ROOM FOR MANOEUVRE OF ECONOMIC POLICY IN EU COUNTRIES ARE THERE COSTS OF JOINING EMU?

Helene Schuberth and Gert Wehinger

WORKING PAPER 35

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Editorial

In this Working Paper Helene Schuberth and Gert Wehinger, economists at the Oesterreichische Nationalbank, examine whether a uniform monetary policy in nine EU countries will be associated with costs. They find that in Finland, Italy, France and Spain, autonomous monetary policy was an important shock absorber, whereas monetary union would not deprive Sweden and the United Kingdom of an important stabilisation tool. Furthermore, they demonstrate that autonomous monetary and fiscal policy were dampening country-specific business cycles, pointing to lower correlated output fluctuations when joining EMU.

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Room for Manoeuvre of Economic Policy in EU Countries

Are there Costs of Joining EMU?*

Helene Schuberth*), Gert Wehinger*)

December 1998

Abstract:

Costs of a monetary union are typically analysed in the context of the optimum currency area approach, looking at the likelihood of asymmetric real disturbances, the degree of real wage flexibility and of labour mobility. But it is also important to consider the leeway of monetary and fiscal policy to respond to country-specific real shocks prior to entering the monetary union.

Applying a structural VAR model to Austria, the Netherlands, Belgium, Sweden, Finland, Italy, United Kingdom, France and Spain indicates that costs of giving up autonomous monetary policy in a European Monetary Union (EMU) would generally not be too high. However, in Belgium, Finland, Italy, France and Spain autonomous monetary policy has shown positive short-run output effects in the past, in all other countries such effects are negligible or not significant.

Some cushioning influence of adverse EMU effects, then, could be expected from autonomous fiscal policy measures, since results suggest that autonomous fiscal policy had positive short-run output ratio effects in the past, those effects being pronounced in Sweden, Finland, United Kingdom and France. It is also shown that autonomous monetary and fiscal policy were both capable of dampening country-specific business cycles. Consequently, EMU could reduce the degree of synchronisation of output fluctuations across Europe.

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1 Introduction

In general, there are two different ways of looking at the costs of a monetary union. Firstly, given the low inter-regional labour mobility in the European Union, whether the benefits of a common currency outweigh costs depends strongly on the degree of asymmetry of real shocks (Mundell 1961). If shocks are affecting countries that fail to meet the flexibility requirements, it would be better for those countries to have the possibility of resorting to the exchange rate instrument to adjust. A common currency may be preferable, however, if the countries are mainly affected by asymmetric money and financial market shocks. In Stage III of the European monetary union, speculative attacks, time-varying risk premia and currency substitution which could cause macroeconomic imbalances will disappear. Many empirical studies deal with the issue of whether the EU-15 are an optimum currency area. Some of these also include considerations about the likelihood of the emergence of new asymmetries in the future monetary union or the decreasing importance of asymmetries compared to the EMS.[1]

Secondly, whatever the degree of asymmetry of real shocks, the identification of costs of a monetary union for individual countries depends on whether a country could reduce the costs of asymmetric shocks through autonomous monetary policy. Given the existence of asymmetries, a monetary union can be considered to entail costs (due to surrendering autonomous monetary policy) only if the respective national monetary authority was able to adjust to asymmetric real disturbances before joining the union. It may be argued that when entering the monetary union, at least the core ERM (European Exchange Rate Mechanism) countries with basically fixed exchange rates should not lose an important policy instrument. They just give up something they have not been using for quite some time. For the other EU countries, monetary policy has been – at least to some extent – used to counteract asymmetric disturbances, but it is by no means clear whether the output effects of such policies were positive and thus whether the ‘costs of monetary union’ would be high for them.

Although the issue of asymmetries has attracted a lot of attention, so far there are only a few studies which have empirically assessed the costs of a monetary union with regard to giving up sovereign monetary policy. They examine whether monetary policy was capable of influencing real output in the short term. Erkel-Rousse and Mélitz (1997), for example, ask if economic costs of asymmetries can be reduced by monetary policy outside the monetary union. They assume that a relative velocity shock of money at home and abroad feeds directly into exchange rate variations. If a shock to the relative velocity influences short-run movements in real output and/or net exports, then monetary policy is assumed to be an effective stabilisation device. It turns out that relative velocity shocks (measured in terms of a shock to the real exchange rate) have short run real effects only in the United Kingdom and in Germany. In the case of Spain, France, Italy and the Netherlands, monetary policy does not seem to be capable of influencing short-run movements in real output.

Canzoneri et al. (1996) look at bilateral relationships between Germany and countries of the periphery, as well as between the core (Germany, the Netherlands and Austria) and

[1] Among the many studies in this field, see e.g. Bayoumi and Eichengreen (1991, 1992, 1994), Commission of the European Community (1990), Eichengreen (1990), De Grauwe and Vanhaverbeke (1991), Frankel and Rose (1996). For an introductory exposition of the problems involved see De Grauwe (1997), Gros and Thygesen (1992) and Melitz (1997), for an overview, see e.g. Pauer (1996).

peripheral countries, in order to distinguish different kinds of asymmetric shocks. The identification of shocks draws on the Mundell-Fleming model to impose long-run restrictions. By comparing the harmfulness of real asymmetric shocks and financial shocks for the monetary union, they find that variations in output are primarily due to non-financial supply and demand shocks. Furthermore, it is shown that for France, Spain and the United Kingdom, nominal exchange rates were not an important shock absorber in the past. Italy seemed to be a borderline case. They conclude that the costs of monetary union are often exaggerated, since their findings show that exchange rates have not played an important role in absorbing shocks in the past. An innovative approach to the study of monetary union costs was introduced by Mélitz and Weber (1996). Within a structural VAR framework they simulate common monetary policy in France and Germany, where they distinguish between German dominance, French dominance and a joint monetary policy. Their main conclusion is that France would gain from German participation in monetary policy-making, while Germany would lose from French dominance in monetary policy. In all three studies, doubts arise about the costs associated with the surrender of autonomous monetary policy. Erkel-Rousse and Mélitz (1997) find that in some countries exchange rate shocks feed directly into prices, and Mélitz and Weber (1996) conclude that France would have had higher growth and lower inflation under German dominance than actually experienced before the ‘franc fort’ policy.

However, costs of a monetary union also depend on how effective fiscal policy is in counteracting asymmetric real disturbances. If an absorption shock, interpreted as a fiscal policy shock, effectively explains many of the forecast errors in output, the retention of fiscal policy would be important for stabilising output. Erkel-Rousse and Mélitz (1997) find that the retention of autonomous national fiscal policy is important for all countries under consideration except Germany.

In this paper we add to the empirical literature on the costs of monetary union in three main areas. By applying a four variable structural VAR-model (described in section 2), we are able firstly to consider the relative output effects of autonomous monetary policy surprises in certain specific countries relative to Germany. Such bilateral relationships are analysed for Austria, Belgium, the Netherlands (core countries), as well as for Sweden, Finland, Italy, the United Kingdom, France and Spain (periphery countries). Thereby countries of high interest like Sweden, Finland, the United Kingdom and Spain, which are often excluded in other studies, are also considered.

Secondly, we ask whether fiscal policy surprises relative to Germany were an important stabilisation device in the past in those countries. The results are presented in section 3. Measuring such innovations as deviations from the German fiscal policy variable, the observed effects implicitly measure the outcome of deviations from a stability-oriented fiscal policy. Thus one could then draw some conclusions on potential costs incurred by the Pact for Stability and Growth.[2]

[2] The pact of stability and growth allows the reference value for the overall net deficit (net borrowing) of 3% of GDP only to be exceeded in special circumstances. A medium term target of ‘close to balance’, which can be interpreted as a target for the structural deficit, should allow the European Union (EU) member states to respect the 3% reference value during economic downturns. The degree of autonomy in fiscal policy is therefore mitigated, especially for countries whose budgetary components react more strongly to the business cycle. However, in the case of a severe or an exceptional recession, a clause providing for a waiver is applied. An economic downturn is considered exceptional if there is an annual fall of real GDP of at least 2%.

Thirdly, we also investigate whether autonomous monetary and fiscal policy contributed to increase the degree of synchronisation of the business cycles across the countries under consideration. If this were the case, EMU without fiscal stabilisation might be associated with lower correlated output fluctuations across these countries.

2 The Structural Model

Due to the criticism of large-scale models (Sims, 1980), SVARs have become an important tool in analysing the effects of different policies. Whereas the former depend on the modeller's belief about whether the variables are to be considered exogenous or endogenous, the SVAR regards all variables as endogenous. However, also the SVAR-approach, though to a minor extent, is based on assumptions about the structure of the economy, by specifying the variables to be included and by identifying independent and economically meaningful shocks imposing theoretical restrictions.

To analyse the estimated model we take advantage of a shock structure of its long-run solution as shortly expounded below. This way of identifying an estimated model is opposed to the short-run techniques of Sims (1980), Bernanke (1986), and others, and was first introduced by Blanchard and Quah (1989). Some recent applications can be found in Canzoneri et al. (1996) and Weber (1998).[3] The advantage of imposing long-run identifying restrictions as opposed to contemporaneous ones is that this methodology allows the data to show unrestricted short-run dynamics based on a long-run flexible price model. By using the long-run triangular structure, we can separate a supply shock from three demand-side disturbances by constraining all of the latter not to have long-run effects on output. This is of course controversial, since some equilibrium growth models allow for demand shocks that have long-run effects on output. But as argued by Blanchard and Quah (1989), even if such effects exist, they are small as compared to those of supply disturbances.

2.1 The Theoretical Model

Our model follows the traditional IS/LM and aggregate supply/aggregate demand (AS/AD) framework, but we assume all variables to be measured relatively to the respective ones of Germany.[4] Then the equations of the system in log relative variables are given by

(1) $$y_t^s = y_{t-1}^s + \varepsilon_t^s$$ *(relative aggregate supply),*

(2) $$y_t^d = d_t + g_t - \gamma[i_t - \mathrm{E}_t(p_{t+1} - p_t)]$$ *(rel. aggr. demand, IS),*

(3) $$d_t = d_{t-1} + \varepsilon_t^d$$ *(rel. aggr. private demand),*

(4) $$g_t = g_{t-1} + \varepsilon_t^f - \phi\varepsilon_t^s$$ *(relative fiscal policy),*

(5) $$y_t^s = y_t^d = y_t$$ *(rel. goods market equilibrium),*

[3] Some of the authors (e.g. Mélitz and Weber, 1996) use non-triangular long-term restrictions, even mixed with short-term constraints (e.g. Galí, 1992), which are usually solved by numerical algorithms.
[4] Our model is a modified version of the ones presented by Clarida and Galí (1994) and Weber (1998).

(6) $$m_t^d - p_t - y_t = -\lambda i_t - \delta d_t$$ *(relative money demand, LM),*

(7) $$m_t^s = m_{t-1}^s + \varepsilon_t^m$$ *(relative money supply),*

(8) $$m_t^s = m_t^d = m_t$$ *(rel. money market equilibrium),*

where y is relative output, i is the nominal interest rate, g is relative government demand, d is relative private demand, p are relative prices, m is relative money, with superindices s and d indicating supply and demand, respectively; γ, ϕ, δ and λ are positive parameters and E_t is the expectations operator for expectations at time *t*. The economy is hit by four uncorrelated asymmetric (relative) shocks with zero mean and finite variance, two of them referring to fiscal and monetary policy surprises, ε^f and ε^m, respectively, and two of them to aggregate supply, ε^s, and aggregate private demand, ε^d.

As can be seen from (1), the relative aggregate supply is driven only by its own asymmetric shocks (e.g. technology shifts or structural changes in the labour market). Along the lines of an IS relationship relative aggregate demand (2) depends on relative private demand d (a random walk (3) driven by shocks ε^d) and on relative government demand g. Relative aggregate demand is negatively related to the real interest rate $[i_t - \mathrm{E}_t(p_{t+1} - p_t)]$. The relative government consumption ratio (4) is driven by country-specific fiscal policy shocks, where spending is reduced to some extent (ϕ) by positive supply shocks. The latter element alludes to the fact that part of government spending (e.g. unemployment benefits) has a short-run negative output elasticity.[5]

Relative real money demand (6) is negatively related to both the nominal interest rate *i* and to private demand *d*, the latter being interpreted as velocity shifts (individuals reduce, c.p., their cash holdings if they want to increase spending). For the relative money supply we assume that central banks target a constant money growth rate equal to the German one, with an autonomous monetary policy element ε^m (which, in our context, could also capture exchange rate effects). Thus, relative money supply can be modelled as a simple stochastic trend as given in (7). The equilibrium conditions (5) and (8) close the model.

We then solve this system in eight variables and eight equations for its dynamic rational expectations equilibrium representation. Eliminating *i* from (2) and (6) and using (5) and (8) we arrive at the semi-reduced form

(9) $$p_t = \frac{\lambda}{1+\lambda}\mathrm{E}_t p_{t+1} - \frac{\gamma+\lambda}{\gamma(1+\lambda)} y_t^s + \frac{\lambda}{\gamma(1+\lambda)} g_t + \frac{\delta\gamma+\lambda}{\gamma(1+\lambda)} d_t + \frac{1}{1+\lambda} m_t^s .$$

The forward solution of this difference equation for the rational expectations equilibrium conditional on *t* using the laws of motion (3), (4) and (7) yields the price equation

(10) $$p_t = -\frac{\gamma+\lambda}{\gamma} y_t^s + \frac{\lambda}{\gamma} g_t + \frac{\delta\gamma+\lambda}{\gamma} d_t + m_t^s .$$

[5] As can be seen in the graphs of the impulse response functions given in the appendix, this relationship can be confirmed empirically for almost all cases.

Taking this solution we can also express the equilibrium real money balances as

(11) $$m_t - p_t = \frac{\gamma+\lambda}{\gamma} y_t^s - \frac{\lambda}{\gamma} g_t - \frac{\delta\gamma+\lambda}{\gamma} d_t .$$

To see that the system in output, government expenses, real money and prices has a triangular shock structure, we take differences (indicated by the operator Δ) of (1), (4), (11) and (10) and using the laws of motion and equilibrium conditions we arrive at

(12) $$\Delta y_t = \varepsilon_t^s ,$$

(13) $$\Delta g_t = \varepsilon_t^f - \phi\varepsilon_t^s ,$$

(14) $$\Delta(m_t - p_t) = \frac{\gamma+\lambda(1+\phi)}{\gamma}\varepsilon_t^s - \frac{\lambda}{\gamma}\varepsilon_t^f - \frac{\delta\gamma+\lambda}{\gamma}\varepsilon_t^d ,$$

(15) $$\Delta p_t = -\frac{\gamma+\lambda(1+\phi)}{\gamma}\varepsilon_t^s + \frac{\lambda}{\gamma}\varepsilon_t^f + \frac{\delta\gamma+\lambda}{\gamma}\varepsilon_t^d + \varepsilon_t^m .$$

We see that all level variables have unit roots. In the long run, output is only driven by supply shocks, the fiscal variable by fiscal policy and supply shocks, real balances are driven by supply, fiscal policy and private demand shocks, and prices by all shocks, including monetary policy innovations.

2.2 Model Estimation and Identification

Assume that a vector $\Delta\mathbf{x}$ of variables follows a covariance stationary process with a moving average representation of the form

(16) $$\Delta\mathbf{x}_t = \mathbf{C}(\mathrm{L})\mathbf{u}_t .$$

In our case $\Delta\mathbf{x} = [\Delta y, \Delta g, \Delta(m-p), \Delta p]'$, with *y* the log of real output ratios between the country under investigation and Germany, *g* the log of the relative real fiscal variable, *m-p* the log of the relative real money variable and *p* the log of relative prices. **C**(L) is a lag polynomial where the **C**'s are coefficient matrices at the respective lags of the serially uncorrelated errors **u** with $\mathrm{E}(\mathbf{u}\,\mathbf{u}') = \Sigma$. We normalise the first coefficient matrix of the polynomial, $\mathbf{C}_0$, to be the identity matrix **I.**

A normalised moving average representation of the process can be given as

(17) $$\Delta\mathbf{x}_t = \mathbf{E}(\mathrm{L})\mathbf{e}_t ,$$

with $\mathrm{E}(\mathbf{e}\,\mathbf{e}') = \mathbf{I}$ (by assumption) and the shocks uncorrelated across time and across variables.

