ii}(i - i_o) + \gamma_{ip}(\hat{p} - \bar{\pi}) + \gamma_{iu}(u - \bar{u}) \tag{6}$$

where we have $\gamma_{ii} = \alpha_i, \gamma_{ip} = \alpha_i(1 + \alpha_{ip}), i.e., \alpha_{ip} = \gamma_{ip}/\alpha_i - 1$ and $\gamma_{iu} = \alpha_i \alpha_{iu}$.

Furthermore, the actual (perfectly foreseen) rate of inflation $\hat{p}$ is used to measure the inflation gap with respect to the inflation target $\bar{\pi}$ of the central bank. Note finally that we could have included (but have not done this here yet) a new kind of gap into the above Taylor rule, the labor share gap, since we have in our model a dependence of aggregate demand on income distribution and the labor share. The state of income distribution matters for the dynamics of our model and thus should also play a role in the decisions of the central bank. All of the employed gaps are measured relative to the steady state of the model, in order to allow for an interest rate policy that is consistent with it.

Taken together the model of this section consists of the following five laws of motion (with the derived reduced form expressions as far as the wage-price spiral is concerned and with reduced form expressions by assumption concerning the goods and the labor market dynamics):[9]

[8] See also Clarida and Gertler (1997).

[9] As the model is formulated we have no real anchor for the steady state rate of interest (via investment behavior and the rate of profit it implies in the steady state) and thus have to assume here that it is the monetary authority that enforces a certain steady state values for the nominal rate of interest.

$$
\begin{aligned}
\hat{v} &\overset{LaborShare}{=} \kappa[(1-\kappa_p)(\beta_{we}(e-\bar{e})-\beta_{wv}(\ln v-\ln v_o)) \\
&\quad -(1-\kappa_w)(\beta_{pu}(u-\bar{u})+\beta_{pv}(\ln v-\ln v_o))], && (7)\\
\hat{u} &\overset{Dyn.IS}{=} -\alpha_u(u-\bar{u})\pm\alpha_v(v-v_o)-\alpha_r((i-\hat{p})-(i_o-\bar{\pi})), && (8)\\
\hat{e} &\overset{O.Law}{=} \alpha_{eu}\hat{u}, && (9)\\
\dot{i} &\overset{T.Rule}{=} -\gamma_i(i-i_o)+\gamma_p(\hat{p}-\bar{\pi})+\gamma_u(u-\bar{u}), && (10)\\
\dot{\pi}^c &\overset{I.Climate}{=} \beta_{\pi^c}(\hat{p}-\pi^c) && (11)
\end{aligned}
$$

The above equations represent, in comparison to the baseline model of New Keynesian macroeconomics, the law of motion (7) for the labor share $\hat{v}=\hat{w}-\hat{p}-\hat{z}$ that makes use of the same explaining variables as the New Keynesian approach (but with inflation rates in the place of their time rates of change and with no accompanying sign reversal concerning the influence of output and wage gaps), the IS goods market dynamics (8), here augmented by Okun's Law as link between the goods and the labor market (9), the Taylor Rule (10), and finally the law of motion (11) that describes the updating of the inflationary climate expression. Note that the model can be reduced to a 4D system since the dynamics of eq.(9) mimics the development of eq.(8) in a perfect way due to our formulation of the firms' hiring policy. We can thus prescind from eq.(9) (and the influence of e as an endogenous variable) in the stability analysis to be discussed below.

We have to make use in addition of the following reduced form expression for the price inflation rate or the price PC, our law of motion for the price level p in the place of the New Keynesian law of motion for the price inflation rate $\hat{p}$:

$$
\begin{aligned}
\hat{p} &= \kappa[\beta_{pu}(u-\bar{u})+\beta_{pv}(\ln v-\ln v_o) \\
&\quad +\kappa_p(\beta_{we}(e-\bar{e})-\beta_{wv}(\ln v-\ln v_o))]+\pi^c, && (12)
\end{aligned}
$$

which has to be inserted into the remaining laws of motion in various places in order to get an autonomous nonlinear system of differential equations in the state variables: labor share v, capacity utilization u, the nominal rate of interest i, and the inflationary climate expression π^c. We stress that one can consider the eq. (12) as a fifth law of motion of the considered dynamics which however – when added — leads a system determinant which is zero and which therefore allows for zero-root hysteresis for certain variables of the model (in fact in the price level if the target rate of inflation of the Central Bank is zero and if interest rate smoothing is present in the Taylor rule).

The Jacobian of the 4D system, calculated at its interior steady state is:

$$J = \begin{pmatrix} - & \pm & 0 & 0 \\ \pm & \pm & - & + \\ \pm & + & - & + \\ \pm & + & 0 & 0 \end{pmatrix}.$$

There are therefore still a variety of ambiguous effects embedded in the general theoretical form of the dynamics, due to the Mundell-effect and the Rose-effect in the dynamics of the goods-market and the opposing Blanchard-Katz error correction terms in the reduced form price Phillips curve. There is first of all, see eq.(7), the still undetermined influence of the rate of capacity utilization on the labor share, which depends on the signs and values of the parameter estimates of the two structural Phillips curves. On the second place, see eq.(8), there is the ambiguous influence of labor share on (the dynamics of) the rate of capacity utilization, which should be a negative one if investment is more responsive than consumption to real wage changes and a positive one in the opposite case, and the indeterminate effect on the aggregate price inflation determined by the reduced form of the price Phillips curve given by eq.(12), on the real interest rate. Concerning this same channel, we have the unambiguous effect on the nominal interest rates determined by the Taylor rule described by eq.(10). And finally there is again the effect of the aggregate price inflation, this time on the inflationary climate of the economy, see eq.(11). Mundell-type, Rose-type and Blanchard-Katz error-correction feedback channels therefore make the dynamics indeterminate on the general level.

The feedback channels just discussed will be the focus of interest in the now following stability analysis of our D(isequilibrium)AS-D(isequilibrium)AD dynamics. We have employed reduced-form expressions in the above system of differential equations whenever possible. We have thereby obtained a dynamical system in four state variables that is in a natural or intrinsic way nonlinear (due to its reliance on growth rate formulations). We note that there are many items that reappear in various equations, or are similar to each other, implying that stability analysis can exploit a variety of linear dependencies in the calculation of the conditions for local asymptotic stability. A rigorous proof of the local asymptotic stability of this dynamical system and its loss by way of Hopf bifurcations can be found in Asada et al. (2005), there for the original baseline model. For the present model variant we supply a more detailed stability proofs in Chen et al. (2004), where also more detailed numerical simulations of the model are provided.

