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Macroeconomic Shocks in Euroland vs. the UK: Supply,
Demand, or Nominal?

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Abstract[*]

The article uses a structural vector autoregressive (SVAR) model under some well agreed long-run neutrality assumptions to identify relative supply, relative demand, and relative nominal shocks in Euroland vs. the UK. The empirical results indicate that most of the variation in relative output is caused by supply shocks while the shocks driving the real ECU exchange rate are mainly non-monetary demand shocks in nature. Therefore, the loss of the exchange rate as a shock absorber will not be great for the UK.

Keywords: Optimal currency area, structural vector autoregression, EMU, UK

JEL Classification: C32, E42, F33, F41, F42

1. Introduction

On February 23rd, 1999 the British goverment published a "national changeover plan" for replacing the sterling with the euro. The government, repeated Mr. Blair, is in favour of joining a successful euro in principle if five economic tests are met. The government will recommend to join if there is sustainable convergence between the economic cycles in the UK and Euroland; if joining would not harm the City; if it would help foreign investment; if it would not cost jobs; and if the British economy is flexible enough to adapt to economic shocks once inside the euro-zone.[1]

In joining EMU, the participating countries no longer have at their disposal either monetary policy or exchange rate policy. This implies that country-specific monetary conditions can no longer cushion differences in cyclical positions among euro area member countries, nor help them to adjust to asymmetric shocks. This paper therefore focuses on the costs of giving up exchange rate flexibility and in independent monetary policy in an economic zone that is centered on the German economy. A sudden reversal in the economic environment could require a major structural adjustment in relative labour costs that would be made more difficult by virtue of participation in a monetary union. Outside EMU, devaluation is a straightforward method to reduce relative labour costs without requiring direct wage reductions and generating high costs in terms of lost employment.[2] Of course this requires that wages are not negotiated upwards to counteract the higher price level generated by a devaluation.[3] Inside EMU, the exchange rate weapon will be ruled out and a "one-size-fits-all" monetary policy will be imposed. Therefore, substantial prudence has to be exercised in order to minimise the danger of over-expansion in the economy and hence the frequency of occasions when an adjustment in relative labour costs needs to take place.[4]

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[1] These five tests are available via the Internet: http://www.euro.gov.uk. A thorough discussion of the tests is available in Artis (2000).

[2] One has to admit, however, that there are few areas of this intellectual battleground which are not contested. There are therefore different views on whether devaluation has been an effective tool in periods when a reduction in relative labour costs is required. Proponents of this view emphasise that the 1982 sterling devaluation helped to lay the basis for subsequent growth; critics note that the 1976 fall of sterling was much less supportive.

[3] The empirical evidence on wage determination, however, seems to suggest that Europe exhibits sluggish real wages, not sluggish nominal wages: nominal wages tend to keep in line with prices, so that real wages show little tendency to fall even in periods with high unemployment. A recent review of chronic unemployment in the euro area is available in IMF (1999), chapter IV.

[4] These costs may prove to be important since it appears unlikely that the loss of exchange rate and monetary policy as a stabilisation tool can be offset by an increased use of a

What follows is an analysis of various types of macroeconomic shocks - demand, supply, and nominal - which are identified using a structural VAR approach (SVAR). The three underlying structural shocks are then used to analyse the sources of macroeconomic fluctuations in Euroland vs. the UK and to answer the question of how much of a buffer the exchange rate has been in addressing country-specific supply shocks.[5] The choice of the union-wide approach is motivated by the belief that the knowledge of the way area-wide macroeconomic shocks impinge on the UK is, unavoidably, the starting point for any assessment of the appropriate monetary policy that the UK should adopt in the pursuit of its objectives.

Several other authors have used SVAR´s to identify structural shocks. Blanchard and Watson (1986) identified a VAR by restricting the contemporaneous correlations of the one-step-ahead forecast errors. They concluded that US fluctuations are due to fiscal, demand, and supply shocks in roughly equal proportions. Blanchard and Quah (1989, 1993) were the first using long-run restrictions to identify VAR´s. After assuming that demand shocks have zero long-run impact on GDP, they find that demand shocks are the primary source of US fluctuations at business cycle frequencies. By contrast, King et al. (1991), who use a combination of long and short-run restrictions to identify their VAR´s report that nominal shocks have very little importance and find evidence of at least two separate real shocks. Gali (1992) examines a structural VAR of the IS-LM variety for the US economy. He assumes there are four shocks: supply, money demand, money supply, and a fiscal shock, i.e. three types of demand shocks, and one supply shock. Identification is achieved through a combination of long-run and short-run restrictions. He finds both types of shocks important, but supply shocks are dominant: 70 percent of GDP variability at business cycle frequencies is accounted for by supply shocks.