Only the **u**'s, but not the **e**'s can be estimated directly from a VAR. Since the **u**'s have nonzero covariance terms, implying that the disturbances are correlated with each other, the problem is to separate the **u**'s into (orthogonal) uncorrelated shocks (**e**'s) in order to ensure independence between the shocks. As we have assumed $\mathbf{C}_0$=**I** and we assume a linear relation between **C**(L) and **E**(L) we can write

(18) $$\mathbf{u}_t = \mathbf{E}_0\mathbf{e}_t.$$

In order to recover **e**'s from the **u**'s, the $\mathbf{E}_0$-matrix has to be derived. Thereby we assume that the estimated shocks are linear combinations of the underlying structural disturbances.

Now the problem is to find $\mathbf{E}_0$ imposing $k \times k$ restrictions, where k is the number of variables in the model and thus $k \times k$ is the dimension of $\mathbf{E}_0$.

From **ee**'=**I** and **uu**'=**Σ** we have with (18)

(19) $$\Sigma = \mathbf{E}_0\mathbf{E}_0'.$$

Due to the symmetry property of Σ this factorisation yields $\frac{k(k+1)}{2}$ non-linear restrictions, for the rest of $\frac{k(k-1)}{2}$ restrictions we impose triangular long-term neutrality conditions on certain errors driving the respective variables as derived from the theoretical model. If we evaluate the polynomial matrices at L=1, where a matrix $\mathbf{E}(1)=\mathbf{E}_0+\mathbf{E}_1+\mathbf{E}_2+\mathbf{E}_3...$, the sum of responses to infinity, is the long-run multiplier for each variable, we have

(20) $$\Delta^*\mathbf{x} = \begin{bmatrix} \Delta^* y \\ \Delta^* g \\ \Delta^*(m-p) \\ \Delta^* p \end{bmatrix} = \begin{bmatrix} \mathrm{E}_{11}(1) & 0 & 0 & 0 \\ \mathrm{E}_{21}(1) & \mathrm{E}_{22}(1) & 0 & 0 \\ \mathrm{E}_{31}(1) & \mathrm{E}_{32}(1) & \mathrm{E}_{33}(1) & 0 \\ \mathrm{E}_{41}(1) & \mathrm{E}_{42}(1) & \mathrm{E}_{43}(1) & \mathrm{E}_{44}(1) \end{bmatrix} \begin{bmatrix} \mathrm{e}_{t^*}^{s} \\ \mathrm{e}_{t^*}^{f} \\ \mathrm{e}_{t^*}^{d} \\ \mathrm{e}_{t^*}^{m} \end{bmatrix},$$

where $\Delta^*\mathbf{x} = \lim_{t\to\infty}\mathbf{x}_t - \mathbf{x}$ and the zeros in **E**(1) indicate that in the long-run equilibrium (as derived in equations (12) to (15)) the respective shocks have no long-run effects on the indicated variables.

As $\mathbf{E}(1)$ is assumed to be lower triangular, we can recover $\mathbf{E}_0$ in the following way. Equating (16) and (17) at their long-run values we have

(21) $$\mathbf{C}(1)\mathbf{u}_t = \mathbf{E}(1)\mathbf{e}_t.$$

With **ee**'=**I** and **uu**'=**Σ** the long run matrix **E**(1) is the result of a Choleski decomposition,

(22) $$\mathbf{C}(1)\Sigma\mathbf{C}(1)' = \mathbf{E}(1)\mathbf{E}(1)'.$$

From the estimated values for **C**(L), accumulated for **C**(1), the variance-covariance matrix **Σ** and the Choleski factor **E**(1) we can then recover $\mathbf{E}_0$ as

(23) $$\mathbf{E}_0 = \mathbf{C}(1)^{-1}\mathbf{E}(1).$$

The matrix $\mathbf{E}_0$ can then be used in $\mathbf{u}_t = \mathbf{E}_0\mathbf{e}_t$ to compute the impact of structural shocks on the entries in $\mathbf{x}_t$ (orthogonal impulse responses).[6] From these responses variance decompositions, which allocate each variable's forecast error variance to the individual shocks, can be computed.

For the following analysis we estimate a vector-autoregressive (VAR) model of the form[7]

$$\mathbf{A}(\mathrm{L})\Delta\mathbf{x}_t = \mathbf{u}_t \tag{24}$$

and compute the long-run entries of $\mathbf{A}(1)$. Inverting yields $\mathbf{A}(1)^{-1}=\mathbf{C}(1)$ from the long-run representation of (16). Consequently we get $\mathbf{E}_0$ from (22) and (23), which we use to compute the respective impulse responses and the forecast error variance decompositions of the structural shocks given in (17). Figures 1-18 in the appendix B show the results of such calculations.[8]

2.3 Simulations Using Structural Shocks

Having recovered the structural shocks $\mathbf{e}_t$ from the estimated errors $\mathbf{u}_t$ through the relation $\mathbf{e}_t = \mathbf{E}_0^{-1}\mathbf{u}_t$, alternative forecast simulations can be computed by dropping certain elements of the shock vector.

We set $\mathbf{e}_t^f = [\mathrm{e}_t^s, 0, \mathrm{e}_t^d, \mathrm{e}_t^m]'$ for the simulations "absent government demand (fiscal policy)" and $\mathbf{e}_t^m = [\mathrm{e}_t^s, \mathrm{e}_t^f, \mathrm{e}_t^d, 0]'$ for the simulations "absent monetary policy", where the errors $\mathbf{u}_t^x\,(x = s, f, d, m)$ to be used for the forecasts with the estimated VAR models will be recovered through $\mathbf{u}_t^x = \mathbf{E}_0\mathbf{e}_t^x$.

As the originally estimated variables are differences, we also perform accumulations (including a mean that had been subtracted before estimation) in order to see how the simulated levels of the variables would evolve under the different assumptions. Figures 19-27 of appendix B show the results of the simulations for relative GDP and prices absent the respective structural shock for the variables' levels as deviations of the actual from the simulated paths.

3 Empirical Results

3.1 Data and Preparatory Testing

SVAR models as described were analysed for Austria (AT), the Netherlands (NL), Belgium (BE), Sweden (SE), Finland (FI), Italy (IT), Spain (ES), the United Kingdom (UK) and France (FR). The respective data are quarterly and taken from the BIS database and the OECD Quarterly National Accounts. The sample period starts in 1970:1 and runs through 1996:4. Real government consumption was used as the real fiscal variable, G.

[6] As an increase of real relative balances (*m-p*) due to a structural shock would have to be interpreted as a negative relative velocity shock (cf. equ. (6)), in implementing the identification procedure we multiply all elements of the third column of $\mathbf{E}_0$ by -1 to get a positive interpretation of the private demand or velocity shock.

[7] For an extensive description of the procedures involved in VAR analyses cf., e.g., Hamilton (1994), pp.291-350, or Judge et al. (1988), pp.720-775.

[8] For impulse responses only their accumulated paths are displayed. This is more useful in interpreting effects on the levels of variables (and not differences, as used for estimation).

Real balances *M/P* were calculated by deflating M3 harmonised with the GDP deflator. Straightforwardly, real GDP was used as the real output variable *Y* and the consumer price index (CPI) as prices *P*.

The data are expressed as log indices of the domestic relative to German index levels, the index basis being the first quarter of 1980. Due to German unification, the raw data for the German monetary aggregate exhibit a level jump in 1990:3 and the data for German real output a level jump in 1991:1. The earlier West German data were extended on the basis of the pan-German growth rates, by replacing the jumps in the quarterly growth rates at these points by the average growth rates of the respective four quarters following the unification. To account for the introduction of the EMS, a step dummy of 1 until 79:2 and zero thereafter was included in the estimated system of equations. An additional step dummy which is zero until 89:3 and 1 thereafter should account for German unification.

The data were seasonally adjusted by taking a backwards four quarter moving average. Since this filter implies seasonal unit roots in the original data, we performed tests described by Hylleberg et al. (1990) on log levels, generally suggesting the correctness of our hypothesis. Augmented Dickey-Fuller[9] (ADF) as well as the Phillips-Perron[10] tests were then applied to the differenced data. All of the test results were broadly consistent with output, government demand, real money stock and prices being integrated of order one, so that differences of these variables used in the estimation are stationary.[11] Johansen (1991) test results did in general not suggest cointegrating restrictions or error correction terms.[12] For all VAR estimations we used 3 lags of the variables, this structure being supported by weighting the results of various information criteria.[13]

3.2 Interpretation

The results of the innovation accounting (impulse responses) are reported in the figures of appendix B.[14] They display the impulse responses (accumulated from responses of differenced variables) of relative real output to the four structural asymmetric shocks (supply, fiscal policy, private demand and monetary policy shock). The impulse responses describe the short and medium-term effects of the shocks on the selected variable (up to 30 quarters). The variance decompositions show the contribution of each structural disturbance to the variance (of k-quarters ahead forecast errors) for each vari-

[9] See Dickey and Fuller (1979, 1981).

[10] See Perron (1988) and Pillips and Perron (1988).

[11] The test results suggested some of the relative price series to be borderline cases between I(1) and I(2). As we found clear I(1) evidence in most cases the relative price level was generally considered to be I(1) in order to provide a single framework for our analysis. This also accounts for the fact that especially during the EMS period, inflation rates converged.

[12] While the two-step Engle and Granger (1987) procedure did not indicate cointegrating relationships between the variables, in some cases the Johansen (1991) procedure pointed to the existence of cointegrating vectors. However, adding error correction terms to the VAR did not seem to alter the results significantly. Therefore, in order to keep the framework simple but still applicable to all countries we did not estimate the model in its vector-error correction form.

[13] Three information criteria were used to determine the lag length for the respective VAR estimation: the Akaike Information Criterion (AIC; Akaike, 1973), the Schwarz Information Criterion (SC; Schwarz, 1978; for both cf., e.g., Judge et al., 1988, p.870ff), and the Hannan and Quinn Information Criterion (HQ; Hannan and Quinn, 1979), using the formulae $AIC = \log|\Sigma| + \frac{2j}{T}$, $SC = \log|\Sigma| + \frac{j \log T}{T}$, $HQ = \log|\Sigma| + \frac{2j \log(\log T)}{T}$, where $|\Sigma|$ is the determinant of the variance-covariance matrix of the VAR residuals, j is the number of parameters in the model and T is the number of observations.

[14] Impulse responses are shown with two standard error bands, which are computed empirically over 300 replications following the method outlined in appendix A.

able, going from one to thirty quarters. Besides looking at impulse reaction functions and variance decompositions, a possibility to study costs of monetary union is to simulate a hypothetical scenario with identical monetary policy shocks. A uniform monetary policy will eliminate the shock ε^{m} related to differences in monetary policy vis-à-vis Germany. We also test whether cross-country correlations of output were significantly higher with autonomous monetary and fiscal policy surprises than without these policy shocks. If this were the case autonomous monetary policy would have contributed to a higher synchronisation of output across the countries.

There are various checks for the accuracy of the imposed model. Impulse responses of the endogenous variables to the structural shocks should be consistent with the theoretical model. In order to compare the results, the same model has been applied to each country. However, due to different economic structures, some of the empirical impulse responses deviate from what would be expected by theory. Leaving further discussions aside, we concentrate on the output effects of fiscal and monetary policy shocks.

3.3 Core countries

It is commonly agreed that Austria, Belgium and the Netherlands form a de-facto monetary union with Germany, the fluctuation bands of the exchange rate vis-à-vis the DEM being small since the eighties. In Austria, an asymmetric supply shock has a negative effect on the price ratio, in Belgium, this effect is insignificant. At first sight, the negative effect of the supply shock on relative money in Austria might be surprising, but given the external restriction of the exchange rate target money supply must only grow at a slower pace than in Germany in order to restrict output to grow much faster than in Germany. Contrary to the prediction of the model an asymmetric supply shock increases relative prices in the Netherlands.[15]

We look at the response of relative output to an autonomous monetary policy and fiscal policy surprise. While in the Netherlands the relative output effect of an asymmetric monetary policy shock is insignificant and only slightly significant in Austria, it is positive in Belgium, though even there this effect becomes insignificant after four quarters. In all three countries a relative monetary policy surprise feeds directly into prices. Autonomous fiscal policy has not been very effective in counteracting asymmetric output disturbances in the Netherlands but Austria and Belgium show a slightly significant effect of an asymmetric fiscal policy surprise. These findings are confirmed by the results of the variance decompositions: In Austria and the Netherlands asymmetric supply shocks, defined as those having a permanent effect on output, are the most important source of relative output variability at business cycle frequencies; they account for about two thirds of short and medium term output fluctuations. In Belgium, the forecast error variance of relative output due to this kind of shock is slightly above 50% (see the even-numbered figures 2-18 of Appendix B). The variance decompositions show that the contribution of autonomous monetary shocks to relative output variability is about 10% in Austria and the Netherlands and about 20% in Belgium. Autonomous fiscal policy shocks accounted for about 10% of short-run variability of the output ratio in Austria and in the Netherlands and about 20% in Belgium.

[15] One possible explanation might be that the small country reacts to an asymmetric supply shock (e.g. a productivity shock) by boosting exports and decreasing domestic supply, which, given domestic demand, pushes up domestic prices.

3.4 Periphery countries

Sweden and the United Kingdom are the only periphery countries under consideration showing no significant positive short run impact of a relative monetary policy surprise on the output ratio. Autonomous monetary policy seems to have been rather effective in Finland, Italy and Spain and only slightly significant in France.

The path of relative output after a unit shock to real government consumption relative to Germany is positive in all periphery countries, this effect being rather pronounced in Finland and not significant in Italy and Spain.

Unlike for the core countries asymmetric real supply shocks are less important in explaining relative output variability. Nevertheless, in all periphery countries under consideration except Finland and France, asymmetric supply shocks account for more than 50% of relative output variability after 30 quarters. In France, only 47% of the variance of the forecast error in relative output is explained by this shock in the long run, in Finland 40%.

Especially in Finland, autonomous fiscal policy was an important shock absorber in the past: Over 40% (after ten quarters) of relative output variation are attributable to a relative fiscal policy shock, in Sweden and the United Kingdom about 20% and 30%, respectively, are explained by this kind of shock. In Spain and Italy about 10% of the forecast error variance is due to autonomous fiscal policy surprises. With 30%, France shows a high contribution of autonomous fiscal policy to variations of the output ratio. While in Sweden and the United Kingdom less than 10% of relative output variation is explained by monetary policy innovations, it is between 10% and 20% in the other periphery countries under consideration.

3.5 EMU-Scenario

Besides looking at impulse reaction functions and variance decompositions, a possibility to study costs of monetary union is to simulate a hypothetical scenario with identical monetary policy. A uniform monetary policy will eliminate the shock ε^{m} related to differences in monetary policy vis-à-vis Germany. Though the deviations of the actual variables from the respective simulated variables were estimated for all variables and all shocks, figures 19-27 in appendix B only display the simulation results for the output and price ratios absent the fiscal and monetary policy shocks. In each country, historical episodes alternate between output losses and gains due to autonomous monetary policy.

Bearing in mind the results of the impulse response functions and variance decompositions those output gains and losses can be considered significant in Finland, Italy and Spain and less significant in Belgium and France. A positive deviation of the actual from the simulated path indicates relative output losses of a monetary union. In the period before the mid 80s deviations from the EMU-scenario seem to correspond to the countries' individual reactions to business cycles and/or oil price shocks. Since the mid-80s however, in Italy, France and Spain such deviations are on average positive which points to possible costs when joining the monetary union: These countries would have been worse off in terms of relative output losses if they had followed a joint monetary policy with Germany. This result has to be qualified with respect to Italy, where after 1990 relative output deviations become smaller. As expounded below, the positive output ratio effect of the devaluation in 1992 seems to have been of a short term nature and turned negative in 1994. Interestingly, since the mid-70s, the Italian price level ratio was lower than the simulated path: Italian inflation would have been even higher under a scenario of common monetary policy with Germany. This indicates that Italian monetary policy was relatively restrictive and that inflation pressures in the past primarily stemmed from the real side of the economy.

In general, since the mid 80s, Italy, France and Spain successfully made use of the room for manoeuvre of monetary policy within the ERM. Surprisingly, even France that follows the policy of the franc fort since 1985/86 had, though to a small extent, some autonomy in monetary policy. Relative output was slightly higher as compared to the simulated relative output variable.[16]

While in Italy, France and Spain some costs of joining a monetary union can be identified, the results of the simulation exercise are different for Finland. After the mid-80s, actual relative output was lower than in the scenario of common monetary policy with Germany. The devaluation of the Finnish currency between 1991 until 1993, however, which followed the breakdown of its largest trading partner, the Soviet Union, seemed to have contributed – after some time lag – to a recovery of the Finnish economy. The recovery was supported by a restrictive monetary policy, which led to a price level ratio lower than achieved with a German style monetary policy.