With respect to the empirically motivated restructuring of the original theoretical framework, the model is as pragmatic as the approach employed by Rudebusch and Svensson (1999). By and large we believe that it represents a working alternative to the New Keynesian approach, in particular when the current critique of the latter approach is taken into account. It overcomes the weaknesses and the logical inconsistencies of the old Neoclassical synthesis, see Asada et al. (2005), and it does so in a minimal way from a mature, but still traditionally oriented Keynesian perspective (and is thus not really “New”). It preserves the problematic stability features of the real rate of interest channel, where the stabilizing Keynes effect or the interest rate policy of the central bank is interacting with the destabilizing, expectations driven Mundell effect. It preserves the real wage effect of the old Neoclassical synthesis, where – due to an unambiguously negative dependence of aggregate demand on the real wage – we had that price flexibility was destabilizing, while wage flexibility was not. This real wage channel is not really discussed in the New Keynesian approach, due to the specific form of wage-price dynamics there considered and it is summarized in the figure 1 for the situation where investment dominates consumption with respect to real wage changes. In the opposite case, the situations considered in this figure will be reversed with respect to their stability implications.

3 Comparing the U.S. and the Euro Area

In this section we empirically estimate the theoretical Keynesian disequilibrium model discussed in the previous section with aggregate time series data of the U.S. and the Eurozone economies.[10] While on the one hand we intend to demonstrate the consistency of our theoretical model with the empirical data, on the other hand we expect to identify the main similarities and differences of the determinants of wage and price dynamics in the two economies. Indeed, despite of the remarkably similar patterns of wage and price inflation in the U.S. and the Eurozone over the last three decades, the similar economic development, market structure and labor market conditions in the two economies, as well as a similar fiscal and monetary policy conduction in the U.S. and the majority of the countries participating in the European Monetary Union, the significant differences for example in the aggregate employment rates of the two economies open up the question whether the influence of the labor and goods markets on the wage- and price-setting has been somewhat different in the two economies.

More specifically we provide here empirical estimates by means of a system estimation of the laws of motion (1)–(6) of our disequilibrium AS-AD model, namely the

[10]From the theoretical point of view the Eurozone could be considered as a sole economy also before the introduction of the euro 1999 due to the economic convergence process which lead to it as well as due to the great economic integration of the participating countries.

structural wage and price Phillips curves, the dynamic multiplier equation, Okun's law and the interest rate policy rule. Indeed, since the five endogenous variables (the nominal wage, the price level, the capacity utilization and employment rates, as well as the nominal interest rate) are assumed to be interdependent in the theoretic model of the last sections, the econometric estimation of their parameters should take this interdependency into account as well.

At this stage we would like to point out nevertheless that the parameter estimates for the Eurozone can only be handle with care since they, despite of the many similarities in the macroeconomic development of the participant economies and the possibility of cross-country aggregation, represent the theoretical values of an artificial economy. Indeed, since country-specific labor market conditions as e.g. the respective bargaining power of national labor unions have played an important role in the wage and price differentials among the member countries of the Eurozone before and after the introduction of the euro, a different development of the competitiveness and the economic performance of the respective economies has taken place which cannot be identified with the estimation of aggregate data.

The estimated parameters serve for the purpose of confirming the parameter signs we have specified in the initial theory-guided formulation of the model and to determine the sizes of these parameters in addition. Indeed, as discussed in the previous section, we have three different situations where we cannot specify the parameter signs on purely theoretical grounds and where we therefore aim at obtaining these signs from the empirical estimates of the equations whenever this happens: the ambiguous influence of labor share on (the dynamics of) the rate of capacity utilization, see eq.(7), on the nominal interest rate (through its effect on the price inflation) as well as on the inflationary climate. Mundell-type, Rose-type and Blanchard-Katz error-correction feedback channels therefore make the dynamics indeterminate on the general level.

We conduct our estimates in conjunction with time-invariant estimates of all the parameters of our model. This in particular implies that Keynes' (1936) explanation of the trade cycle, which employed systematic changes in the propensity to consume, the marginal efficiency of investment and liquidity preference over the course of the cycle, find no application here and that – due the use of detrended measures for income distribution changes and unit-wage costs – also the role of technical change is downplayed to a significant degree, in line with its neglect in the theoretical equations of the model presented in section 2. As a result we expect to obtain from our estimates long-phased economic fluctuations, but not yet long-waves, since important fluctuations in aggregate demand (based on time-varying parameters) are still ignored and since the dynamics is then driven primarily by slowly changing income distribution, indeed a slow process in the overall evolution of especially the

U.S. economy after World War II.

3.1 Data Description

The empirical data of the corresponding time series stem from the Federal Reserve Bank of St. Louis data set (see http:/www.stls.frb.org/fred) and the OECD database for the U.S. and the Eurozone, respectively. The data are quarterly, seasonally adjusted and concern the period from 1961:1 to 2004:4 for the U.S. and from 1970:1 to 2004:4 for the Eurozone.

Table 1: Data used for the empirical investigation

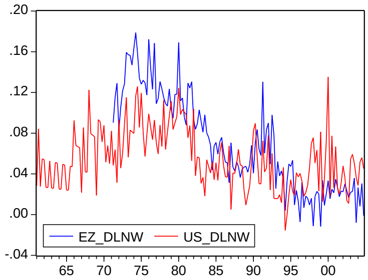
Variable	Description of the original series
e	US : Employment Rate
	EZ : Employment Rate
u	US : Capacity Utilization: Manufacturing, Percent of Capacity
	EZ : Output Gap
w	US : Nonfarm Business Sector: Compensation Per Hour, 1992=100
	EZ : Business Sector: Wage Rate Per Hour,
p	US : Gross Domestic Product: Implicit Price Deflator, 1996=100
	EZ : Gross Domestic Product: Implicit Price Deflator, 2000=100
z	US : Nonfarm Business Sector; Output Per Hour of All Persons, 1992=100
	EZ : Labor Productivity of the business economy,
v	US : Nonfarm Business Sector: Real Compensation Per Output Unit, 1992=100
	EZ : Business Sector: Real Compensation Per Output Unit,
i	US : Federal Funds Rate
	EZ : Short Term Interest Rate

The logarithms of wages and prices are denoted $\ln(w_t)$ and $\ln(p_t)$, respectively. Their first differences (backwardly dated) $\mathrm{dln}(w_t)$, $\mathrm{dln}(p_t)$, i.e. the current rate of wage and price inflation (annualized) are shown in figure 2.