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countercyclical domestic fiscal policy. The *Growth and Stability Pact* which has been introduced as a requirement for sound long-run monetary conditions would imposes a tight upper bound on the deficit to GDP ratio.

[5] At this point, it is worth entering a caveat. The new common currency and the new monetary policy regime seem to imply considerable uncertainty about the transmission mechanism of supply, demand and nominal shocks. One issue is whether price- and wage-setting behaviour, their inertia and their sensitivity to output gaps and unemployment will change in the future. Another issue is whether the sensitivity of GDP and unemployment to interest rate changes will change. Finally, expectations formation might change in the new circumstances, thereby making old relations unstable. The introduction of the euro will arguably mainly have consequences in the financial sector, by increasing financial integration and financial competition. On the other hand, considerable integration has already taken place over the last decade. Given this, the effects on aggregate supply and demand relations may be much less dramatic and more gradual, and the construction of conditional forecasts less difficult, than it appears at first sight.

SVAR models with long-run restrictions have also been used by Ahmed et al. (1993), Ahmed and Park (1994), Clarida and Gali (1994), Canzoneri et al. (1996) and Thomas (1997) to examine evidence on the sources of macroeconomic shocks in other countries. They generally find that a very high proportion of GDP innovations can be attributed to real shocks. They also find that a high proportion of innovations to the real exchange rate are accounted for by real shocks.

This paper considers the identification scheme of Clarida and Gali (1994) to discover the determinants of GDP and real exchange rate innovations in Euroland vs. the UK. The remainder of the paper is organised as follows. Section 2 contains a brief sketch of the underlying theoretical model. Section 3 presents the econometric methodology to SVAR identification. The data and the empirical results are presented in Section 4 concentrating upon accumulated impulse response functions and forecast error variance decompositions. Finally, a brief summary is given in Section 5.

2. The Theoretical Setup

The model is a stochastic version of the open economy Mundell-Fleming-Dornbusch model and focuses on short- and medium-term price-output dynamics.[6] The model assumes the presence of price rigidities in the short-run, while positing the neutrality of money in the long-run. All variables except interest rates are natural logarithms and represent Euroland relative to UK levels. For example, $y_t = y_t^{Euroland} - y_t^{UK}$. The IS equation is defined as

$$(1) \qquad y_t^d = d_t + \eta q_t - \sigma \left(i_t - E_t \left(p_{t+1} - p_t \right) \right)$$

where y_t^d is relative aggregate demand, d_t is a relative demand shock, i_t is the difference between Euroland and UK nominal interest rates, and p_t denotes the relative price of output. The real exchange rate is defined as $q_t = (s_t - p_t) = (s_t - p_t^{Euroland} + p_t^{UK})$ where the nominal exchange rate s_t denotes the euro price of sterling. $E_t(p_{t+1} - p_t)$ is the relative inflation rate expected in t to prevail in $t+1$. According to equation (1), Euroland output relative to UK output is increasing in the real exchange rate and the relative demand shock and is decreasing in the real interest rate differential. The standard LM equation in (2) depends positively upon relative output and negatively upon the interest rate differential.

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[6] The approach draws on papers by Obstfeld (1985), Canzoneri et al. (1996), Clarida and Gali (1994) and Thomas (1997).

(2) $m_t - p_t = y_t - \lambda i_t$

The relative interest rate is determined according to the interest parity condition

(3) $i_t = E_t(s_{t+1} - s_t)$

Finally, the relative price level in period t is a weighted average of the expected market-clearing price and the price that would actually clear the output market in period t, p_t^e.

(4) $p_t = (1 - \theta) E_{t-1} p_t^e + \theta p_t^e$

Before solving the model, one has to specify the stochastic processes that govern the relative supply of output, y_t^s, the relative demand shock, d_t, and relative money m_t. Clarida and Gali (1994) postulate that the two-country model is driven by three structural shocks: supply shocks (ε_s), non-monetary demand shocks (ε_d) and nominal (monetary) shocks (ε_n).[7] We assume random walks for y_t^s and m_t while the demand shock has a permanent and a transitory component. In particular, it is assumed that a fraction γ of any demand disturbance in t-1 is expected to be reversed in t.

(5) $y_t^s = y_{t-1}^s + \varepsilon_{s,t}$

(6) $m_t = m_{t-1} + \varepsilon_{n,t}$

(7) $d_t = d_{t-1} + \varepsilon_{d,t} - \gamma \varepsilon_{d,t-1}$

where ε_{st}, ε_{dt}, ε_{nt} are orthogonal iid mean-zero shocks. The long-run RE flexible-price equilibrium of the model ($\theta = 1$) can then be represented by the equations:[8]

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[7] Non-monetary demand shocks could stem from variations in government spending or shifts in the consumption or investment functions.