The hypothetical scenario with identical monetary policy also allows to get some insight into the recent experiences of Italy, Spain and the United Kingdom following the crises of September 1992 in the EMS that are sometimes cited as successful devaluations as compared to France which maintained its franc fort policy.[17] However, our simulations indicate that the relative output effects are high only in the case of Spain and low for the United Kingdom and Italy. Furthermore, they seem to be only of a short term nature.

Though monetary union per se does not imply uniform fiscal policy, the Pact for Stability and Growth will constrain the countries to follow a more uniform fiscal policy. So the next type of simulations is one absent autonomous government demand shocks. Again, we only discuss countries such as Sweden, Finland and the United Kingdom that showed significant output ratio effects of autonomous fiscal policy surprises. Of special interest are the 90s where all three countries as opposed to Germany considerably increased their structural deficits, whereby their fiscal position became unsustainable until the second half of the 90s, when consolidation measures were implemented successfully (Brandner et al., 1998). In Sweden and Finland, relative output was higher than with uniform fiscal policy in the beginning of the 90s. In the course of the consolidation measures around the mid-90s, those output gains turned negative. The results for the United Kingdom are less clear-cut. In all cases the output ratio effects of autonomous fiscal policy surprises are much higher than those of autonomous monetary policy surprises. For Finland, Sweden and the United Kingdom, fiscal policy measures seemed to be capable of counteracting asymmetric disturbances.

Including the results of the impulse response functions, the variance decompositions and the simulation exercise, several conclusions can be drawn with respect to EMU: We observe that fluctuations in relative GDP were mainly driven by supply shocks. Autonomous fiscal policy has some initial positive output ratio effects in all countries.

[16] On the other hand, the graph indicates that during the period of monetary ease between 1976 and 1983, France would have been better off in terms of relative output gains if it had followed the German style of monetary policy. This result supports the findings of Melitz and Weber (1996).

[17] See Gros (1996) for a discussion of the experience of Italy, United Kingdom and Spain.

These effects are prominent in Sweden, Finland and the United Kingdom and have low or no significance in Austria, the Netherlands, Italy and Spain. For the former countries, the Pact for Stability and Growth could consequently have undesirable effects on their ability to dampen variability in relative output and to counteract asymmetric disturbances.

Less important than relative fiscal policy surprises are autonomous monetary policy innovations with respect to their effect on the output ratio. Relative output effects of asymmetric money supply shocks are significant in Belgium, Finland, Italy, France and Spain. Since the mid-80s, these countries successfully made use of monetary policy within the restrictions of the ERM. In all other countries, output ratio effects of autonomous monetary policy were small. Another unexpected implication is that with regard to monetary policy, monetary union will not deprive countries like Sweden and the United Kingdom of an important stabilisation tool.

3.6 Economic policy and synchronisation of output fluctuations across Europe

From the literature on monetary transmission in the US and in Europe we know that a common monetary policy may have asymmetric impacts due to different financial and industrial structures of the economies. Another aspect that may be associated with costs are nationally differentiated business cycles. If autonomous fiscal and monetary policy were capable of dampening country-specific business cycles EMU would reduce the degree of synchronisation of output fluctuations across Europe. Of course, an offsetting effect will come, e.g., from increased trade between the EMU participants. In order to see whether nationally differentiated economic policy measures contributed to increased synchronisation of output, we tested three hypothesis based on cross-country correlations as tabulated in Appendix C, Table 3.

Table 1: Tests on cross-country correlations of relative output series

Hypothesis 1: Cross-country correlations of actual relative output (case 1) are higher than relative output absent fiscal policy shocks (case 2).

χ^2 (97) = 1615,8 ***

Hypothesis 2: Cross-country correlations of actual relative output (case 1) are higher than relative output absent monetary policy shocks (case 3).

χ^2 (97) = 1978,0 ***

Hypothesis 3: Cross-country correlations of domestic output absent fiscal policy shocks (case 2) are higher than relative output absent monetary policy shocks (case 3).

χ^2 (97) = 362,2 ***

*** denotes significance at the 1% level.
The chi-square test statistic, e.g. for hypothesis 1, is calculated (including a multiplier correction equal to the number of countries) as follows: χ^2 (degrees of freedom) = (number of observations – number of countries) * (log determinant(case 1) – log determinant(case 2)), where log determinants are calculated from the variance-covariance matrix of the cross-country correlations of the respective series.

The three hypotheses as formulated in Table 1 are alternative hypothesis. The chi-square tests indicate that hypotheses 1 and 2 are accepted at the 1 percent significance level: Autonomous fiscal and monetary policy both contributed to a higher correlation of relative output. Without nationally differentiated fiscal and monetary policy surprises, relative output would have been less correlated across the countries. This indicates that national policies did not only dampen national fluctuations but also tended to phase in their economies to a "European" cycle.[18] Therefore, if EMU will, ceteris paribus, not enhance a synchronisation of the business cycles, monetary union might be associated with lower correlated output fluctuations across the countries. Furthermore, we tested whether monetary policy contributed more to a synchronisation of relative output fluctuations than fiscal policy (hypothesis 3). The test statistic clearly indicates that, in this respect, autonomous monetary policy was more important than fiscal policy.

These results, based on actual and simulated output series, are corroborated by testing the cross-country correlations of the structural shocks (cf. Appendix C, Table 3). Interesting conclusions can be drawn with regard to the degree of economic policy coordination. Again, the hypotheses as formulated in Table 2 are alternative hypotheses. While asymmetric real supply shocks are, as one could expect, not significantly correlated, asymmetric monetary and fiscal policy shocks follow a synchronised pattern. Table 2 shows that asymmetric monetary and fiscal policy shocks are significantly correlated. Since the room for manoeuvre of autonomous monetary policy was lower than for autonomous fiscal policy, monetary policy shocks are significantly higher correlated than fiscal policy shocks.

Table 2: Tests on cross-country correlations of asymmetric structural shocks

Hypothesis 1: Cross-country correlations of asymmetric supply shocks are significantly correlated.

χ^2 (97) = 88,9

Hypothesis 2: Cross-country correlations of asymmetric fiscal policy shocks are significantly correlated.

χ^2 (97) = 273,6 ***

Hypothesis 3: Cross-country correlations of asymmetric monetary policy shocks are significantly correlated.

χ^2 (97) = 150,1 ***

Hypothesis 4: Cross-country correlations of asymmetric monetary policy shocks (case 1) are higher than asymmetric fiscal shocks (case 2).

χ^2 (97) = 123,5 **

** (***) denotes significance at the 5% (1%) level.
The chi-square test statistic for hypothesis 1, 2 and 3, is calculated (including a multiplier correction equal to the number of countries) as follows: χ2 (degrees of freedom) = (number of observations-number of countries) * log determinant, where log determinants are calculated from the variance-covariance matrix of the cross-country correlations of the respective structural shocks. The chi-square test statistic for hypothesis 4, is calculated (including a multiplier correction equal to the number of countries) as follows: χ2 (degrees of freedom) = (number of observations-number of countries) * (log determinant(case 1) - log determinant(case 2)), where log determinants are calculated from the variance-covariance matrix of the cross-country correlations of the respective structural shocks.

4 Conclusions and Prospects

The costs of monetary union are considered by asking whether autonomous monetary policy was an important stabilisation device in the past. We approach this question within a SVAR framework using variables measured relative to Germany. The countries

[18] Due to our specification the hypotheses are tested only for variables relative to Germany, thus Germany is excluded from inference. However, the results might point to a more general European case.

under consideration are Austria, the Netherlands and Belgium (core countries) as well as Sweden, Finland, Italy, the United Kingdom, France and Spain (periphery countries). Contrary to the findings of previous literature, we found short- and medium term output effects of monetary policy innovations relative to Germany being significant in all countries except the core countries Austria and the Netherlands and except the periphery countries Sweden and the United Kingdom. In those countries, autonomous monetary policy feeds directly into relative prices. In Finland, Italy, France, Spain, and even in Belgium, autonomous monetary policy seems to have been an important shock absorber. However, the effects were small as compared to the output ratio effects of asymmetric real supply shocks, suggesting that these countries could in any case have to bear some costs from giving up an autonomous monetary policy.

This general result has to be qualified in four respects. Firstly, since in our model we assumed that asymmetric demand shocks have no long-run impact on output, we exclude any possible long-lasting output effects of monetary policy. It could also be argued, for example, that monetary policy can be useful to avoid a temporary shock (e.g. due to a cyclical downturn) which, given hysteresis, could turn out to have a permanent effect on output and employment. However, the empirical relevance of such effects is unclear. Theoretically, such effects could be accounted for in endogenous growth models (Zagler 1998).

Secondly, also in the case of a permanent demand shock (e.g. due to the loss of one trading partner), exchange rate policy could be useful in a transitory phase since it can respond quickly, while the acquisition of new markets, for instance, takes time. If nominal wages are fixed for a given period, the exchange rate instrument could be used without delay, whereas wage contracts can be modified only after a certain time. Especially if money illusion exists, i.e. if unions do not respond to exchange rate induced price increases by demanding higher nominal wages, devaluation might be an appropriate instrument.

The third remark is closely related to the second: In the history of the countries under consideration, there are well-known episodes of devaluations, where some of them are considered successful. The latest examples are the experiences of Italy, the United Kingdom and Spain following the EMS crisis of September 1992. In the period after the nominal depreciation in all three countries, domestic inflation did not offset a real depreciation (Gros, 1996). The time-inconsistency literature, however, expresses doubts whether these kinds of operations can be successfully repeated at any time. Institutional reforms in these countries such as a higher degree of independence of the central banks, fiscal consolidation measures and the institutional change of the wage bargaining process (as in Italy) may have contributed to the moderation of a price level increase. Our results based on the empirical evaluation of historical data confirm that there have been episodes where some countries successfully exploited the room for manoeuvre of monetary policy. But it is by no means clear whether these episodes can be repeated successfully at any time.

Fourthly, the costs of surrendering autonomous monetary policy have to be weighted against the benefits of disappearance of asymmetric financial market and money shocks in EMU. The more open an economy with own money, the greater will be the transmission of asymmetric nominal shocks to the real economy. So even if there are costs associated with the surrender of monetary policy, a common currency may be preferable, especially if asymmetric nominal shocks such as speculative attacks and currency substitution, that may cause macroeconomic imbalances, dominate over asymmetric real shocks.

We also analysed whether there would be any costs associated with the application of the Pact for Stability and Growth decreasing a country's ability to counteract nationally differentiated shocks. As we found relative real government demand innovations to have initial output ratio effects in most of the countries, some autonomy in fiscal policy could cushion adverse effects of a common monetary policy. These effects have been shown to be quite pronounced in Sweden, Finland and the United Kingdom and of some significance in Belgium and France.

We also found that both monetary and fiscal policy were important tools to increase the degree of synchronisation of the business cycles across the countries under consideration; the contribution of autonomous monetary policy was shown to be more pronounced than the contribution of fiscal policy. Consequently, a common monetary policy might lead to lower correlated output fluctuations across the countries, as far as increased integration between EMU participants will not enhance a synchronisation of the business cycles.

Of course, as the analysis is retrospective, we cannot definitely conclude what the costs of EMU might be. However, there is evidence that there will be situations where a country might be better off with its own currency, at least over some limited time horizon. So when giving up autonomous monetary policy, some autonomy in other policy instruments should be retained.

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6 Appendix A: Confidence Bands of Impulse Response Functions

In order to report two-standard error bands in the graphs of the impulse response functions as shown below we apply a Monte-Carlo approach. Although there is a common procedure for the "traditional" VARs that use short-term restrictions to identify the structural shocks, the calculation of the error bands for VARs using long-run restrictions are, as of now, not common knowledge among model builders. So far, also an analytical approach - which is given by Lütkepohl (1993, p.313ff) for "traditional" VARs - has not been finally designed in the context of long-run identifying restrictions.[19] Here we use a slightly modified version of a technique expounded in, e.g., Mélitz and Weber (1996).[20]
If we write the VAR as

$$y_t = (\mathbf{I} \otimes x_t)\beta + u_t$$

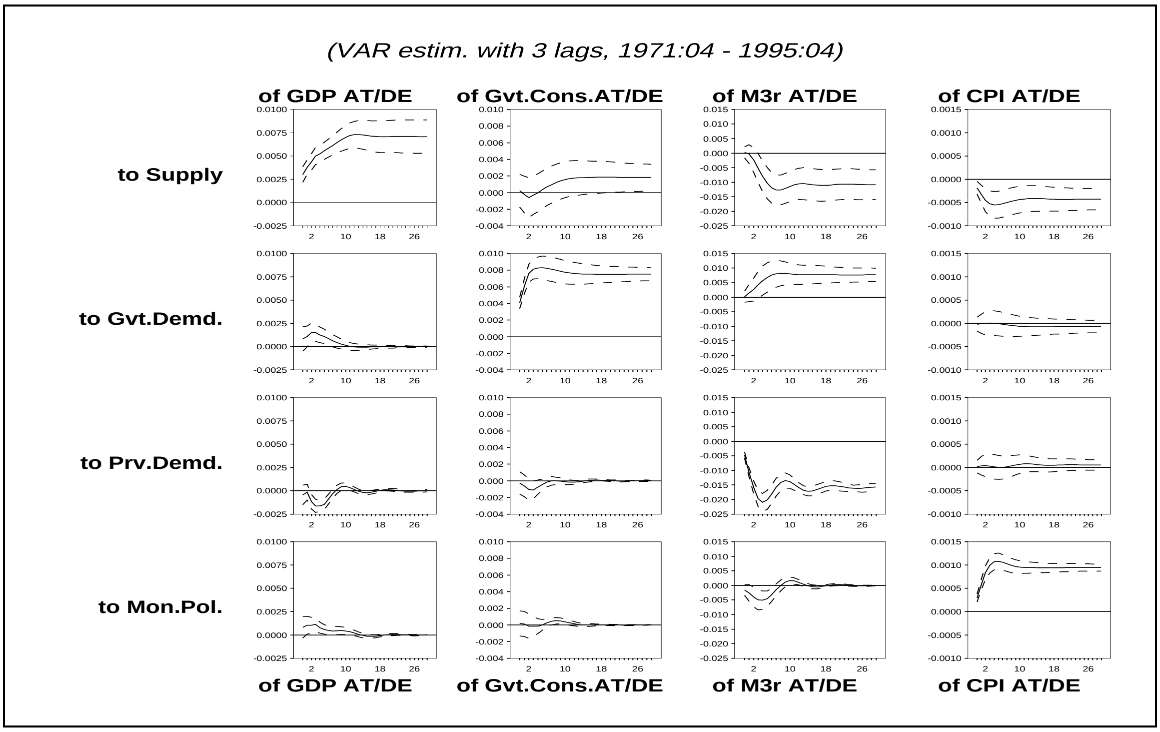
where $\otimes$ is the Kronecker product, x_t is the vector of lagged y_{it}'s ($i = 1,2,...m$), β is a vector containing the stacked version of the structural VAR lag polynomial matrices, $A(L)$, and u_t is i.i.d. with distribution $\mathrm{N}(0,\Sigma)$. The OLS estimates of β and Σ are denoted by b and Z. Assuming that the prior distribution of β is $f(\beta,\Sigma) \propto |\Sigma|^{-(n+1)/2}$, the posterior distribution of β, conditional on Σ, is $\mathrm{N}(\mathrm{b}, \Sigma \otimes (x'x)^{-1})$ and the distribution of Σ^{-1} is $\mathrm{Wishart}((\mathrm{TZ})^{-1}, \mathrm{T})$ with T as sample size.
First and second moments for the impulse responses (the moving average representation) can be computed by drawing q times[21] from the above distribution for β and Σ, inverting the VAR, calculating each time[22] the innovation-orthogonalising matrix $\mathbf{E}_0^{-1}$ (as shown in the text) and conditional on that calculating the mean and the variance impulse responses (moving average parameters).

[19] But see the suggestion by Vlaar (1998).
[20] For the calculations we modify a RATS program procedure given in Doan (1992, p.10-5).
[21] We used $q = 300$ for our calculations.
[22] Here we differ from the approach as given in Melitz and Weber (1996); they perform the calculations conditional on $\mathbf{E}_0^{-1}$ as derived from the initial estimation.