We can observe the remarkably similar pattern of wage and price inflation in the U.S. and the Eurozone over the last three decades. We can particularly identify the high periods of wage and price inflation caused by the oil shocks in the 1970s, as well as the "Volcker"disinflation of 1981-85 especially in the U.S. as well as the subsequent low inflation periods in the late 1980s and the 1990s, respectively.

The inflationary climate π^c of the theoretical part of this paper is approximated here in a very simple way by a linearly declining moving average of price inflation rates with linearly decreasing weights over the past 12 quarters.[11] The capacity

[11]We estimated the structural model shown in table 4 with other proxies for the inflationary



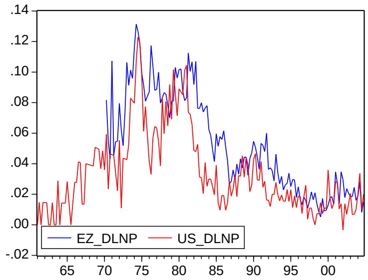
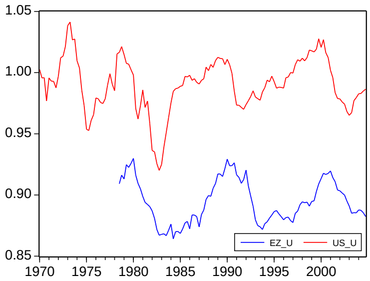


Figure 2: U.S. and Eurozone Wage and GDP Deflator Inflation

utilization rates of the capital stock u and the nominal interest rate i for the U.S. and the Eurozone are shown in figure 3.



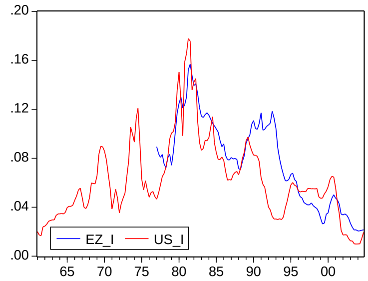


Figure 3: U.S. and Eurozone Capacity Utilization and Nominal Interest Rates

In figure 4 the U.S. and Eurozone employment rates and wage shares are depicted. Let us focus on the former first: While the U.S. unemployment rate has fluctuated, roughly speaking, around a constant level (what would speak for a somewhat constant or at least for a not all too varying NAIRU) over the last two decades, the European employment (unemployment) rate has described a persistent downwards (upwards) trend over the same time period, as shown in figure 4.

As discussed in Layard, Nickell, and Jackman (1991) and Ljungqvist and Sargent (1998), the main determinant for this development has been in Europe the overproportional increase in the number of long-term unemployed (i.e. workers with an unemployment duration over 12 months) with respect to short term unemployed (workers with an unemployment duration of less than 12 months) and the phe-

climate besides, which also covered the four, six and eighteen last quarters and which estimates could be rejected even at the 10% significance level.

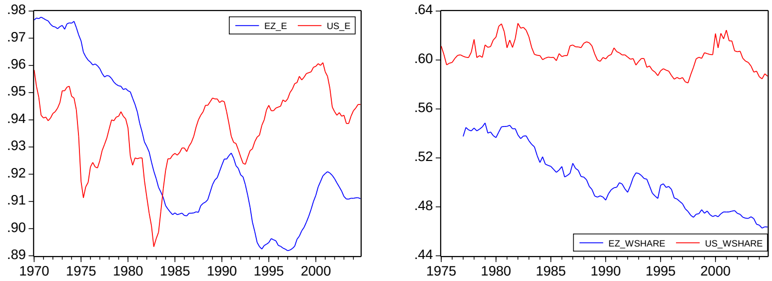


Figure 4: U.S. and Eurozone Aggregate Employment Rate and Wage Share

nomenon of hysteresis especially in the first group. One main explanation for the persistence in long-term unemployment is that human capital, and therefore the productivity of the unemployed, tend to diminish over time, what makes long-term unemployed less "hirable" for firms, see Pissarides (1992) and Blanchard and Summers (1991). Because long-term unemployed become less relevant, and primarily the short-term unemployed are taken into account in the determination of nominal wages, the potential downward pressure on wages resulting from the unemployment of the former diminishes, with the result of a higher level of the NAIRU.[12] When the long-term unemployment is high, the aggregate unemployment rate of an economy, thus, "becomes a poor indicator of effective labor supply, and the macroeconomic adjustment mechanisms – such as downward pressure on wages and inflation when unemployment is high – will then not operate effectively"[13]. For many years, these considerations were not taken into account in the empirical analysis and estimations of wage (and price) Phillips Curves: As e.g. in Galí, Gertler, and López-Salido (2001), only the unemployment gap (the deviation of the actual from the NAIRU level) matters for the wage determination, implicating that long and short term unemployed possess the same wage bargaining power. Llaudes (2005) makes a first attempt to estimate the NAIRU by means of the Kalman Filter using a modified wage Phillips curve which incorporates the different influence of long-and short-term unemployed in the wage determination. He finds empirical evidence for some OECD countries which supports the above discussed notion that in fact long-term unemployed have only a negligible influence on the wage determination.[14]

Since time series data for long-term unemployment in the Eurozone is not available, we try to approximate it in a rather simple way: We first perform the HP-filter on

[12]See Blanchard and Wolfers (2000).

[13]OECD (2002, p.189).

[14]See Logeay and Tober (2005) for a Kalman Filter estimation of a time varying NAIRU with German data.

the Eurozone unemployment rate with a high smoothing factor ($\lambda = 640000$). We normalize the resulting smoothed series so that the 1970:1 value equals to zero, implicitly assuming that in 1970:1 the number of long-term unemployed was negligibly small, not different from zero (indeed, since before the oil shocks in the 1970s unemployment (and also long-term unemployment) were extremely low in the European continent, this assumption appears to us reasonable). We interpret this smoothed series as a proxy for the actual development of long-term unemployment. The difference between this series and the aggregate unemployment rate, denoted u^{st}, can be handle as a proxy for the short term unemployment rate, the relevant variable for the wage determination. The corresponding employment rate is calculated as $e = 1 - u^{st}$.