[8] Since the analytical framework is borrowed from Clarida and Gali (1994) and Obstfeld and Rogoff (1996), Chapter 9, it is presented rather briefly. The interested reader may find further details concerning the mechanics and intuition of this model in the above mentioned references.

(8) $\quad y_t^e = y_t^s$

(9) $\quad q_t^e = \dfrac{\left(y_t^s - d_t\right)}{\eta} + \dfrac{\sigma\gamma\varepsilon_{d,t}}{\eta(\eta+\sigma)}$

and

(10) $\quad p_t^e = m_t - y_t^s + \dfrac{\lambda\gamma\varepsilon_{d,t}}{(1+\lambda)(\eta+\sigma)}$

In the long-run RE equilibrium, the levels of relative output, the real exchange rate and the relative price levels are determined by the three underlying shocks ε_s, ε_d and ε_n. An interesting feature of the system is that it triangular. Clarida and Gali (1994) then solve the model for the short-run equilibrium with sluggish price adjustment. The exact degree of "rigidity" is indexed by $(1-\theta)$. The short-run price setting rule is given

(11) $\quad p_t = p_t^e - \left(1-\theta\right)\!\left(\varepsilon_{n,t} - \varepsilon_{s,t} + \alpha\gamma\varepsilon_{d,t}\right)$

where $\alpha \equiv \lambda(1-\lambda)^{-1}(\eta+\sigma)^{-1}$. In response to a positive demand or nominal shock, the price level rises but less than the flexible price p_t^e. A positive supply shock decreases the price level but again less than the flexible price p_t^e. The real exchange rate under sluggish price adjustment can be represented by

(12) $\quad q_t = q_t^e + v\left(1-\theta\right) + \left(\varepsilon_{n,t} - \varepsilon_{s,t} + \alpha\gamma\varepsilon_{d,t}\right)$

where $v \equiv (1+\lambda)(\lambda+\eta+\sigma)^{-1}$. Contrary to the RE equilibrium with flexible prices, nominal shocks have a temporary impact upon the real exchange rate. Finally, the short-run IS curve is given by

(13) $\quad y_t = y_t^e + \left(\eta+\sigma\right)v\left(1-\theta\right) + \left(\varepsilon_{n,t} - \varepsilon_{s,t} + \alpha\gamma\varepsilon_{d,t}\right)$

Contrary to the flexible-price-equilibrium, not only supply shocks but also demand shocks and nominal shocks boost relative output in the short-run. The overall response of the three variables to the underlying structural shocks can then be described as follows: A positive supply shock ε_s increases (decreases) output (the price level) in the long-run. Additionally, the excess supply of

domestic goods leads to a depreciation of the real exchange rate. A positive demand shock ε_d creates a temporary (permanent) increase in output (the price level) and results in an appreciation of the real exchange rate. Finally, a positive nominal shock lowers the home interest rate and leads to a temporary increase in output and a temporary depreciation of the real exchange rate. Over time both variables will return to their pre-shock level. On the contrary, the domestic price level will increase permanently after a demand shock.

3. From the VAR Model to the SVAR Model

Disregarding deterministic variables for simplicity, the model above implies that the trivariate system can be written as

$$(14) \quad \Delta x_t = A(L)\varepsilon_t$$

where Δ is the first-difference operator, $x_t = (y_t, q_t, p_t)'$, $\varepsilon_t = (\varepsilon_{st}, \varepsilon_{dt}, \varepsilon_{nt})'$ and $A(L) = A_0 + A_1 L + A_2 L^2 + ...$ is the matrix polynomial in the lag operator. ε_t is serially uncorrelated and $E[\varepsilon_t \varepsilon_t']$ is normalised to the identity matrix. The lag polynomials are assumed to have absolutely summable coefficients. It is assumed that the structural shocks are orthogonal and their variances are normalised to unity. The VMA representation of the standard VAR model is given by

$$(15) \quad \Delta x_t = C(L)u_t$$

where $C(L) = C_0 + C_1 L + C_2 L^2 + ...$, $u_t = (u_{st}, u_{dt}, u_{nt})'$ is a vector of reduced form disturbances with $E(u_t) = 0$ and $E[u_t u_t'] = \Omega$. As is well-known, VAR residuals are generally correlated across equations, reflecting their joint dependence on common underlying shocks as well as the direct contemporaneous dependence of the variables on each other.[9] In order to obtain the structural residuals, it is necessary to purge from the residuals of each variable of the VAR the shocks which are derived from the other variables. In order to identify the three underlying structural shocks we employ long-run restrictions in the tradition of Blanchard and Quah (1989, 1993). The sequence of C_i matrices can be obtained by inverting the VAR representation of Δx. When comparing the structural model to the reduced form model, note that for $j = 0$ $A(0)\varepsilon_t = u_t$ because $C(0) = I$. Lagging this expression j periods yields $A(j)\varepsilon_{t-j} = C(j)u_{t-j}$, so that $A(j) =$