In order to derive standard errors for the accumulated impulse responses as shown in the graphs (for "level series"), we accumulate the impulses of each of the q draws for every impulse step period p, calculate their variance over the q draws and then adjust this variance in each impulse step, multiplying it by p^{-1}. The standard errors are then given by the square root of the resulting adjusted variances. We perform this adjustment referring to the fact that the identifying restrictions are imposed on the long-run moving average parameters, i.e. the accumulations of the moving average parameters derived from the estimated model with differenced series, and any variance of the accumulated parameters at step p has to be treated as sample variance of the parameters up to step p.

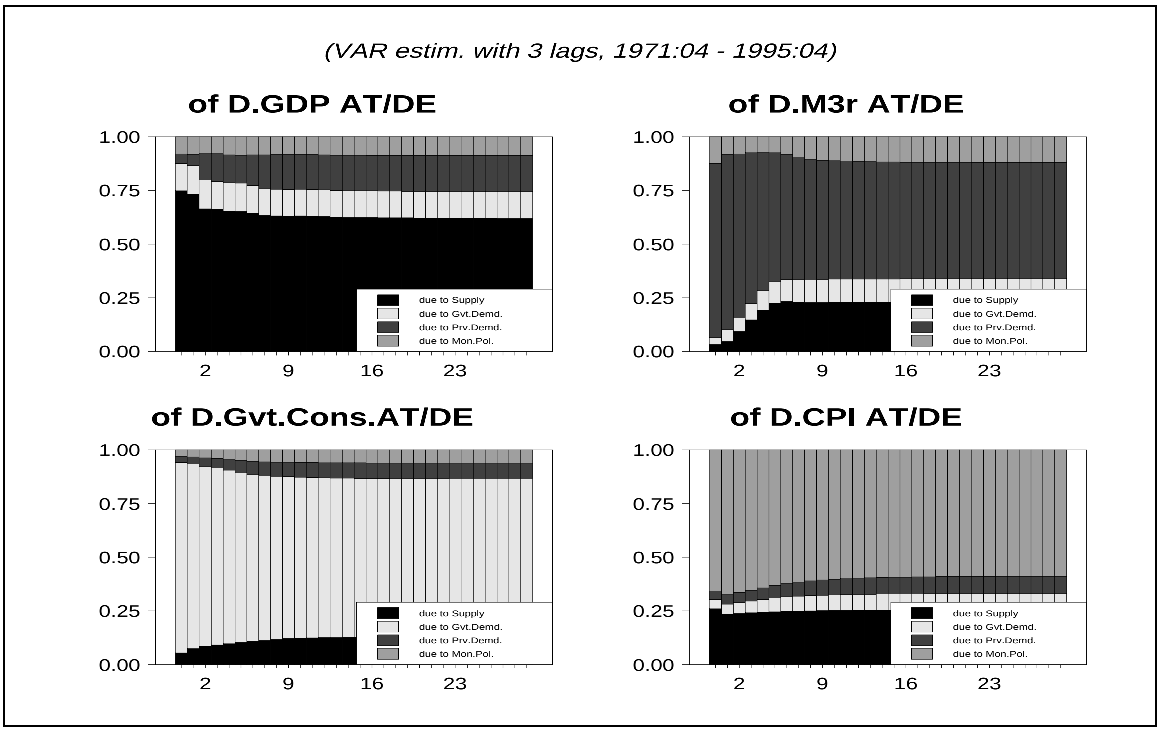
7 Appendix B: Graphs

Figure 1: Austria - Accumulated Impulse Response Functions



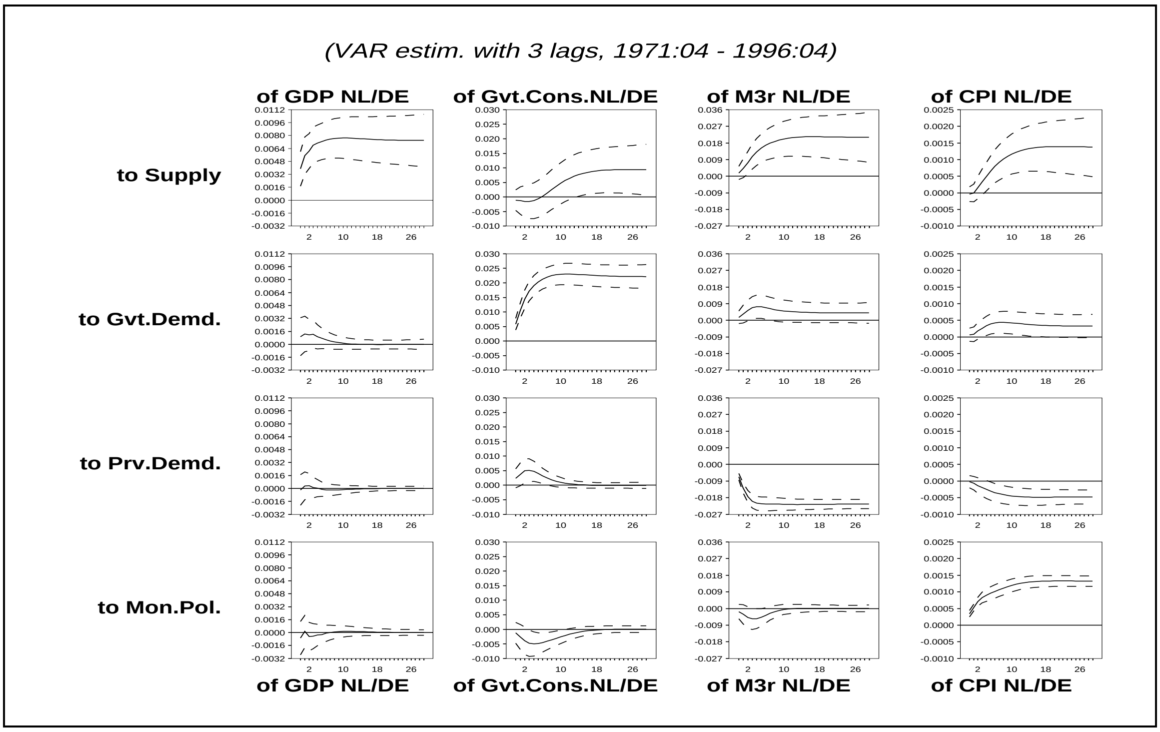
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 2: Austria - Forecast Error Variance Decompositions



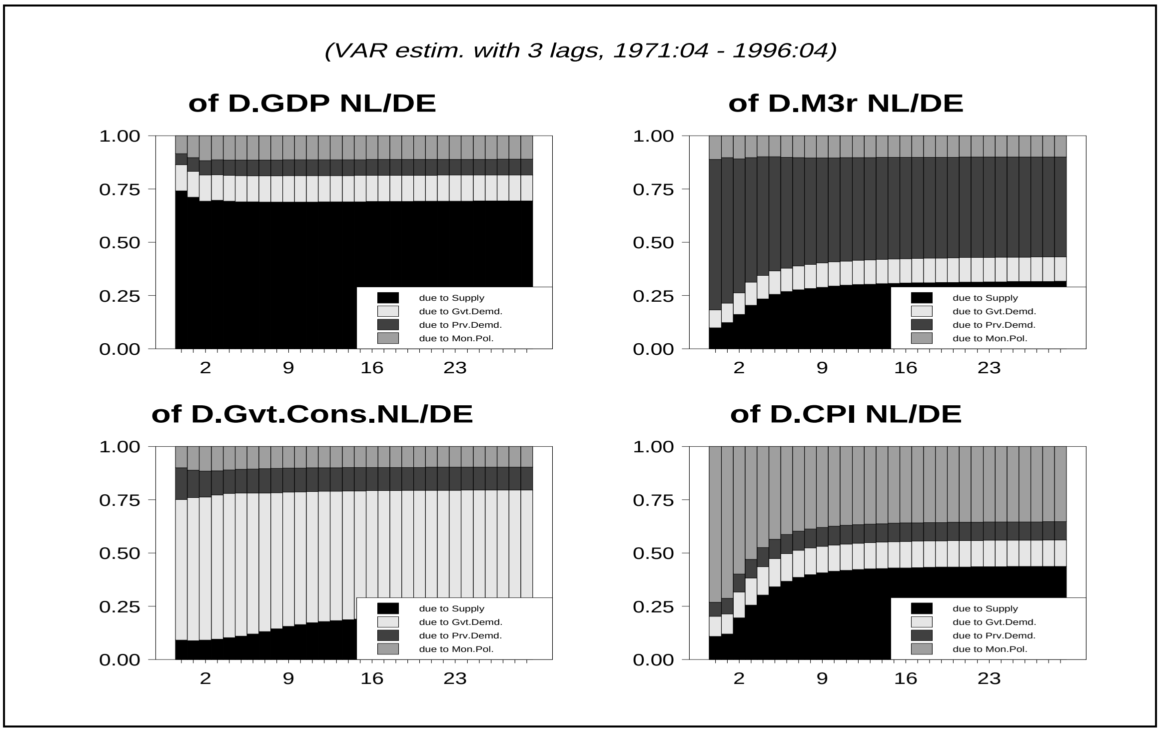
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 3: The Netherlands - Accumulated Impulse Response Functions



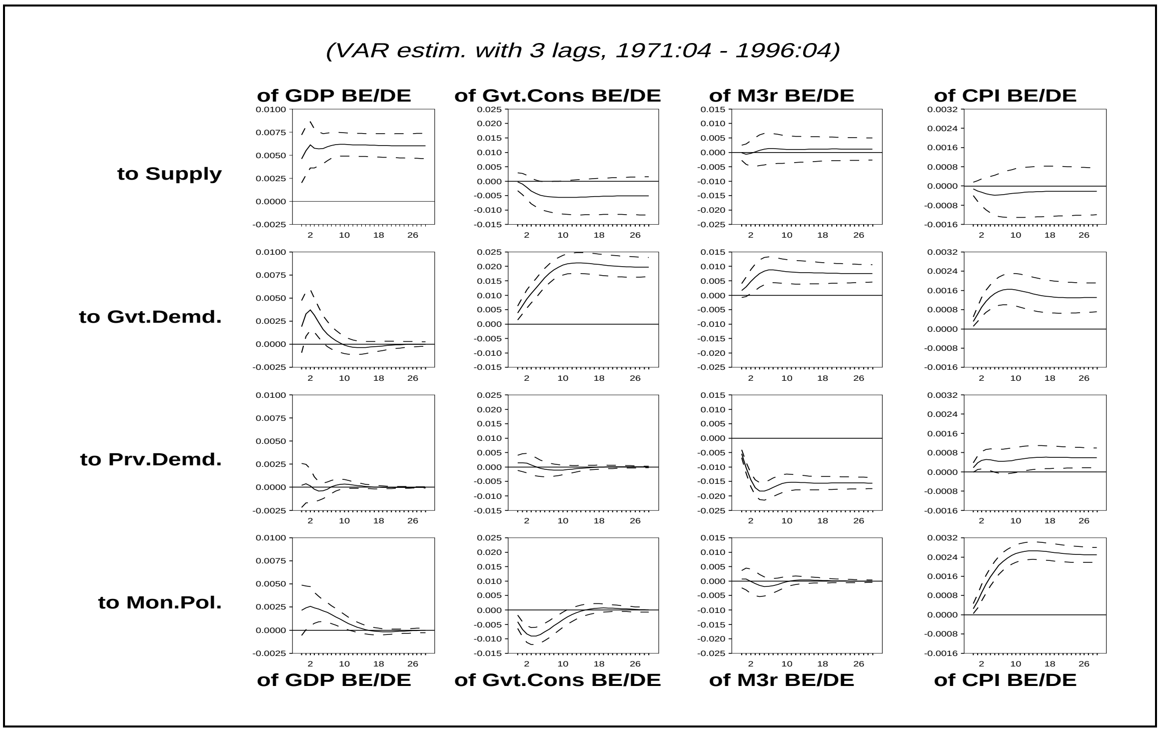
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 4: The Netherlands - Forecast Error Variance Decompositions



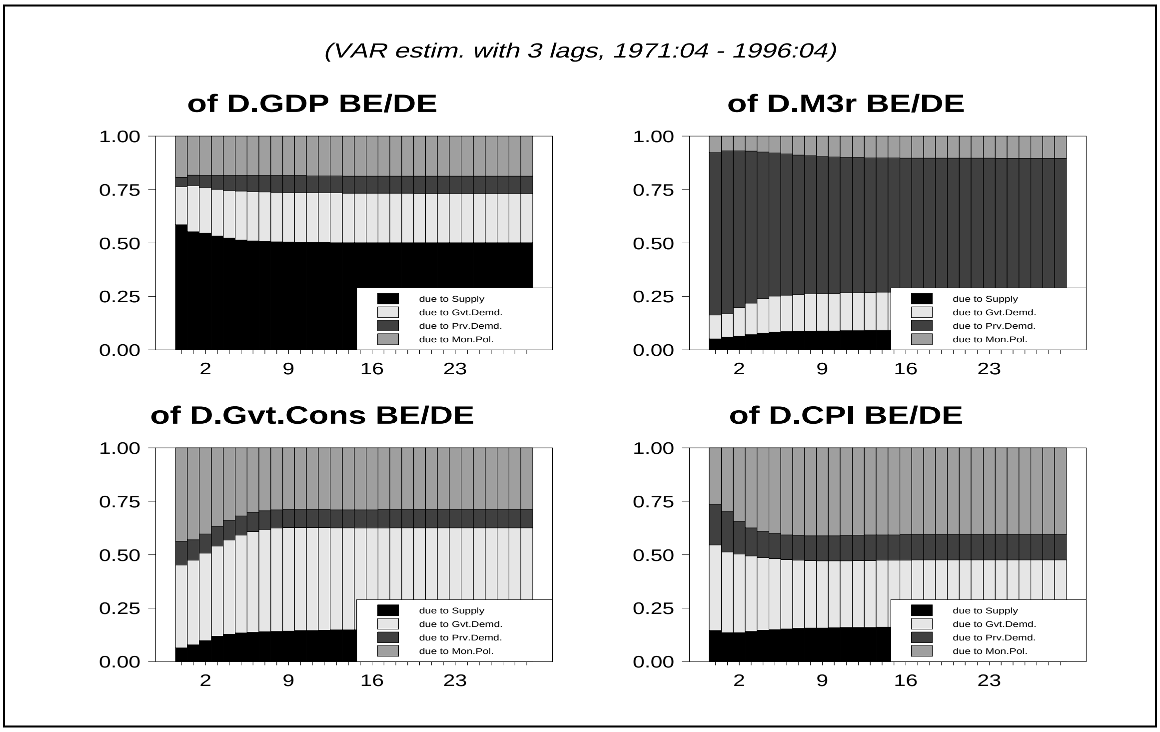
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 5: Belgium - Accumulated Impulse Response Functions



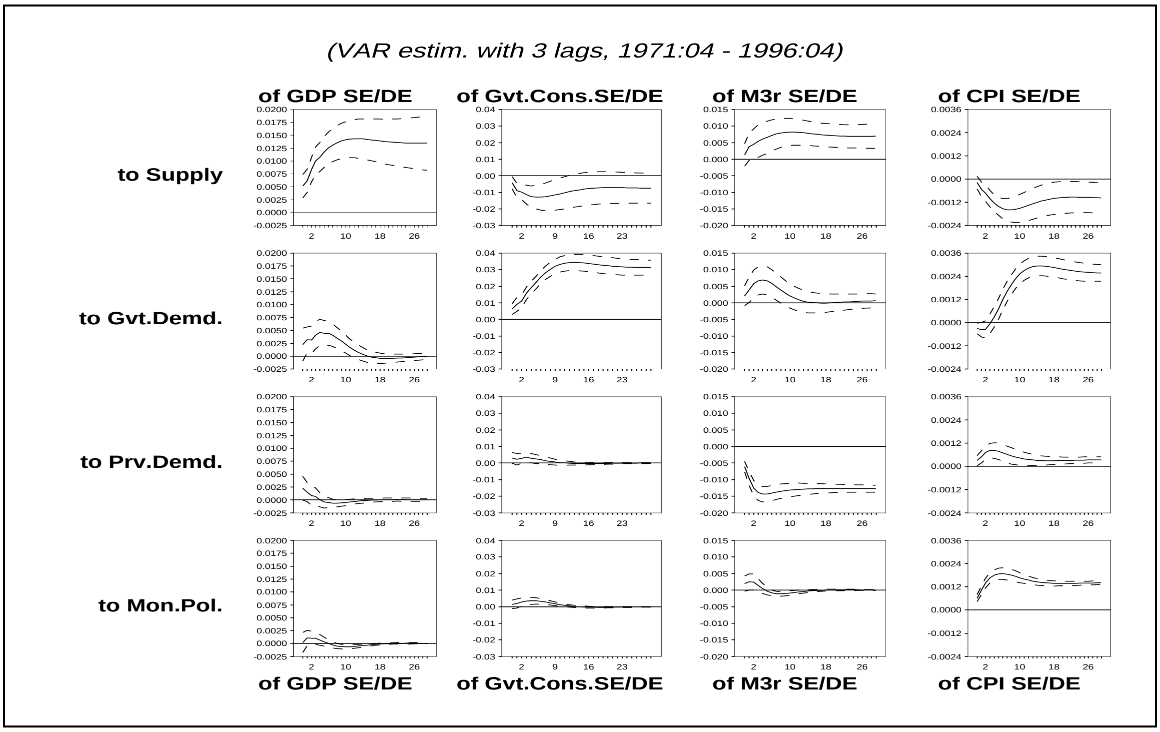
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 6: Belgium - Forecast Error Variance Decompositions