Concerning the wage share in the Eurozone (normalized to 0.60 in 1970), it possesses a pronounced downward trend over the whole sample period. Because this trend is not the topic of this analysis which concentrates on the cyclical implications of changed in income distribution, we also filter it by means of the Hodrick-Prescott methodology with the same smoothing factor $\lambda = 640000$. We depict these series in figure 5.

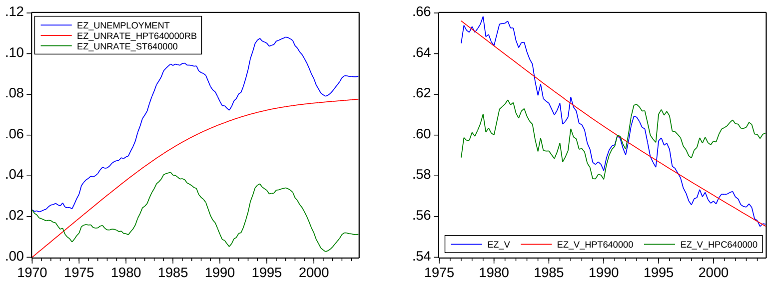


Figure 5: Modified Eurozone Long- and Short Term Unemployment Rate and Wage Share

We expect the resulting five time series for wage and price inflation, growth rates of capacity utilization and short term employment rates, and the interest rate (federal funds rate) to be stationary. To statistically test for this presumption we carry out Phillips-Perron unit root tests for each series in order to account, besides of residual autocorrelation as done by the standard ADF Tests, also for possible residual heteroskedasticity. The Phillips-Perron test specifications and results are shown in table 2.

The applied unit root tests confirm our presumptions with the exception of the nominal interest rate i. Although the test cannot reject the null of a unit root,

Table 2: Phillips-Perron Unit Root Test Results

Country	Variable	Sample	Lag Length	Determ.	Test Stat.	Prob.*
U.S.	dln(p)	1960:1-2004:4	1	const.	-3.5995	0.0067
	dln(w)	1960:1-2004:4	1	const.	-9.4177	0.0000
	dln(e)	1960:1-2004:4	-	-	-6.3869	0.0000
	dln(u)	1960:1-2004:4	1	const.	-10.5693	0.0000
	i	1960:1-2004:4	1	const.	-2.2817	0.1790
Eurozone	dln(p)	1975:1-2004:4	1	-	-2.3464	0.0189
	dln(w)	1977:3-2004:4	1	const.	-3.4567	0.0110
	dln(u)	1979:1-2004:4	1	-	-8.6973	0.0000
	dln(e)	1975:2-2004:4	1	-	-3.6923	0.0003
	i	1977:2-2004:4	1	-	-1.0099	0.2792

*McKinnon (1996) one-sided p-values.

there is no reason to expect the rate of the federal funds rate to be a unit root process. Indeed, we reasonably expect the nominal interest rate in the U.S and the Eurozone to be constrained to certain limited ranges, say from zero to 0.10. Due to the general lower power of the unit root tests, this test result only provides a hint that the nominal interest rate exhibits a strong autocorrelation.

3.2 Structural Model Estimation

As discussed in section 2, the law of motion for the real wage rate given by eq. (7), represents a reduced form expression of the two structural equations for $\text{dln}(w_t)$ and $\text{dln}(p_t)$. Noting again that the inflation climate variable is defined in the estimated model as a linearly declining function of the past twelve price inflation rates, the dynamics of the system (1) – (6) can be formulated as

$$\begin{aligned}
\text{dln}(w_t) &= \beta_{we}e_{t-1} - \beta_{wv}\ln(v_{t-1}) + \kappa_{wp}\text{dln}(p_t) + \kappa_{w\pi^c}\pi_t^c + \kappa_{wz}\text{dln}(z_t) + c_w + \epsilon_{wt} \\
\text{dln}(p_t) &= \beta_{pu}u_{t-1} + \beta_{pv}\ln(v_{t-1}) + \kappa_{pw}\text{dln}(w_t) + \kappa_{p\pi^c}\pi_t^c - \kappa_{pz}\text{dln}(z_t) + c_p + \epsilon_{pt} \\
u_t &= \alpha_{uu}u_{t-1} - \alpha_{ui}(i_{t-1} - \text{dln}(p_t)) \pm \alpha_{uv}v_{t-1} + c_u + \epsilon_{ut}, \\
\text{dln}(e_t) &= \alpha_{eu-1}\text{dln}(u_{t-1}) + \alpha_{eu-2}\text{dln}(u_{t-2}) + \alpha_{eu-3}\text{dln}(u_{t-3}) + \epsilon_{et} \\
i_t &= \gamma_{ii}i_{t-1} + \gamma_{ip}\text{dln}(p_t) + \gamma_{iu}u_{t-1} + c_i + \epsilon_{it}.
\end{aligned}$$

This structural model specification is additionally confirmed by the pairwise Granger-causality test results obtained from a unrestricted VAR(12) for the Eurozone shown in table 3.

These test statistics deliver some interesting insights on the interdependency of the system variables: On the first place they confirm our modelling approach of two

Table 3: Eurozone Pairwise Granger Causality Tests: Significance Probabilities

H0:	dln(w)	dln(p)	u	e	i	dln(z)	log(v)	π^c
dln(w) does not Granger cause	-	0.742	0.566	0.138	0.831	0.295	0.139	0.369
dln(p) does not Granger cause	0.367	-	0.034	0.198	0.761	0.000	0.198	0.000
u does not Granger cause	0.017	0.068	-	0.024	0.011	0.255	0.119	0.199
e does not Granger cause	0.012	0.885	0.001	-	0.618	0.652	0.025	0.015
i does not Granger cause	0.015	0.008	0.777	0.426	-	0.074	0.906	0.002
dln(z) does not Granger cause	0.232	0.090	0.645	0.188	0.389	-	0.405	0.653
log(v) does not Granger cause	0.026	0.885	0.570	0.165	0.636	0.652	-	0.940
π^{12} does not Granger cause	0.408	0.184	0.240	0.670	0.514	0.001	0.246	-

different demand pressure terms for the wage and price inflation determination, $e - \bar{e}$ and $u - \bar{u}$, respectively. On the second place they show, as expected, a close relationship between the capacity utilization and the employment rate which gives an empirical motivation for the specific law of motion of the labor market given by eqs.(5). On the third place we see that while the null hypothesis that the real marginal costs (proxied by the labor share or the real average unit costs) do not Granger cause wage inflation cannot be rejected at the 5% significance level, the relationship between this variable and price inflation seems not to be so close.