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[9] VAR´s are therefore essentially subject to the "garbage in, garbage out" rule. Statements about impulse response functions are vacuous if it is unclear what one is actually estimating.

C(j)A(0). Thus, the structural model can be obtained by post-multiplying the VMA representation *C(L)* by the *A(0)* matrix, i.e. the SVAR model is fully identified by *A(0)*. Note further when *A(1)* is triangular the calculation of *A(0)* is simplified. Specifically, for *j = 1* the above derivation shows that *A(1) = C(1)A(0)* and using the fact that *A(0)A(0)' = Ω* yields

$$(16) \quad A(1)A(1)' = C(1)\Omega C(1)'$$

In other words, *A(1)* can be obtained as the Choleski decomposition of the matrix *C(1)ΩC(1)'*. It is well-known that the Choleski decomposition is unique up to the signs of the diagonal elements. *A(0)* is then obtained as *C(1)⁻¹A(1)*. That is the strategy which we will follow here to identify the structural residuals. The long-run representation of (14) can be written as

$$(17) \quad \begin{pmatrix} \Delta y_t \\ \Delta q_t \\ \Delta p_t \end{pmatrix} = \begin{pmatrix} A_{11}(1) & A_{12}(1) & A_{13}(1) \\ A_{21}(1) & A_{22}(1) & A_{23}(1) \\ A_{31}(1) & A_{32}(1) & A_{33}(1) \end{pmatrix} \begin{pmatrix} \varepsilon_s \\ \varepsilon_d \\ \varepsilon_n \end{pmatrix}$$

where *A(1)* is the long-run effect of ε_t on Δx_t. Using Clarida and Gali´s (1994) identifying assumptions, the long-run restrictions imposed on the model are $A_{12} = A_{13} = A_{23} = 0$.[10] These three restrictions make the *A(1)* matrix triangular and the system is exactly identified. The empirical results for this methodology are the subject of the next section.

4. Empirical Results

We turn next to empirical application of the preceding ideas. We will examine the trivariate structural VAR given above for Euroland and the UK. The data for this study are quarterly beginning in 1980:1 (before differencing and lags) and ending in 1997:4. Euroland consists of the following ten countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal and Spain. This comprises the entire Euroland except Luxembourg, for which not all of the required data are available. The Euroland income and price variable is defined as real GDP (in 1990 prices) and the GDP deflator (index 1990 = 100). For most of the smaller countries the annual GDP data are interpolated from

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[10] Thus, identification of the structural shocks is fundamentally based on the idea that demand shocks tend to push prices and output in the same direction, while supply shocks push them in opposite directions.

annual frequency to quarterly frequency using the quadratic-linear form of the dynamic programming algorithm.[11] The income variables are seasonally adjusted either at the national level or using X11. In constructing Euroland-wide aggregates we have used the purchasing power parities from 1990 to convert national currencies into Deutschmarks. Then Euroland-wide values for GDP were constructed by adding up the converted national values. Finally, the Euroland GDP deflator was created through weighting the national rates by national real GDP to Euroland real GDP, and adding them up. The corresponding GDP and GDP deflator data for the UK were obtained from *Economic Trends Annual Supplement*. Finally, the nominal exchange rate s_t is approximated by the ECU/sterling exchange rate.[12]

The model and the empirical methodology presented above impose the restriction that the three series y_t, q_t, and p_t are I(1) and that there exists no cointegrating relationship among them. Before developing and estimating the model, therefore, the data need to be examined for nonstationarity and possible cointegration features. We first checked for stationarity of the variables by means of the the augmented Dickey-Fuller (ADF) and the Perron (1997) tests. Unlike the ADF tests, the Perron (1997) test is a statistical procedure which allows for a break in the deterministic trend function. The important thing about the procedure is that the date of the possible change is not fixed a priori but is considered as unknown.

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[11] For details, see Bertsekas (1976), pp. 70-72. The data have been extracted from the *International Financial Statistics (IFS)* database.