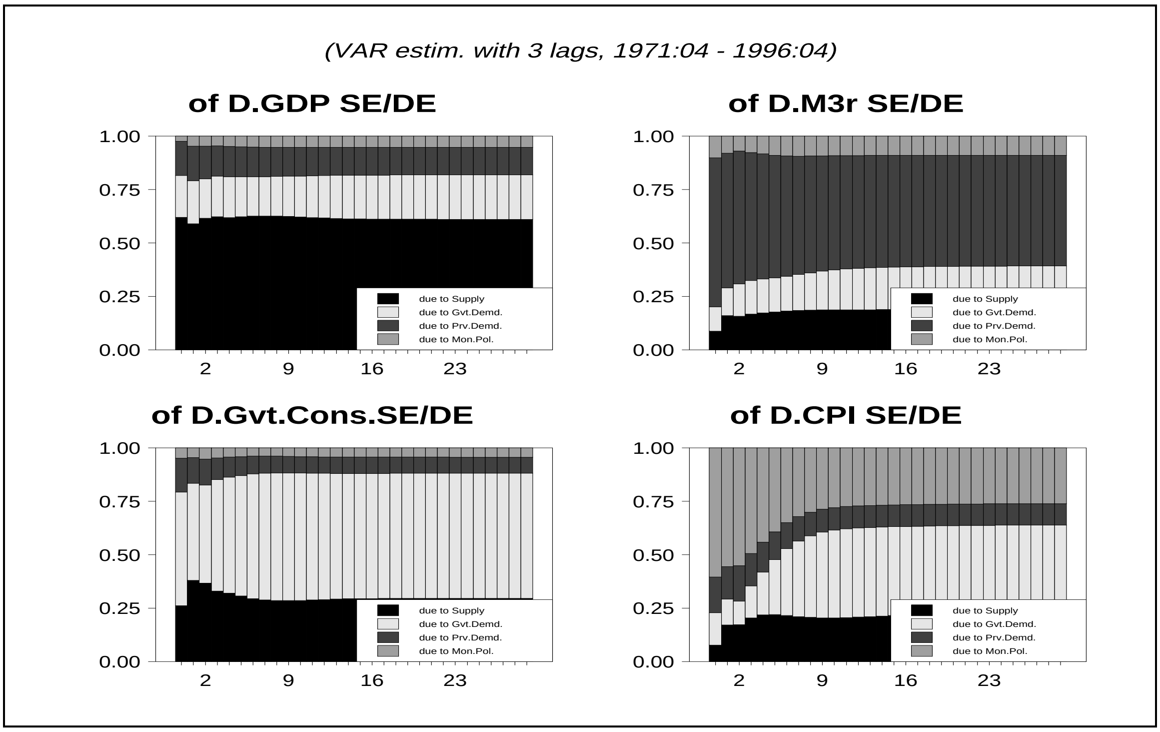
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 7: Sweden - Accumulated Impulse Response Functions



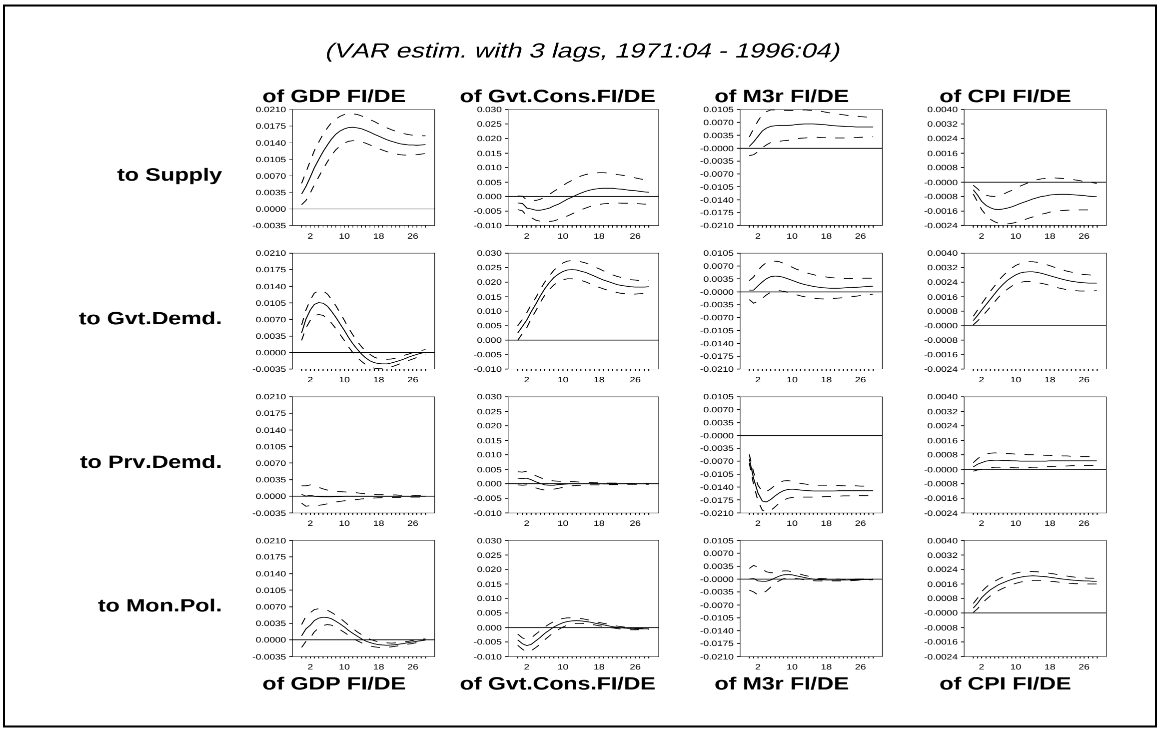
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 8: Sweden - Forecast Error Variance Decompositions



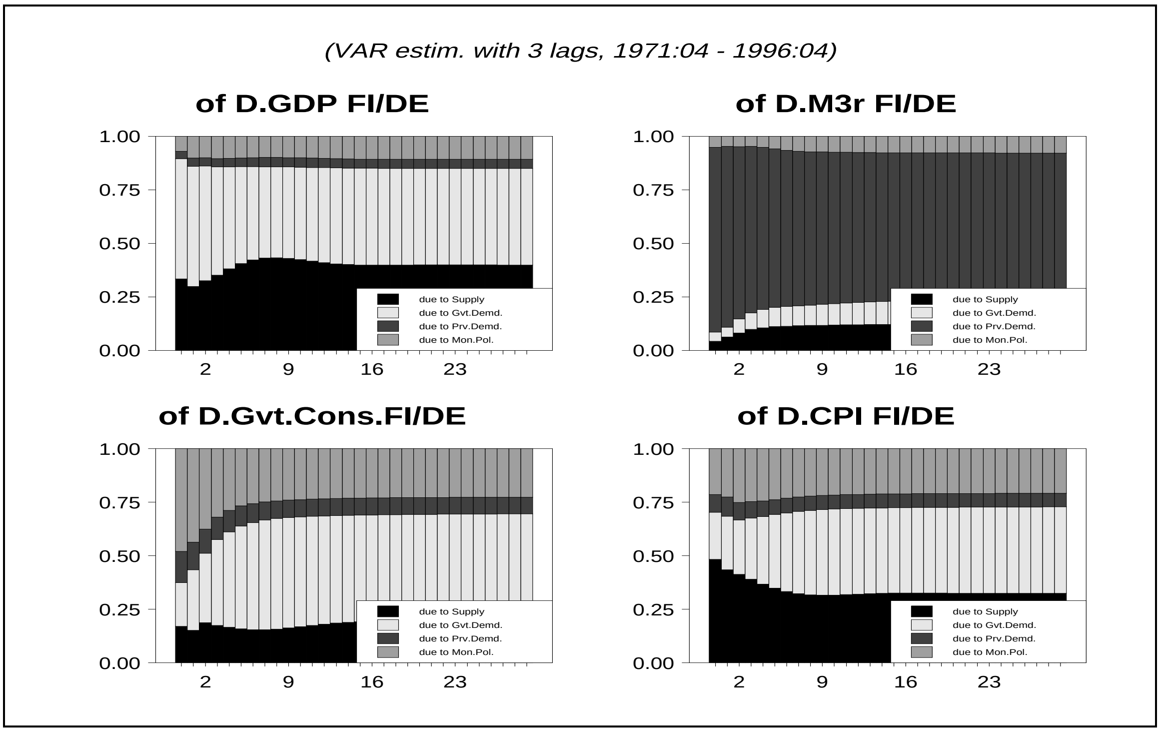
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 9: Finland - Accumulated Impulse Response Functions



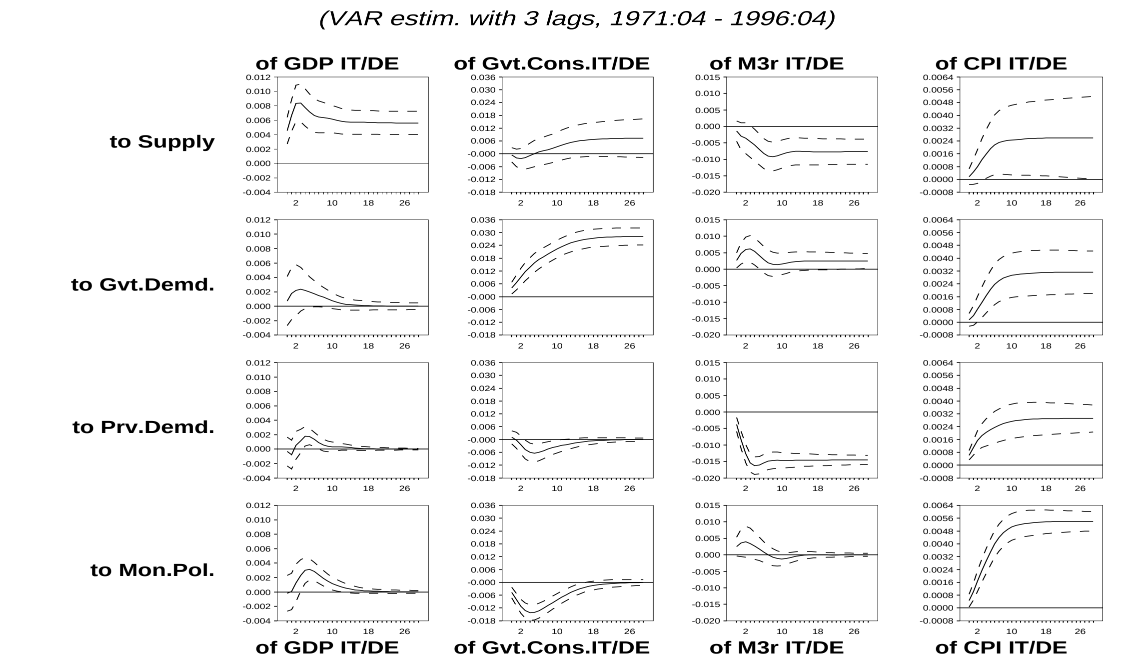
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 10: Finland - Forecast Error Variance Decompositions



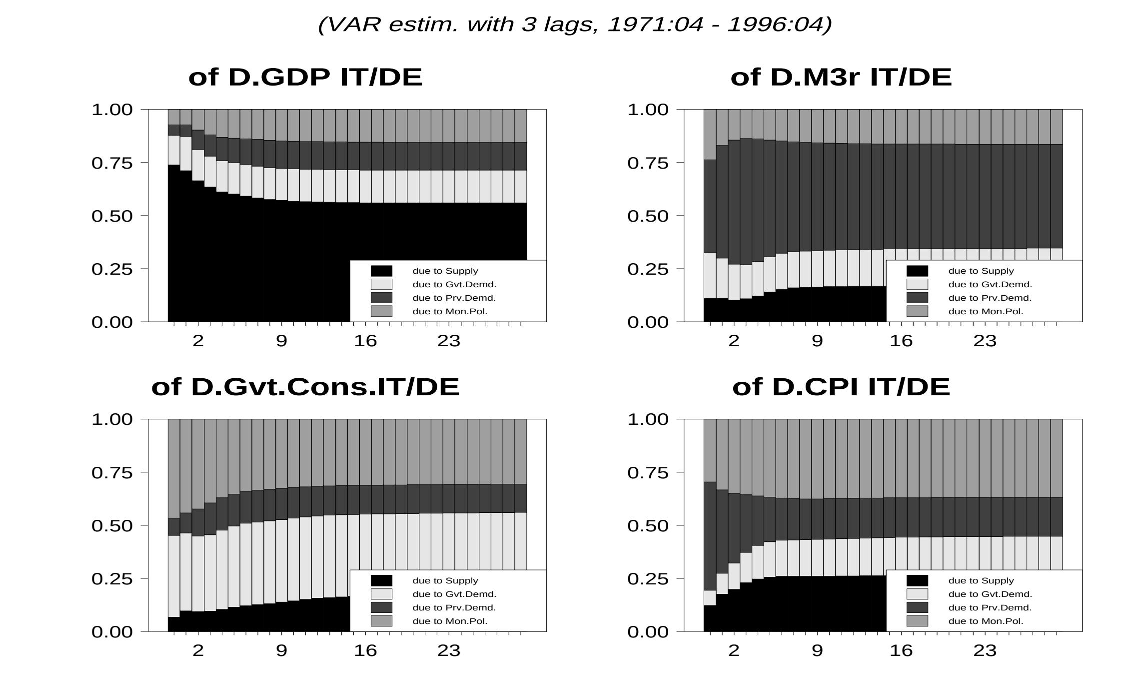
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 11: Italy - Accumulated Impulse Response Functions



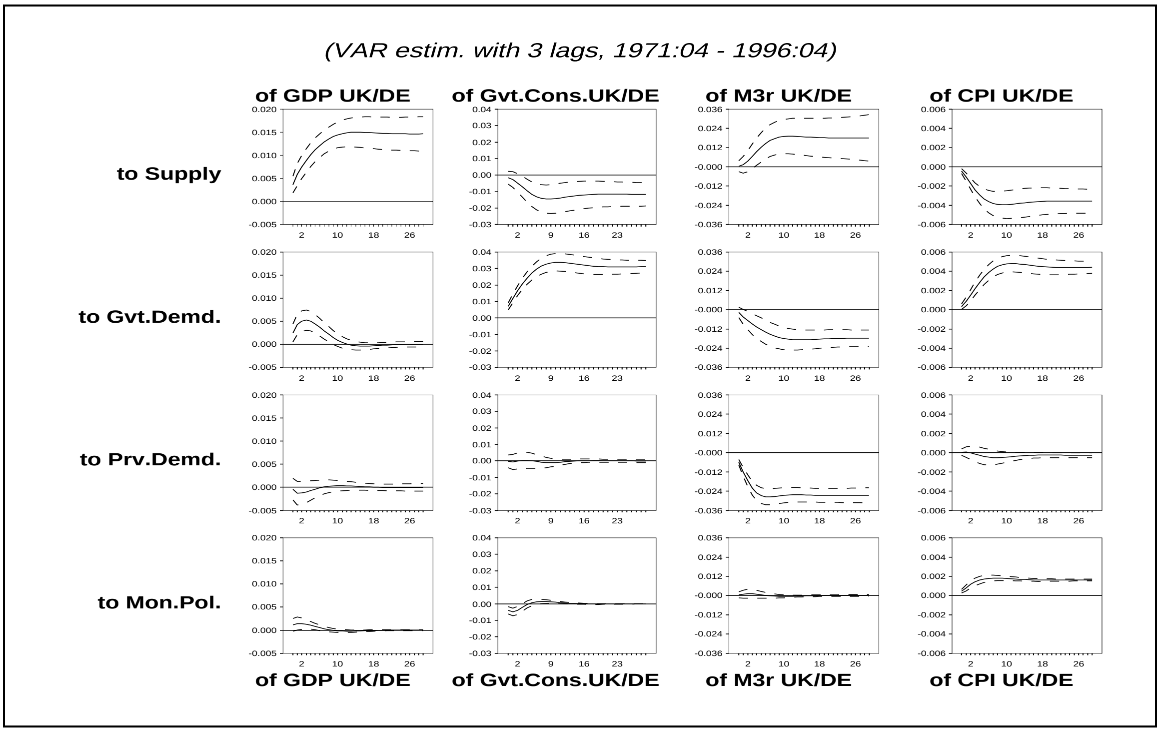
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 12: Italy - Forecast Error Variance Decompositions