The structural model is estimated by means of the General Method of Moments (GMM) methodology. An estimation by means of GMM, as stated in Wooldridge (2001, p.92), possesses several advantages with respect to more traditional estimation methods as OLS and 2SLS, especially in time series models, where heteroskedasticity in the residuals is a common feature: "The optimal GMM estimator is asymptotically no less efficient than two-stage least squares under homoskedasticity, and GMM is generally better under heteroskedasticity."[15] This and the additional robustness property of GMM estimates of no relying on a specific assumption with respect to the distribution of the residuals make the GMM methodology viable and advantageous for our estimation.[16]

As instrumental variables in all five equations we use, besides the strictly exogenous variables, the last four lagged values of the employment rate, the labor share (detrended by the Hodrick-Prescott Filter) and the growth rate of labor productivity. We present the structural parameter estimates for the U.S. and the Eurozone economies (t-statistics in brackets) in table 4. Estimation results with different sample sizes for the U.S. and the Eurozone economies are presented in the appendix. The

[15] Wooldridge (2001).

[16] In a wage equation estimation Wooldridge (2001, p.94) shows that "the GMM estimates and standard errors are very similar to those for two-stage least squares. [...] using GMM does not hurt anything, and perhaps [*it might offer*] greater precision."

similarity of the parameter estimates of different samples speak for the robustness of our results.

Table 4: GMM Parameter Estimates of the Structural Model

Estimation Sample: U.S. :1961 : 1 − 2004 : 4, Eurozone : 1979 : 4 − 2004 : 4								
Kernel: Bartlett, Bandwidth: variable Newey-West (U.S.: 6, Eurozone: 4)								
dln(w_t)	β_{we}	β_{wv}	κ_{wp}	$\kappa_{w\pi^c}$	κ_{wz}	c_w	$\bar{R}^2$	DW
U.S.	0.604	-0.266	0.475	0.511	0.228	-0.688	0.496	1.985
	[15.186]	[-9.729]	[20.994]	[14.916]	[13.333]	[-18.257]		
Eurozone	0.541	-0.462	0.656	0.502	0.210	-0.767	0.714	1.594
	[16.941]	[-17.907]	[21.992]	[14.288]	[23.739]	[-20.718]		
dln(p_t)	β_{pu}	β_{pv}	κ_{pw}	$\kappa_{p\pi^{12}}$	κ_{pz}	c_p	$\bar{R}^2$	DW
U.S.	0.382	0.253	-	0.996	-0.063	-0.249	0.754	1.361
	[30.413]	[13.959]	-	[92.271]	[-11.250]	[-18.653]		
Eurozone	0.112	0.200	0.443	0.468	-	-	0.849	1.692
	[13.021]	[13.295]	[38.191]	[37.304]				
u_t	α_{uu-1}	α_{uu-2}	α_{uu-3}	α_{ui}	α_{uv}	c_u	$\bar{R}^2$	DW
U.S.	0.904	-	-	-0.042	-0.206	0.220	0.903	1.690
	[133.09]			[-9.479]	[-13.597]	[16.986]		
Eurozone	0.901	-	-	-0.054	-0.216	0.219	0.927	1.971
	[119.70]			[-11.938]	[-21.559]	[22.234]		
dln(e)	α_{eu-1}	α_{eu-2}	α_{eu-3}	α_{eu-4}	α_{eu-5}		$\bar{R}^2$	DW
U.S.	0.171	0.117	0.054	-	-		0.382	1.572
	[31.888]	[20.489]	[10.957]					
Eurozone	0.140	0.110	0.054	0.076	0.094		0.691	1.452
	[34.000]	[23.905]	[11.396]	[20.139]	[11.840]			
i	α_{ii}	α_{ip}	α_{iu}	c_i			$\bar{R}^2$	DW
U.S.	0.916	0.111	0.114	-0.112			0.922	1.704
	[158.92]	[13.816]	[19.211]	[-19.006]				
Eurozone	0.919	0.129	0.133	-0.118			0.981	1.431
	[122.97]	[12.604]	[20.973]	[-21.681]				
Determinant Residual Covariance				U.S.: 2.31E-20, Eurozone: 7.88E-23				
J-Statistic				U.S.: 0.148, Eurozone: 0.215				

At a general level the GMM parameter estimates shown above deliver an empirical support for the specification of our theoretical Keynesian disequilibrium model and confirm, for the Eurozone, some of the empirical findings of Flaschel and Krolzig (2004) and Flaschel, Kauermann, and Semmler (2004), for the U.S. economy. Especially the high significance of the parameter estimates for the inflationary climate in both the wage and price Phillips curves support the incorporation of this variable in the theoretical model of the last section. Nevertheless, the role of the inflationary climate in the wage and price inflation determination in the two analysed economies seems to be somewhat heterogeneous: While in the estimated wage Phillips curves for the U.S. and the Eurozone economies the influence of the perfectly foreseen price inflation and the inflationary climate is quite similar (what supports our formulation of this joint effect as a weighted average), in the price Phillips curves the parameter estimates of the inflationary climate for the U.S. and the Eurozone significantly differ from each other. In the U.S. the inflationary climate seems to have a predominant role in the price determination by the firms, while in the Eurozone the wage inflation and the inflationary climate apparently influence the price determination with a similar strength. Eurozone firms, thus, when setting the goods prices, take into account the inflationary climate in which the economy is embedded as their U.S. counterparts, but they also incorporate their expected (and perfectly foreseen) future cost pressure terms in their decisions. These results relativize in a significant manner the findings based on standard New Keynesian Phillips curves as in Galí, Gertler, and López-Salido (2001, p.1256), where prices depend only on future expected marginal costs.

Also confirming the results of Flaschel and Krolzig (2004) and Flaschel, Kauermann, and Semmler (2004), we find that wage flexibility is greater than price flexibility (with respect to their demand pressure in the labor and goods markets, respectively) in both economies (though nevertheless we expect a greater fluctuation amplitude in the capacity utilization than in the employment rate), and additionally that wage flexibility is not significantly higher in the U.S. as in the Eurozone, as discussed in Nickell (1997).