[12] Prior to the announcement of the eleven Euroland countries, the ECU was used as an indicator of what the euro´s value would have been, had it existed. Now that the Euroland countries are known, it would be possible to create ex-post a "synthetic euro" based on the eleven currencies that it has replaced. A conceptual concern, however, is that the properties of this "synthetic euro" may not be representative of the new currency, since the "synthetic euro" is a weighted average of currencies that in the past moved relative to each other. See IMF (1998), chapter V.

Table 1: ADF Unit Root Tests

Test Statistic	ADF Regressions without Trend	ADF Regressions with a Linear Trend
Series y_t		
ADF(1)	-2.50	-2.11
ADF(2)	-2.68	-2.46
Series q_t		
ADF(1)	-2.22	-2.16
ADF(2)	-2.09	-1.72
Series p_t		
ADF(1)	-0.37	-2.18
ADF(2)	-0.74	-2.29

Notes: All variables are in logs; the estimation period is 1981Q1 - 1997Q4 ; ADF(k) is the augmented Dickey-Fuller *t*-statistic calculated with truncation lag *k* and a drift term. The MacKinnon critical values for the second (third) column are -2.91 (-3.48) at the 5% level.

Table 2: Perron (1997) Unit Root Tests

Series	Model	T_b	k	α	t_α
y_t	I1	1990Q1	4	0.88	-5.00
	I2	1993Q1	11	0.82	-4.98
q_t	I1	1996Q1	1	0.79	-4.81
	I2	1994Q3	1	0.72	-5.07
p_t	I1	1985Q3	10	0.69	-5.50
	I2	1985Q3	12	0.69	-5.61

Notes: Under the first model (I1) an innovational outlier with a change in the intercept is allowed at time T_b. Under the second model (I2) both a change in the intercept and the slope are allowed at time T_b. The break date T_b is determined endogenously as that date which minimizes the *t*-statistic for testing $\alpha = 1$. The truncation lag parameter k is chosen using a general to specific recursive procedure based on the *t*-statistic of the coefficient associated with the last lag in the estimated autoregression. The simulated 5% (10%) critical values for the first model (the second model) are -5.23 (-4.92) and -5.59 (-5.29), respectively. See Perron (1997) for details.

Since the test statistics in Table 1 and 2 are generally smaller than their reported critical values, we cannot reject the hypotheses of nonstationarity of y_t, q_t and p_t. The results for Johansen cointegration tests are given in Table 3. At the five percent level of significance, the results suggest not to reject the null hypothesis of non-cointegration. This is in accord with the underlying theoretical which assumes that there are three stochastic trends (permanent shocks) in the relative GDP, relative GDP deflator and real exchange rate data.

Table 3: Cointegration Tests

LR Test Based on Maximal Eigenvalue of the Stochastic Matrix			
Null	Alternative	Statistic	95% Critical Value
r = 0	r = 1	13.22	21.12
r ≤ 1	r = 2	9.19	14.88
r ≤ 2	r = 3	3.17	8.07
LR Test Based on Trace of the Stochastic Matrix			
Null	Alternative	Statistic	95% Critical Value
r = 0	r = 1	25.59	31.54
r ≤ 1	r = 2	12.37	17.86
r ≤ 2	r = 3	3.17	8.07
Choice of the Number of Cointegrating Relations Using Model Selction Criteria			
Rank	Maximized LL	SBC	HQC
r = 0	630.23	604.73	612.87
r = 1	636.84	600.73	612.24
r = 2	641.44	598.95	612.50
r = 3	643.03	598.42	612.65

Notes: The Cointegration Tests have been calculated with unrestricted intercepts and no trends in the VAR, and using Osterwald-Lenum (1992) tables. The optimal lag length ($k = 2$) has been determined using sequential LR-Tests. SBC = Schwarz Baysian Criterion; HQC = Hannan-Quinn Criterion.

Table 4: Residual Analysis

Variable	Normality	LB (16)	Arch (16)
y_t	4.69 (0.10)	17.17 (0.24)	15.56 (0.48)
q_t	6.84 (0.03)	13.52 (0.48)	14.55 (0.55)
p_t	0.74 (0.68)	6.94 (0.94)	12.37 (0.72)
Testing for Joint Residual Autocorrelation			
Statistic	$\chi^2(117) = 111.14$ (0.63)		
Testing for Multivariate Normality			
Statistic	$\chi^2(2) = 6.89$ (0.07)		

Notes: The Jarque-Bera normality test is distributed $\chi^2(2)$. LB(k) is the Ljung-Box test for residual autocorrelation, distributed $\chi^2(k)$. ARCH is the LM test for residual ARCH. The test for multivariate normality is the Shenton and Bowman (1977) test with a modification of that test as proposed in Doornik and Hansen (1994). The statistic is jointly testing for zero skewness and zero excess kurtosis in the residuals from each equation and is tested against a $\chi^2(2)$ distribution. The joint test for residual autocorrelation is the Portmanteau joint test for white noise residuals. The *p*-values are given in parentheses.