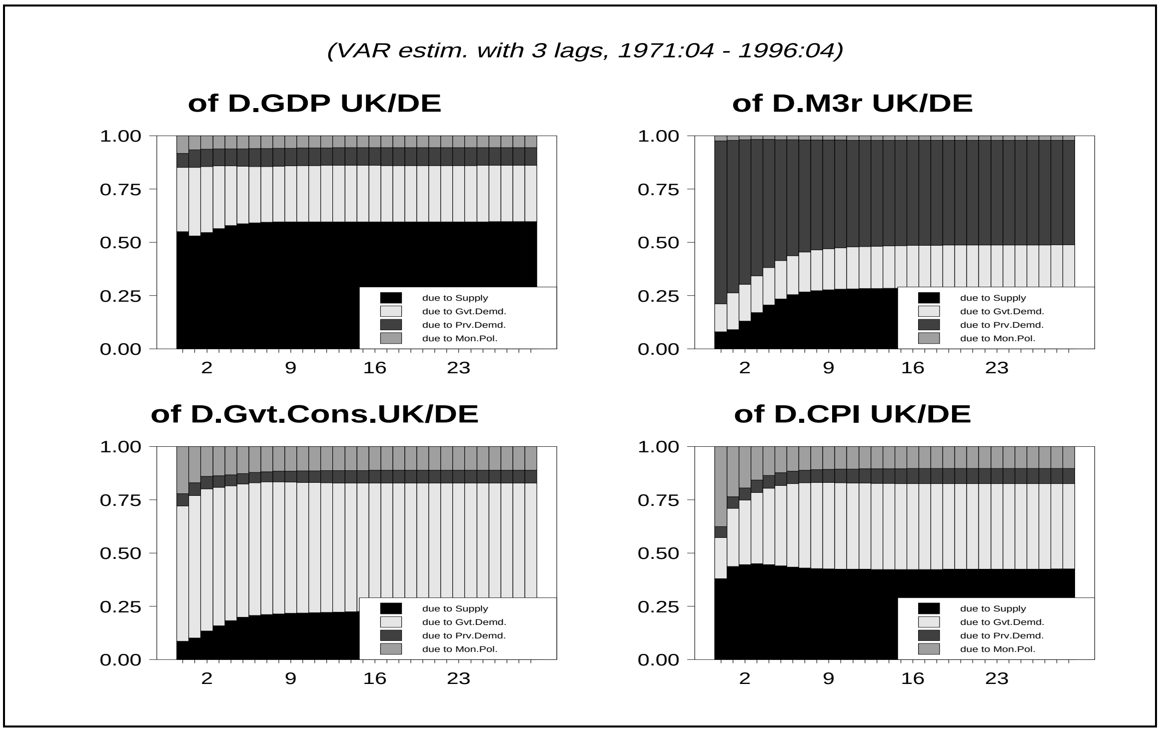
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 13: United Kingdom - Accumulated Impulse Response Functions



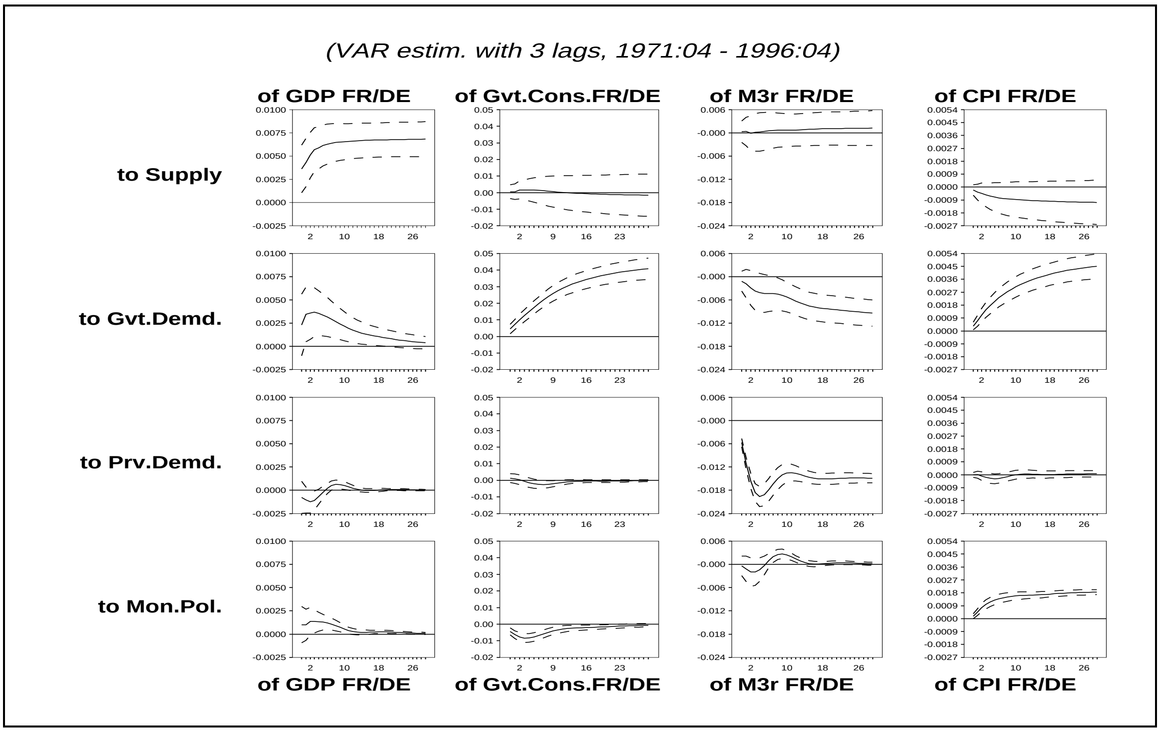
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 14: United Kingdom - Forecast Error Variance Decompositions



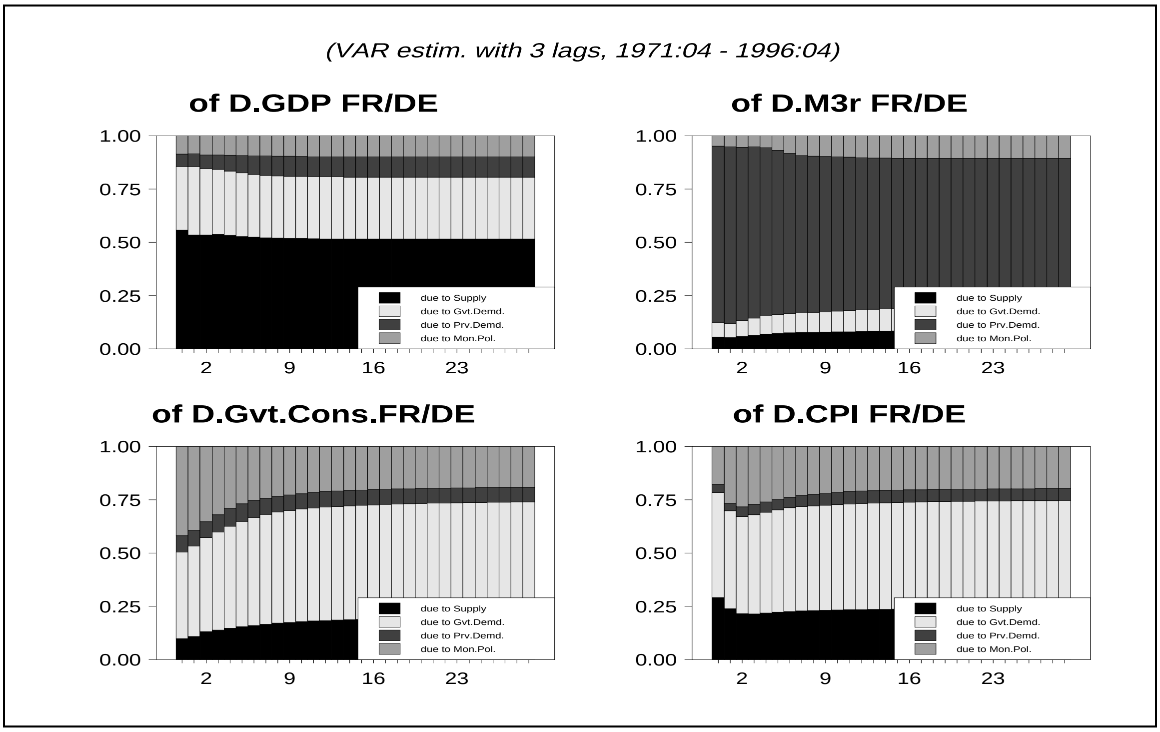
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 15: France - Accumulated Impulse Response Functions



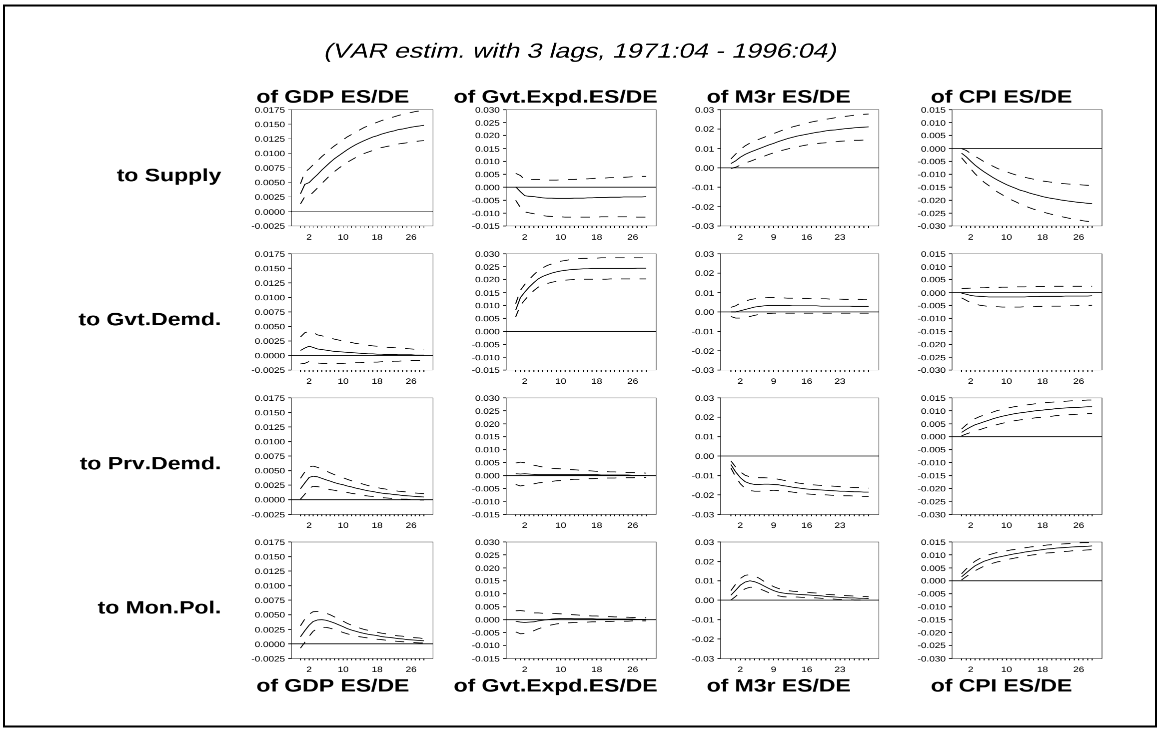
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 16: France - Forecast Error Variance Decompositions



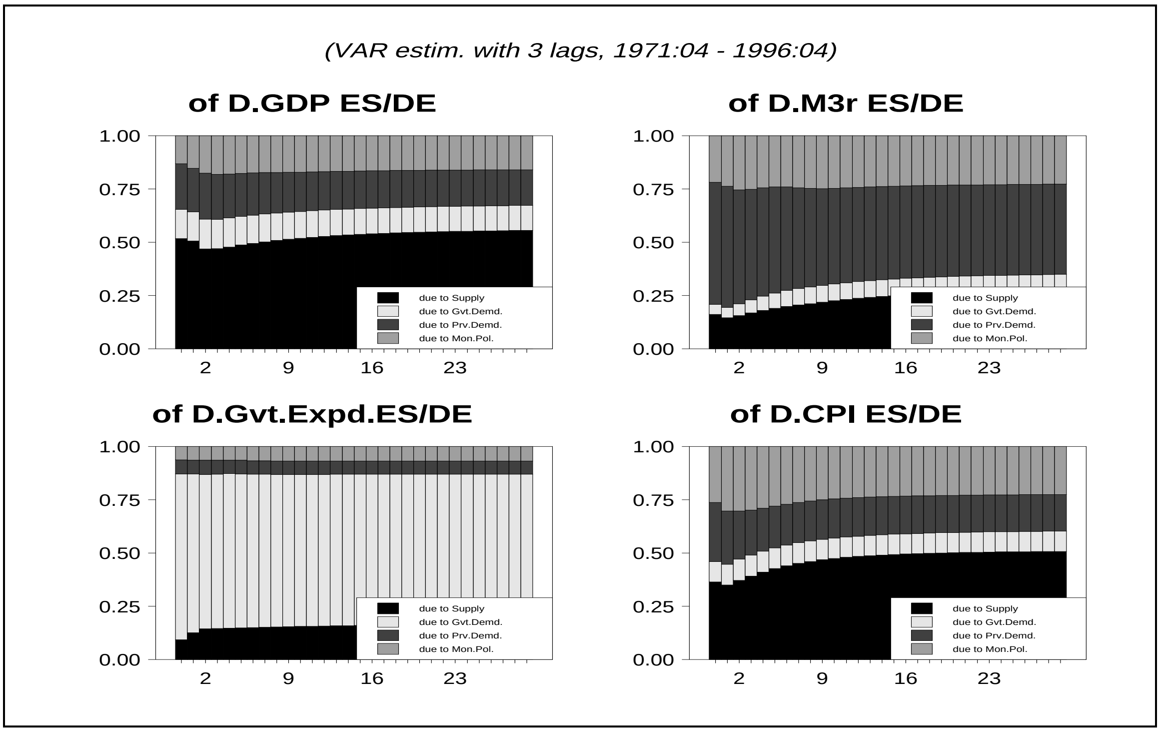
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 17: Spain - Accumulated Impulse Response Functions



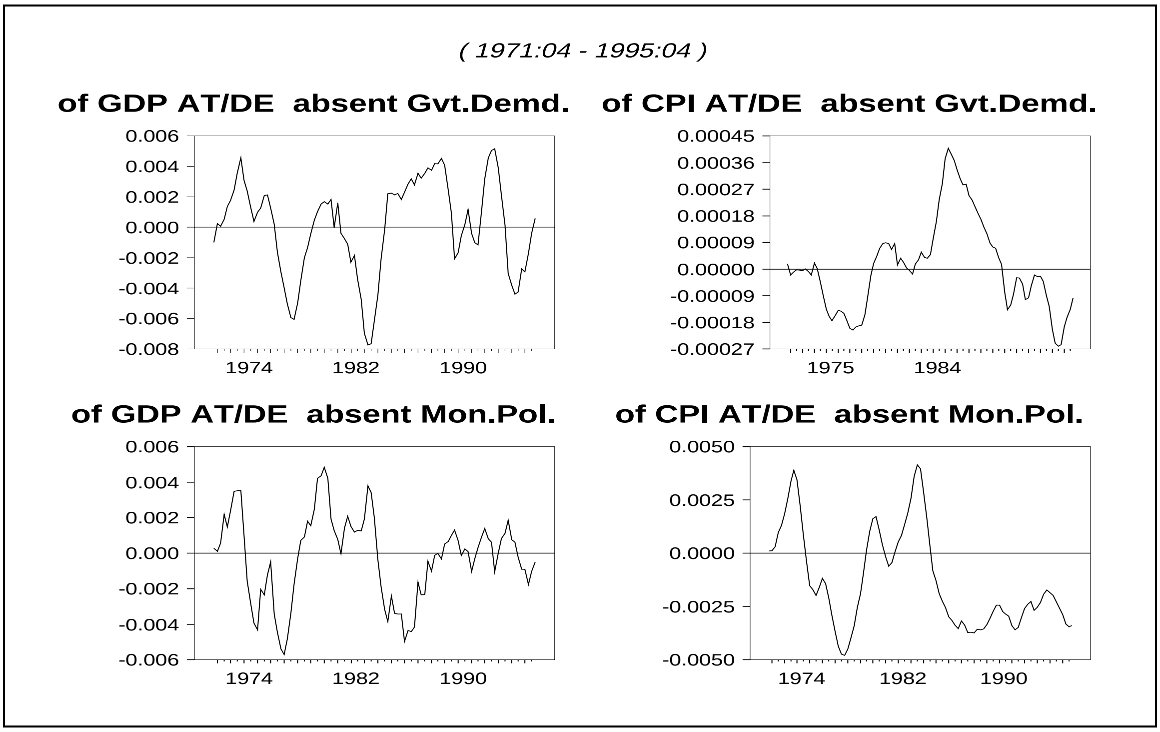
Note: The solid lines indicate the estimated and accumulated response to the respective first period structural unit shock, dashed lines above and below are the upper and lower two standard deviation bounds computed from a simulation as described in Appendix A.