Concerning the (log of the) wage share, the Blanchard-Katz error correction term, while we find a similar influence on the price inflation dynamics in both economies, a higher effect of this variable on the wage dynamics in Europe is observable, confirming the empirical findings of Blanchard and Katz (1999). In contrast, while the growth rate of labor productivity appears to influence positively, in a significant way and a similar extent the wage inflation in the two economies (the parameter estimates equal 0.228 for the U.S. and 0.210 for the Eurozone economy), the same variable appears to be significant for the price setting only in the U.S. economy. With respect to the three remaining equations, we can only state that the similarity in the estimated coefficients in the capacity utilization (the IS Curve) equation, the growth rate of employment and the nominal interest rate (the Taylor Rule like) equations between the U.S. and the Eurozone economies support our approach of comparing the U.S. and the Eurozone economies due to their intrinsic similarity.

Our structural model does not only deliver theory-consistent parameters but it additionally is able to fit the dynamic behavior of the analyzed endogenous variables for both the euro area and the U.S. in good manner, as the one-period ahead forecasts depicted in figures 6 and 7, as well as the dynamic forecasts (calculated solely by endogenously generated time series) presented in the appendix show.

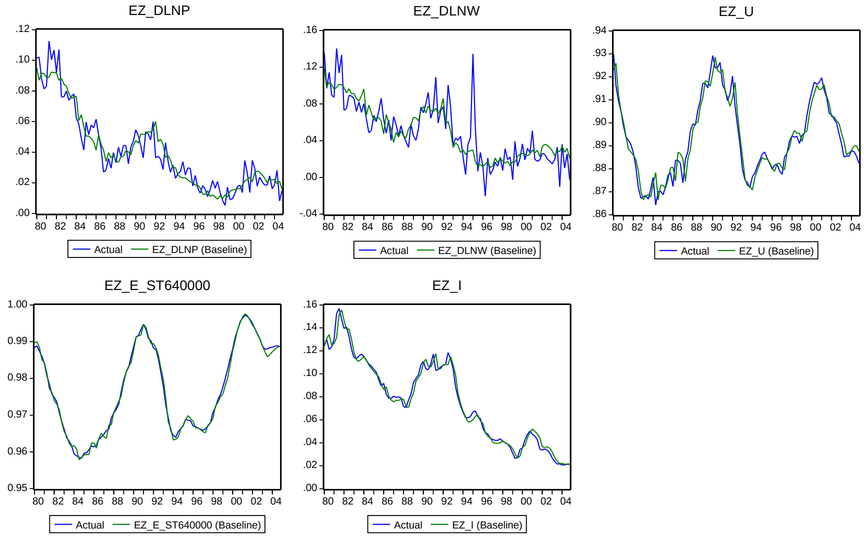


Figure 6: Euro Area One-Period Ahead Forecasts

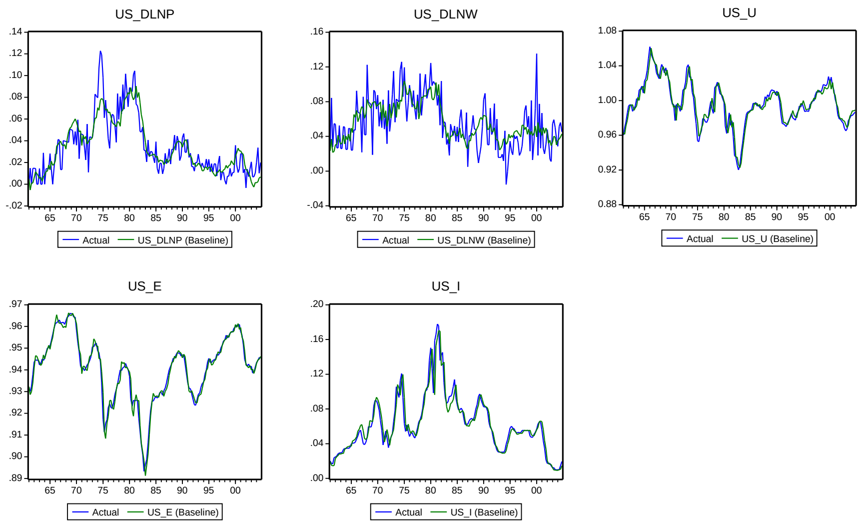


Figure 7: U.S. One-Period Ahead Forecasts

Taken together, these results deliver a different insight on the role of the price development on the nominal wage determination. Indeed, while the New Keynesian approach is based on the assumption that only next period expected values are relevant for the respective wage and price determination, our estimation results deliver a twofold innovation: Indeed, the cross over expectation formation (where future price (wage) inflation influences the actual wage (price) inflation rate) as well as the inflationary climate cannot be rejected as significant explaining variables in the wage and price Phillips Curves.

By inserting the estimated values of the structural parameters in the reduced-form price Phillips curve (which must be included at several places in the dynamical system given by eqs. (7), (8), (10) and (11)), a positive and unambiguous dependency of $\hat{p}$ with respect to the capacity utilization u and the (log of the) labor share v for the U.S. is found,[17] while for the Eurozone only the first dependency can be unambiguously identified as positive. The influence of the labor share in the Eurozone, on the contrary, is unclear since $\kappa_{pw} \neq 0$, ($\kappa_{pw} = 0.443$): by substituting the estimated coefficients in eq.(12), we obtain a net effect of the (log of the) labor share on price inflation of 0.048. The Rose effect influences price inflation principally via the goods markets in a positive, though weak manner.

These parameter estimates deliver, after their inclusion of the resulting reduced form price Phillips curve in the dynamical system, the following signs for the 4D Jacobian for the U.S. and the Eurozone,

$$\text{U.S.:} \quad J = \begin{pmatrix} - & - & 0 & 0 \\ - & - & - & + \\ + & + & - & + \\ + & + & 0 & 0 \end{pmatrix} \qquad \text{Eurozone:} \quad J = \begin{pmatrix} - & + & 0 & 0 \\ - & - & - & + \\ + & + & - & + \\ + & + & 0 & 0 \end{pmatrix}.$$

These Jacobians deliver some additional interesting insights on the macroeconomic interaction of the analysed variables: On the first place we find that, because the trace of both Jacobian is unambiguously negative, the endogenous system variables v, u, i and π^c in both economies do not act per se in a destabilizing manner, implying that both systems are intrinsically stable and that possible unstable scenarios are thus generated by cross-effects. Additionally, the fact that all elements of the estimated Jacobians for the U.S. and the Eurozone economies possess the same sign, with the exception of J_{12} (the effect of the capacity utilization on the labor share),[18] supports the notion that no significant differences in the basic macroeconomic interaction of the analysed variables between the U.S. and the Eurozone economies can be detected. The ambiguous result concerning the influence of the capacity utilization on the labor share, which implies a procyclical income redistribution in favor of workers in the Eurozone and an anticyclical counterpart in the U.S., is nevertheless

[17] This can be easily calculated by taking into account that κ_{pw} was estimated to be insignificant in the structural price Phillips curve equation, i.e. equal to zero. Thereafter the second term in the reduced price PC disappears, making the influence of v unambiguous.