Next, the stationary reduced-form VAR model was estimated with OLS and lag truncation order $k = 2$ since the residual analysis in Table 4 below indicates that the reduced-form residuals are normal and not serially correlated.[13]

With what degree of confidence can we interpret ε_s, ε_d and ε_n as the " relative aggregate supply", "relative aggregate demand" and "relative aggregate nominal" shock, respectively? The estimated model can be used to answer this question. After mapping the reduced form residuals into the structural (fundamental) shocks, accumulated impulse response functions were calculated showing the effects of the fundamental shocks. These functions simulate the responses of the *level* of the three variables to positive or favourable innovations in each of the structural shocks on average (i.e., over the whole sample period).[14] The horizon (in quarters) is given on the horizontal axis. Several features deserve attention. Figure 1 shows the accumulated impulse response functions to a supply shock. The response of (relative) output to a supply shock builds up gradually until the long-run positive response is achieved at a lag of about three years and stabilises at that level. The responses of relative GDP to demand and nominal shocks in Figure 2 and 3 are positive initially, but fade away to zero. The accumulated response of the relative GDP deflator to a supply shock in Figure 1 is negative, implying that when a supply shock raises output, it lowers the price level. On the contrary, the accumulated responses of Δp_t to a demand or nominal shock are positive. The empirical results therefore support Blanchard and Quah´s (1989, 1993) interpretation: The permanent shock to output acts like aggregate supply causing price and output to move in opposite directions and the temporary shocks behave like aggregate non-monetary demand and monetary shocks causing price and output to move in the same direction.

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[13] As expected, the residuals of the exchange rate equation turned out to be non-normal but the test for multivariate normality was not significant at the 5 % level.

[14] The shocks have been normalised so that each structural form shock equals 1. The dashed lines enclose 90 percent confidence intervals which were calculated using Runkle´s (1987) Monte Carlo simulation method with 250 draws from the posterior distribution . Some experimentation suggested that using more than 250 draws had no impact on the results.

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Figure 1: Accumulated Impulse Responses to a Supply Shock (ε_s)
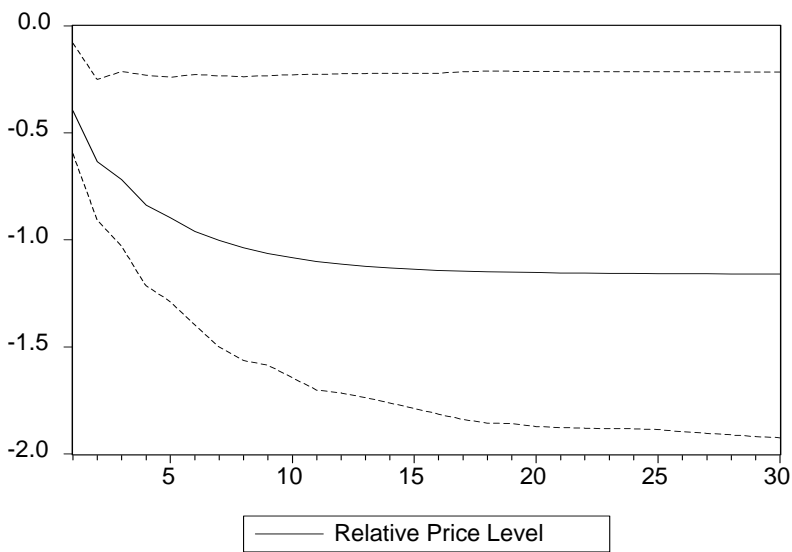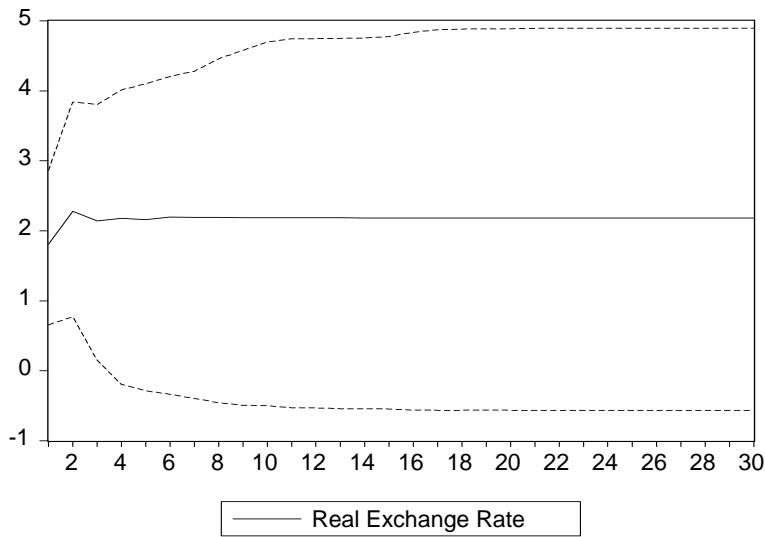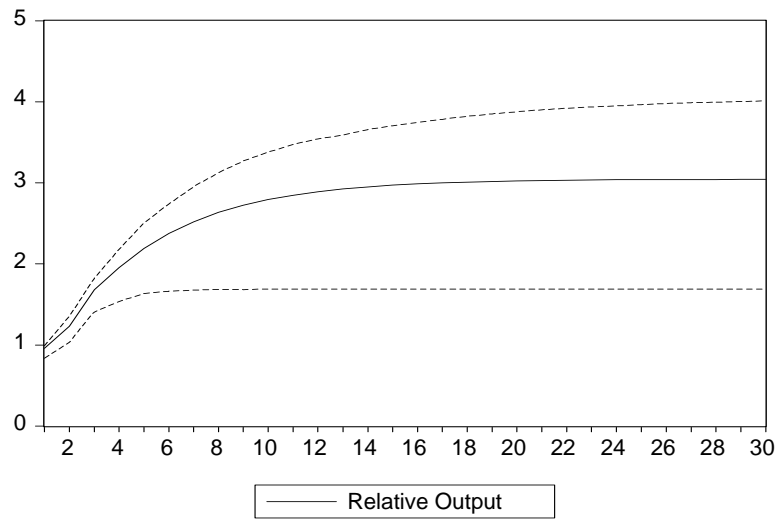