Figure 18: Spain - Forecast Error Variance Decompositions



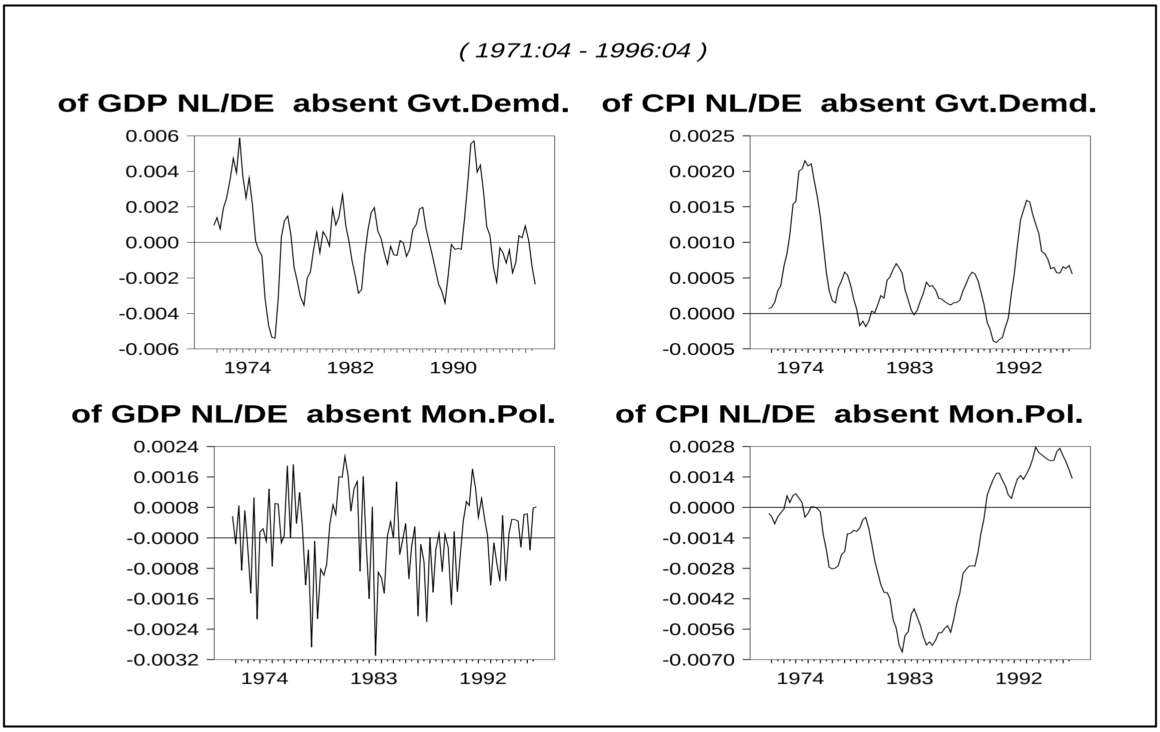
Note: The height of the bars indicate the relative contribution of a specific structural shock to the forecast error variance of the respective series.

Figure 19: Austria - Deviations of Actual from Simulated Variables (Levels)



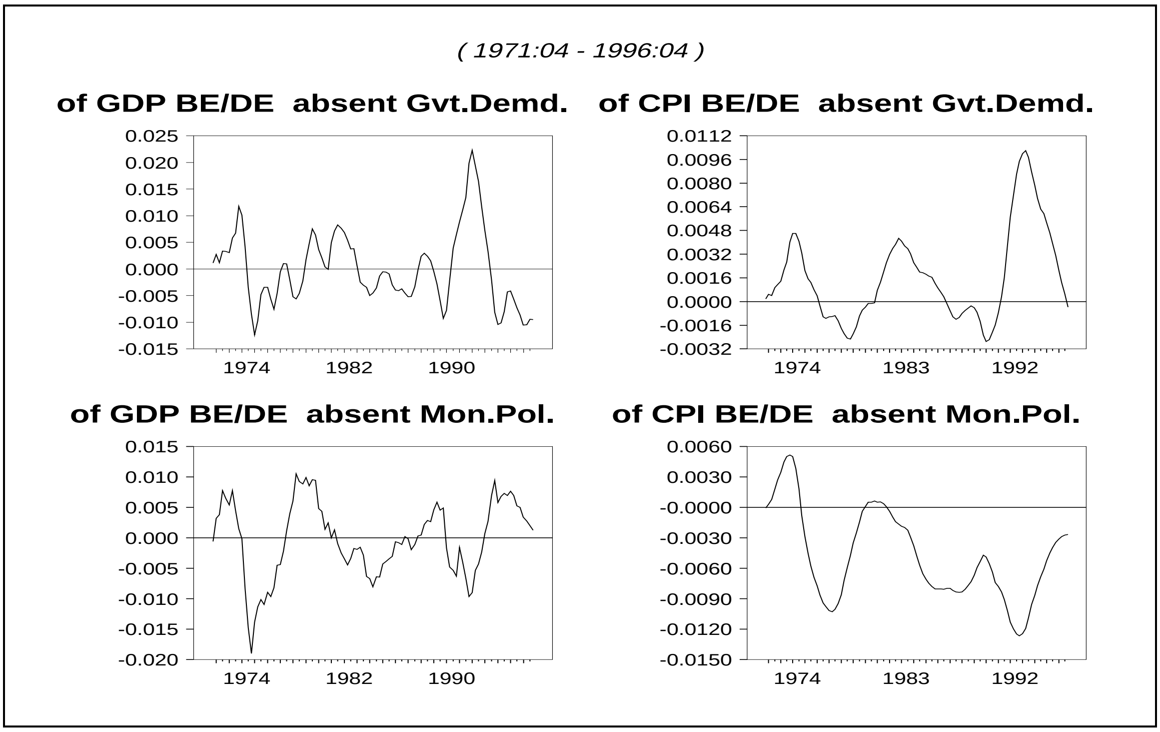
Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

Figure 20: The Netherlands - Deviations of Actual from Simulated Variables (Levels)



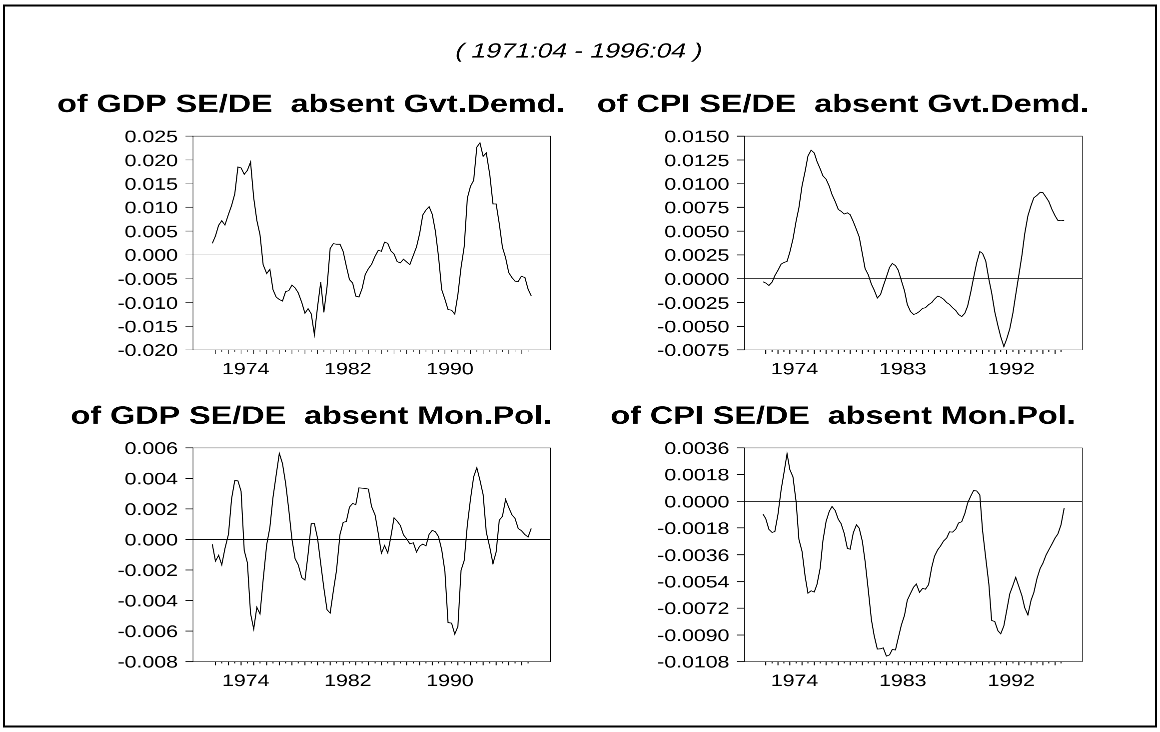
Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

Figure 21: Belgium - Deviations of Actual from Simulated Variables (Levels)



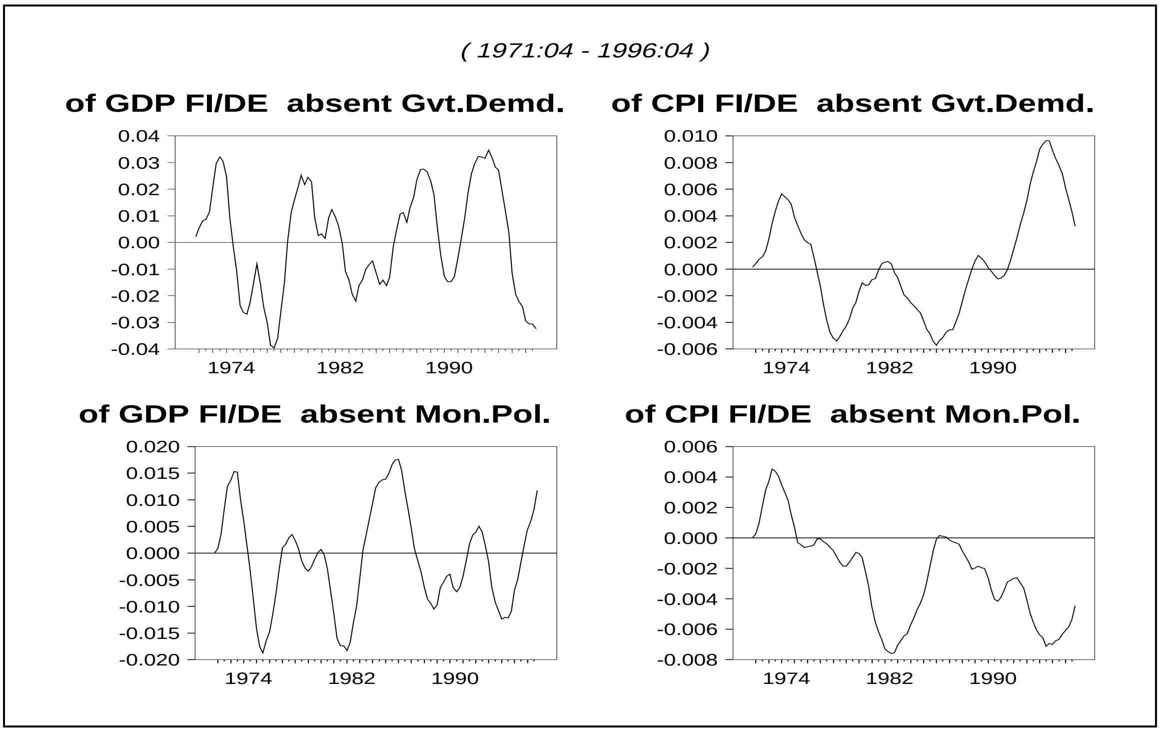
Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

Figure 22: Sweden - Deviations of Actual from Simulated Variables (Levels)



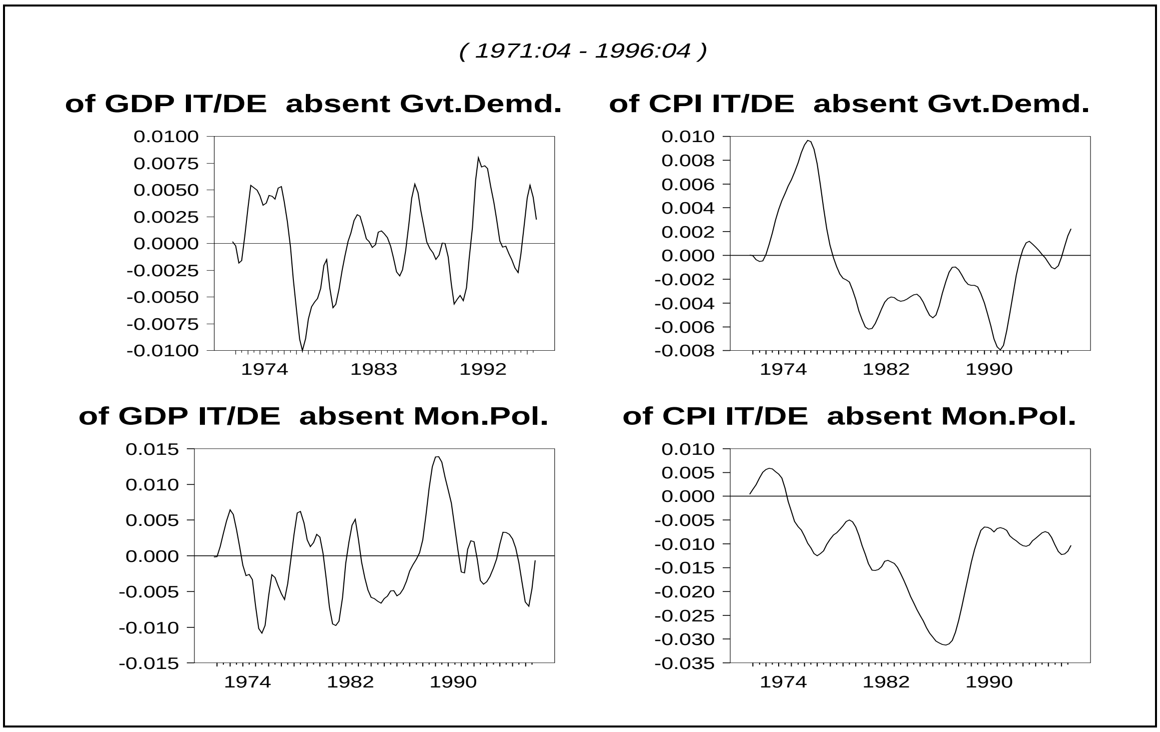
Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