[18] Indeed, due to our modelling of the employment rate dynamics, which follow the behavior of the capacity utilization, an increase of the latter affects positively the labor share via nominal wage inflation and negatively via goods price inflation.

very weak in both countries and probably cannot be considered as determining for the factual income distribution.

An interesting result respecting the influence of the Blanchard-Katz error correction terms on the dynamics of the labor share is that in the U.S. the latter are determined, after our theoretical formulation of the wage-price dynamics, principally by the nominal wage dynamics, while in the Eurozone both wage and price developments have a similar influence. Concerning the capacity utilization equation, we find evidence for a principally profit led goods markets dynamics in both countries (determined by the negative sign of J_{21}), a result which supports the neoclassical point of view where lower real wages, due to the profit maximizing behavior of the firms, lead to a higher production level. We find here also empirical evidence for the positive influence of the Mundell effect (J_{14}) – which influences aggregate production through the real interest rate channel – in both economies. Additionally, by making use of the estimated parameter values, we find an empirical confirmation for an active interest rate policy in both economies, since $\gamma_p = \alpha_i(1 + \alpha_p) > 1$.

In sum the system estimates for the U.S. and the Eurozone discussed in this section provide us with a result that confirms the theoretical sign restrictions for both economies. They moreover provide more definite answers with respect to the role of income distribution in the considered disequilibrium AS-AD or DAS-DAD dynamics, confirming in particular the orthodox point of view that economic activity is likely to depend negatively on real unit wage costs. We have also a negative real wage effect in the dynamics of income distribution in the U.S. and a positive one in the Eurozone, in the sense that the growth rate of real wages, see our reduced form real wage dynamics in section 2, depends – through Blanchard and Katz error correction terms – negatively and positively on the real wage, respectively. Its dependence on economic activity levels however is somewhat ambiguous, but in any case small. Real wages therefore only weakly decrease in the U.S., and increase in the Eurozone, with increases in the rate of capacity utilization which in turn however depends in an unambiguous way negatively on the real wage, implying in sum that the Rose (1967) real wage effect is present, but may not dominate the dynamic outcomes in both economies.

4 Concluding Remarks

We have considered in this paper a significant extension and modification of the traditional approach to AS-AD growth dynamics, primarily by means of an appropriate reformulation of the wage-price block of the model, that principally allows us to avoid the empirical weaknesses and theoretical indeterminacy problems of the so-called New Keynesian approach that arise from the existence of only purely forward looking behavior in baseline models of staggered price and wage setting.

The empirical estimation of the structural model equations with aggregate time series data for the U.S. and the Eurozone economies, besides of confirming the theoretical signs of the dynamical system, delivered some interesting insights in the similarities and differences of both economies with respect to the analysed macroeconomic variables. On the first place we found a remarkabe similarity in nearly all the estimated coefficients in the structural equations. This is a somewhat surprising result if we keep in mind that the Eurozone became a factual currency union with a unique and centrally determined monetary policy only five years ago, on January 1^{th} 1999, so that the estimated coefficients reflect only the theoretical values of a, for a long interval of the estimated sample, actually artificial economy. Nevertheless, at the macroeconomic level, thus, the U.S. and the Eurozone seem to share more common characteristics as usually thought. On the second place, the high significance of our proxy for the inflationary climate within an economy, as well as of the Blanchard-Katz error correction terms in the wage and price Phillips curve equations of both economies, are empirical findings with relativize in a significant manner wage and price dynamics modelling based on the "standard" New Keynesian approach. Our overall approach, which may be called a disequilibrium approach to business cycle modelling of mature Keynesian type, thus provides a theoretical framework within the contributions of authors such as Zarnowitz (1999), who also stresses the dynamic interaction of many traditional macroeconomic building blocks, can be consider.

5 Appendix

5.1 GMM Estimation Results for Different Sample Sizes

5.1.1 United States

Table 5: Estimation Sample: $1961:1-1985:4$

Kernel: Bartlett, Bandwidth: variable Newey-West (4)								
$\mathrm{dln}(w_t)$	β_{we}	β_{wv}	κ_{wp}	$\kappa_{w\pi^c}$	κ_{wz}	c_w	$\bar{R}^2$	DW
	0.516	-0.291	0.445	0.468	0.185	-0.612	0.535	2.276
	[24.770]	[-13.844]	[30.054]	[23.633]	[24.363]	[-32.886]		
$\mathrm{dln}(p_t)$	β_{pu}	β_{pv}	κ_{pw}	$\kappa_{p\pi^{12}}$	κ_{pz}	c_p	$\bar{R}^2$	DW
	0.477	0.501	-	1.013	-0.055	-0.218	0.743	1.382
	[80.359]	[36.672]	-	[129.70]	[-17.081]	[-25.412]		
u_t	α_{uu-1}	α_{uu-2}	α_{uu-3}	α_{ui}	α_{uv}	c_u	$\bar{R}^2$	DW
	0.867	-	-	-0.067	-0.319	0.326	0.905	1.778
	[287.89]			[-30.856]	[-20.819]	[29.466]		
$\mathrm{dln}(e)$	α_{eu-1}	α_{eu-2}	α_{eu-3}	α_{eu-4}	α_{eu-5}		$\bar{R}^2$	DW
	0.169	0.109	0.058	-	-		0.376	1.558
	[43.887]	[37.540]	[16.508]					
i	α_{ii}	α_{ip}	α_{iu}	c_i			$\bar{R}^2$	DW
	0.913	0.111	0.091	-0.089			0.898	1.777
	[214.91]	[21.877]	[19.911]	[-19.680]				
Determinant Residual Covariance				7.31E-20				
J-Statistic				0.264				