Relative Output

Real Exchange Rate

Relative Price Level

14

Figure 2: Accumulated Impulse Responses to a Demand Shock (ε_d)
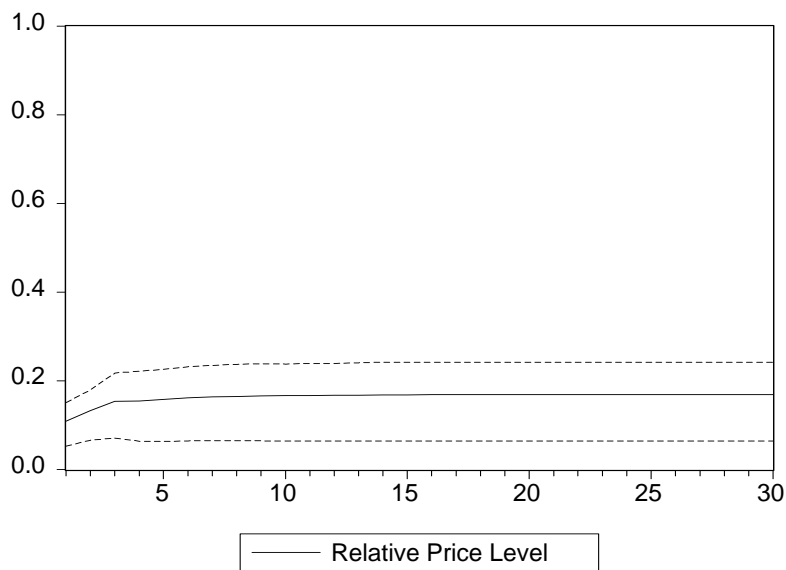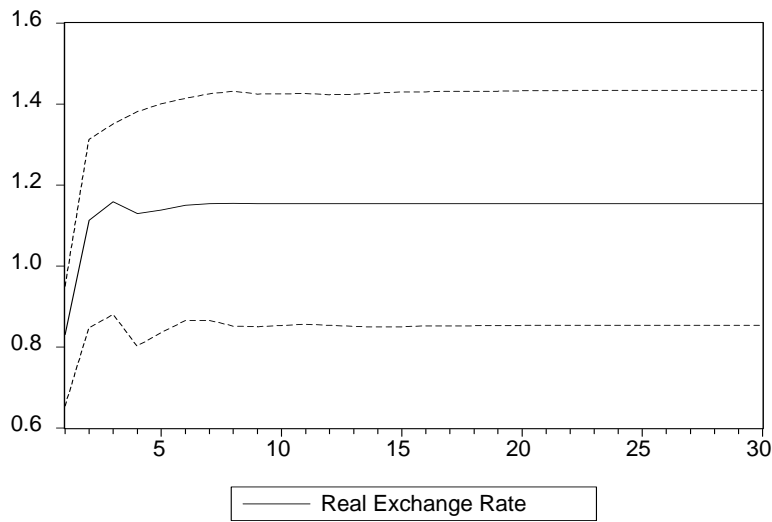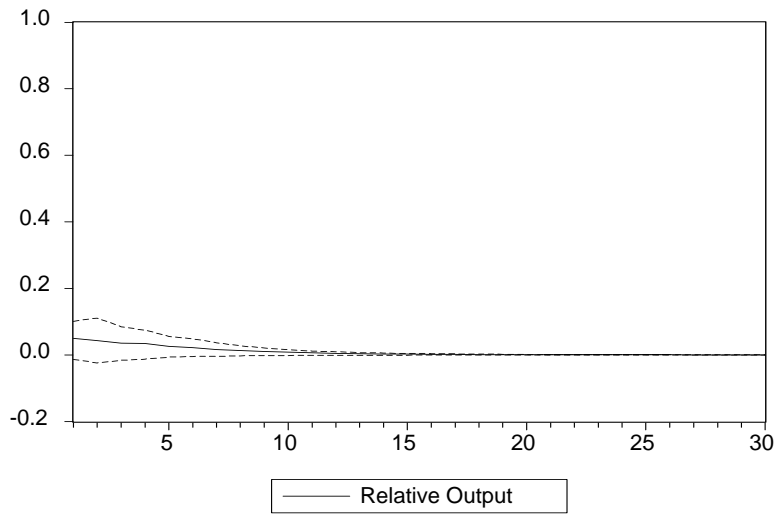