Figure 23: Finland - Deviations of Actual from Simulated Variables (Levels)



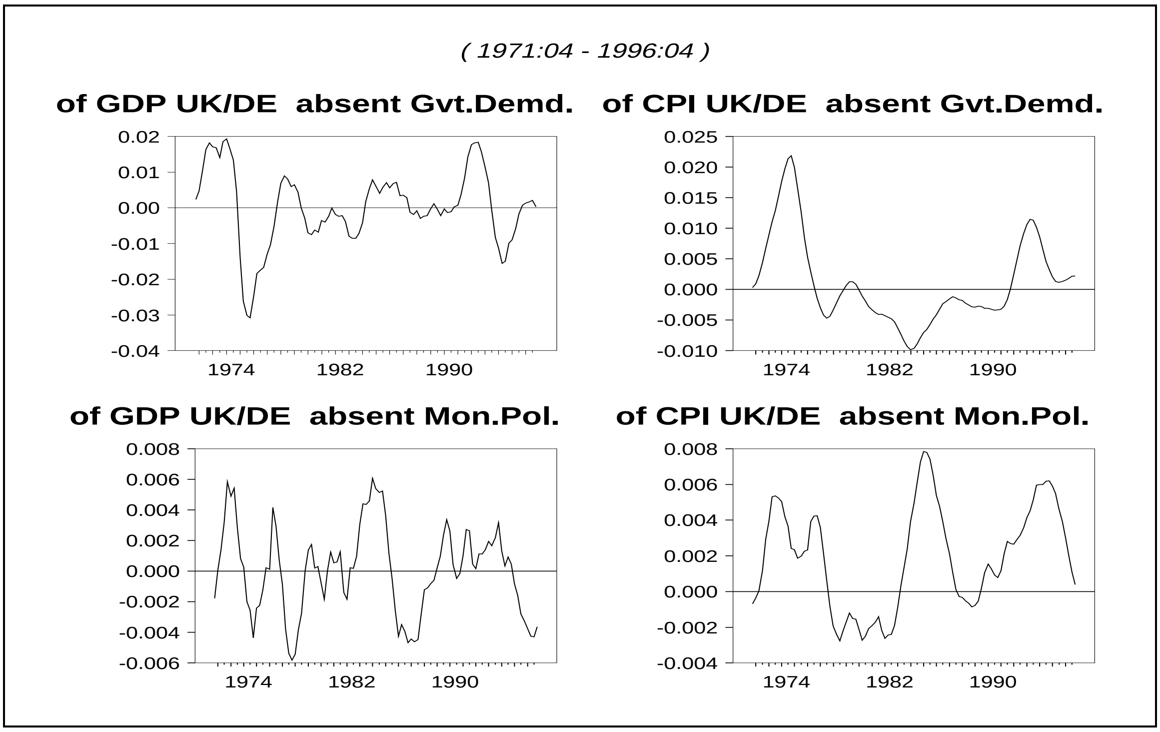
Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

Figure 24: Italy - Deviations of Actual from Simulated Variables (Levels)



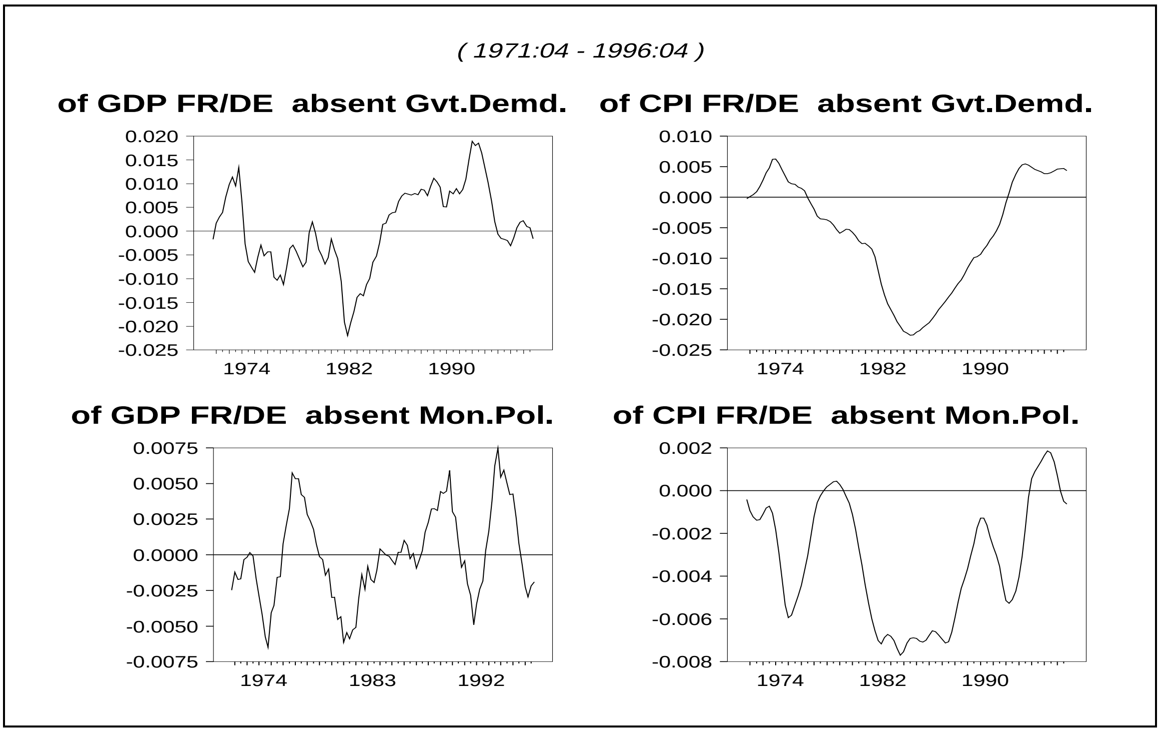
Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

Figure 25: United Kingdom - Deviations of Actual from Simulated Variables (Levels)



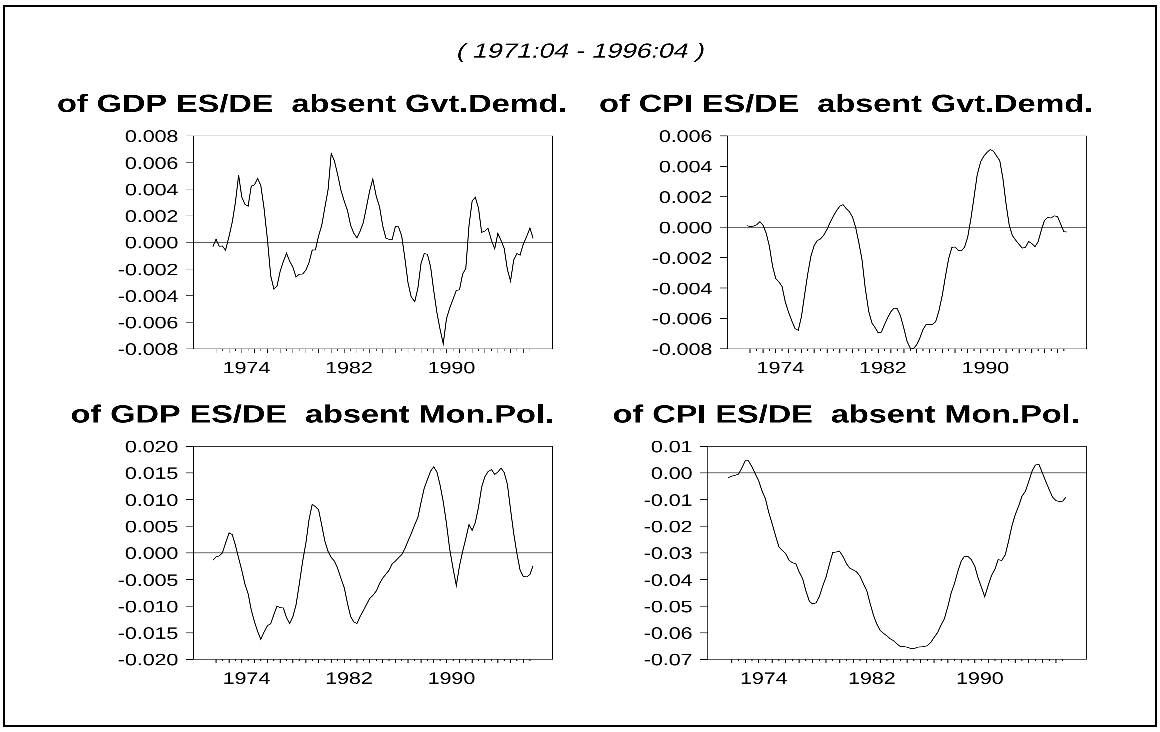
Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

Figure 26: France - Deviations of Actual from Simulated Variables (Levels)



Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

Figure 27: Spain - Deviations of Actual from Simulated Variables (Levels)



Note: Deviations are defined as the difference between the indicated actual variable and the respective simulated variable, where simulations were performed setting the indicated respective structural shock path to zero as described in section 2.3. As also described in the text, for all countries analysed variables are defined relative to the respective German ones.

8 Appendix C: Cross-Country Correlations

Table 3: Cross-Country Correlations of Asymmetric Structural Shocks (below diagonal) and Relative Output Series (above diagonal)

Cross country correlations of structural shocks	**Austria**	**The Netherlands**	**Belgium**	**Sweden**	**Finland**	**Italy**	**United Kingdom**	**France**	**Spain**	*Cross-country correlations of the growth rate of relative GDP*
Austria		0,32	0,28	0,28	0,43	0,40	0,11	0,40	0,49	of rel. GDP
of Supply	*1,00*	0,29	0,07	0,14	-0,02	0,14	-0,04	0,23	0,28	absent Supply
of Govt.Dem.	*1,00*	0,23	0,45	0,31	0,41	0,39	0,28	0,49	0,35	absent Govt.Dem.
of Prv.Dem.	*1,00*	-0,11	-0,06	0,08	-0,15	0,24	0,03	0,24	-0,02	absent Prv.Dem
of Mon.Pol.	*1,00*	-0,29	0,32	0,17	0,08	0,24	0,04	-0,04	0,16	absent Mon.Pol.
The Netherlands			0,34	0,37	0,34	0,23	0,28	0,35	0,34	of rel. GDP
of Supply	*0,27*	*1,00*	0,12	0,34	-0,04	0,19	0,13	0,16	0,26	absent Supply
of Govt.Dem.	*0,41*	*1,00*	0,48	0,36	0,11	0,16	0,34	0,35	0,52	absent Govt.Dem.
of Prv.Dem.	*0,09*	*1,00*	0,01	-0,15	-0,24	-0,07	-0,32	-0,14	0,05	absent Prv.Dem
of Mon.Pol.	*0,38*	*1,00*	-0,20	0,05	0,03	-0,06	-0,09	-0,13	-0,01	absent Mon.Pol.
Belgium				0,33	0,31	0,26	0,20	0,46	0,35	of rel. GDP
of Supply	*0,05*	*0,12*	*1,00*	0,25	0,16	0,14	0,01	0,34	0,21	absent Supply
of Govt.Dem.	*0,40*	*0,69*	*1,00*	0,28	0,32	0,23	0,32	0,48	0,35	absent Govt.Dem.
of Prv.Dem.	*0,24*	*0,27*	*1,00*	0,13	0,10	-0,38	-0,34	-0,08	0,03	absent Prv.Dem
of Mon.Pol.	*0,18*	*0,36*	*1,00*	0,11	0,12	0,13	0,26	0,56	0,30	absent Mon.Pol.
Sweden					0,64	0,42	0,44	0,39	0,38	of rel. GDP
of Supply	*0,12*	*0,36*	*0,19*	*1,00*	0,30	0,21	0,11	0,16	0,30	absent Supply
of Govt.Dem.	*0,13*	*0,35*	*0,41*	*1,00*	0,45	0,36	0,39	0,32	0,45	absent Govt.Dem.
of Prv.Dem.	*0,03*	*0,28*	*0,56*	*1,00*	0,18	0,12	-0,18	-0,19	0,20	absent Prv.Dem
of Mon.Pol.	*0,06*	*0,20*	*0,22*	*1,00*	0,42	0,17	0,03	0,12	0,33	absent Mon.Pol.
Finland						0,48	0,51	0,43	0,55	of rel. GDP
of Supply	*-0,01*	*0,08*	*0,20*	*0,22*	*1,00*	0,18	0,10	0,03	0,29	absent Supply
of Govt.Dem.	*0,19*	*0,21*	*0,28*	*0,40*	*1,00*	0,45	0,29	0,31	0,12	absent Govt.Dem.
of Prv.Dem.	*0,25*	*0,36*	*0,59*	*0,36*	*1,00*	-0,04	0,15	-0,12	0,07	absent Prv.Dem
of Mon.Pol.	*0,01*	*0,20*	*0,36*	*0,26*	*1,00*	0,07	0,09	0,06	0,07	absent Mon.Pol.
Italy							0,18	0,57	0,36	of rel. GDP
of Supply	*0,13*	*0,20*	*0,12*	*0,08*	*0,18*	*1,00*	0,20	0,29	0,22	absent Supply
of Govt.Dem.	*0,34*	*0,45*	*0,43*	*0,42*	*0,37*	*1,00*	0,17	0,36	0,27	absent Govt.Dem.
of Prv.Dem.	*-0,07*	*0,09*	*0,29*	*0,19*	*0,40*	*1,00*	-0,04	0,04	0,20	absent Prv.Dem
of Mon.Pol.	*-0,06*	*0,28*	*0,46*	*0,26*	*0,24*	*1,00*	0,03	0,19	0,28	absent Mon.Pol.
United Kingdom								0,29	0,44	of rel. GDP
of Supply	*0,01*	*0,10*	*-0,06*	*0,11*	*0,12*	*0,05*	*1,00*	0,20	0,19	absent Supply
of Govt.Dem.	*0,31*	*0,51*	*0,46*	*0,30*	*0,28*	*0,28*	*1,00*	0,31	0,02	absent Govt.Dem.
of Prv.Dem.	*0,14*	*0,44*	*0,60*	*0,41*	*0,60*	*0,24*	*1,00*	0,44	-0,26	absent Prv.Dem
of Mon.Pol.	*-0,09*	*0,12*	*0,28*	*0,03*	*0,29*	*0,23*	*1,00*	0,31	0,26	absent Mon.Pol.
France									0,51	of rel. GDP
of Supply	*0,20*	*0,22*	*0,35*	*0,18*	*0,03*	*0,21*	*0,15*	*1,00*	0,26	absent Supply
of Govt.Dem.	*0,46*	*0,43*	*0,51*	*0,28*	*0,38*	*0,35*	*0,37*	*1,00*	0,31	absent Govt.Dem.
of Prv.Dem.	*0,25*	*0,48*	*0,60*	*0,41*	*0,60*	*0,27*	*0,60*	*1,00*	-0,42	absent Prv.Dem
of Mon.Pol.	*-0,08*	*0,23*	*0,57*	*0,28*	*0,32*	*0,28*	*0,39*	*1,00*	0,23	absent Mon.Pol.
Spain										of rel. GDP
of Supply	*0,36*	*0,27*	*0,08*	*0,23*	*0,16*	*0,28*	*0,22*	*0,24*	*1,00*	absent Supply
of Govt.Dem.	*0,46*	*0,67*	*0,53*	*0,42*	*0,25*	*0,43*	*0,28*	*0,42*	*1,00*	absent Govt.Dem.
of Prv.Dem.	*0,28*	*0,57*	*0,41*	*0,34*	*0,48*	*0,11*	*0,43*	*0,52*	*1,00*	absent Prv.Dem
of Mon.Pol.	*-0,01*	*-0,10*	*0,20*	*0,33*	*0,03*	*0,32*	*0,12*	*0,05*	*1,00*	absent Mon.Pol.

Note: The figures in italics (below diagonal) indicate cross-country correlations of asymmetric structural shocks (supply, government demand, private demand and monetary policy shocks). The figures above diagonal are cross-country correlations of growth rates of five different output series: 1. cross-country correlations of relative output (vis-à-vis Germany), 2. cross-country correlations of relative output absent supply shocks, 3. cross-country correlations of relative output absent government demand shocks, 4. cross-country correlations of relative output absent private demand shocks, and 5. cross-country correlations of relative output absent monetary policy shocks.