Table 6: Estimation Sample: $1980:1-2004:4$

Kernel: Bartlett, Bandwidth: variable Newey-West (6)								
$\mathrm{dln}(w_t)$	β_{we}	β_{wv}	κ_{wp}	$\kappa_{w\pi^c}$	κ_{wz}	c_w	$\bar{R}^2$	DW
	0.690	-0.237	0.475	0.583	0.243	-0.757	0.349	1.818
	[21.954]	[-15.761]	[18.986]	[17.660]	[22.588]	[-22.540]		
$\mathrm{dln}(p_t)$	β_{pu}	β_{pv}	κ_{pw}	$\kappa_{p\pi^{12}}$	κ_{pz}	c_p	$\bar{R}^2$	DW
	0.323	0.086	-	0.956	-0.007	-0.276	0.767	1.361
	[54.685]	[12.177]	-	[202.43]	[-2.932]	[-35.321]		
u_t	α_{uu-1}	α_{uu-2}	α_{uu-3}	α_{ui}	α_{uv}	c_u	$\bar{R}^2$	DW
	0.915	-	-	-0.046	-0.166	0.184	0.901	1.528
	[460.19]			[-29.342]	[-33.382]	[43.873]		
$\mathrm{dln}(e)$	α_{eu-1}	α_{eu-2}	α_{eu-3}	α_{eu-4}	α_{eu-5}		$\bar{R}^2$	DW
	0.198	0.117	0.044	-	-		0.383	1.643
	[60.248]	[34.467]	[15.369]					
i	α_{ii}	α_{ip}	α_{iu}	c_i			$\bar{R}^2$	DW
	0.859	0.264	0.106	-0.103			0.935	2.033
	[371.55]	[62.630]	[43.172]	[-42.902]				
Determinant Residual Covariance				7.98E-21				
J-Statistic				0.215				

5.1.2 Euro Area

Table 7: Estimation Sample: $1982:1-2003:4$

Kernel: Bartlett, Bandwidth: variable Newey-West (5)								
$\text{dln}(w_t)$	β_{we}	β_{wv}	κ_{wp}	$\kappa_{w\pi^c}$	κ_{wz}	c_w	$\bar{R}^2$	DW
	0.568	-0.547	0.370	0.675	0.162	-0.833	0.588	1.426
	[22.841]	[-31.288]	[16.798]	[26.154]	[32.273]	[-33.431]		
$\text{dln}(p_t)$	β_{pu}	β_{pv}	κ_{pw}	$\kappa_{p\pi^{12}}$	κ_{pz}	c_p	$\bar{R}^2$	DW
	0.149	0.338	0.338	0.544	-	-	0.798	1.586
	[14.405]	[56.263]	[56.263]	[62.741]	-	-		
u_t	α_{uu-1}	α_{uu-2}	α_{uu-3}	α_{ui}	α_{uv}	c_u	$\bar{R}^2$	DW
	0.906	-	-	-0.064	-0.222	0.219	0.927	2.061
	[222.47]			[-17.495]	[-28.516]	[35.186]		
$\text{dln}(e)$	α_{eu-1}	α_{eu-2}	α_{eu-3}	α_{eu-4}	α_{eu-5}		$\bar{R}^2$	DW
	0.136	0.114	0.057	0.079	0.097		0.687	1.413
	[42.027]	[40.267]	[19.835]	[22.985]	[14.849]			
i	α_{ii}	α_{ip}	α_{iu}	c_i			$\bar{R}^2$	DW
	0.960	0.053	0.130	-0.116			0.981	1.518
	[301.94]	[7.873]	[29.425]	[-29.331]				
Determinant Residual Covariance				8.13E-23				
J-Statistic				0.185				

5.2 Dynamic Forecasts

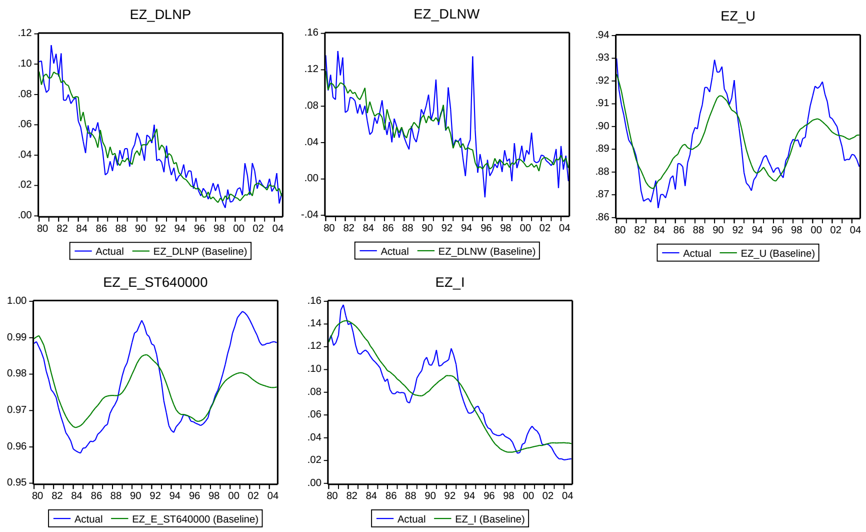


Figure 8: Euro Area Dynamic Forecasts

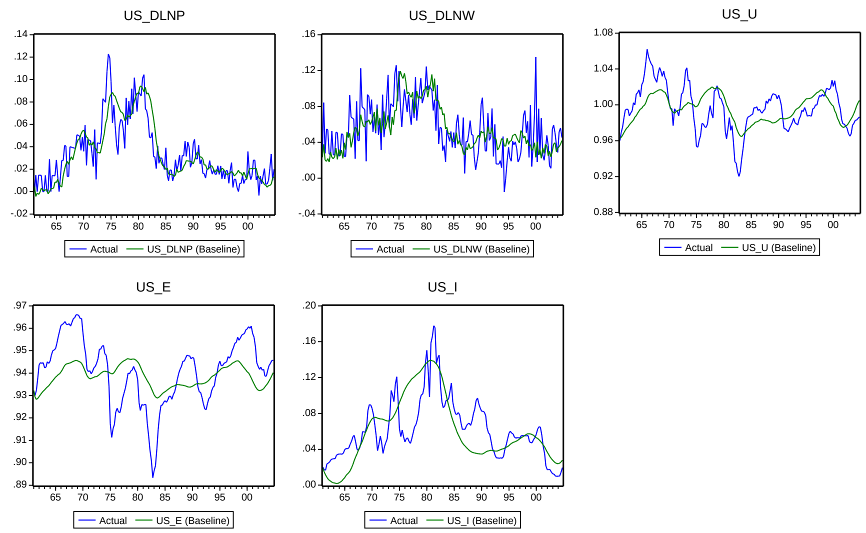


Figure 9: U.S. Dynamic Forecasts

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