Relative Output

Real Exchange Rate

Relative Price Level
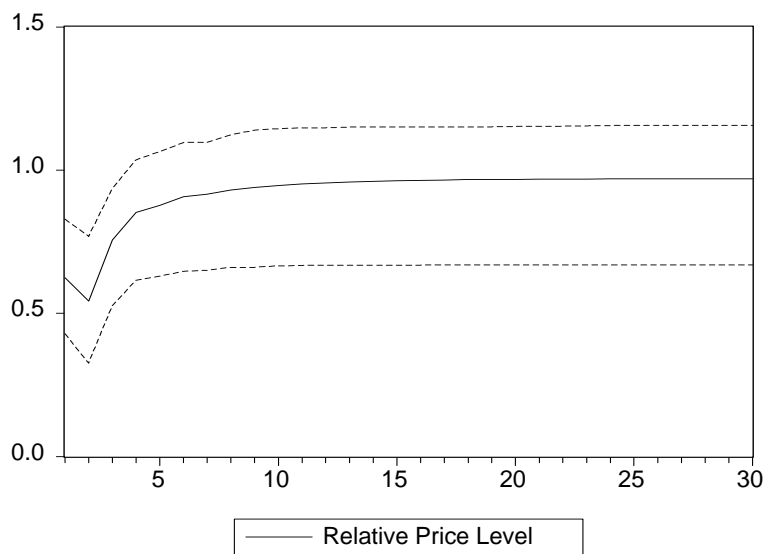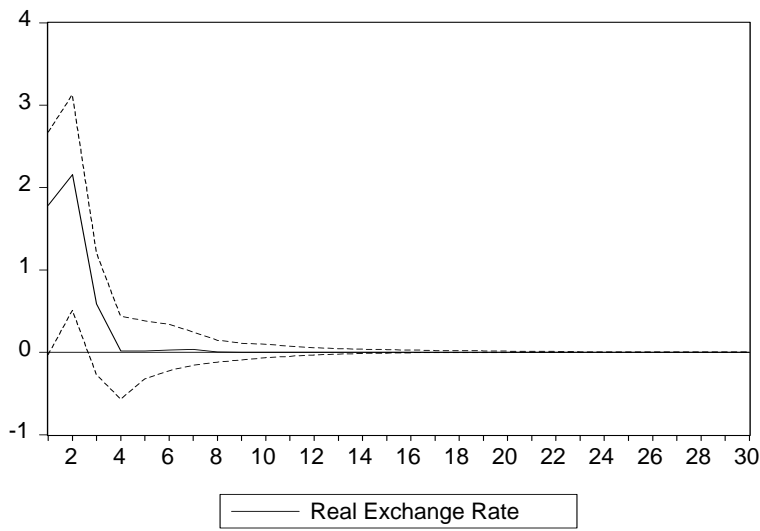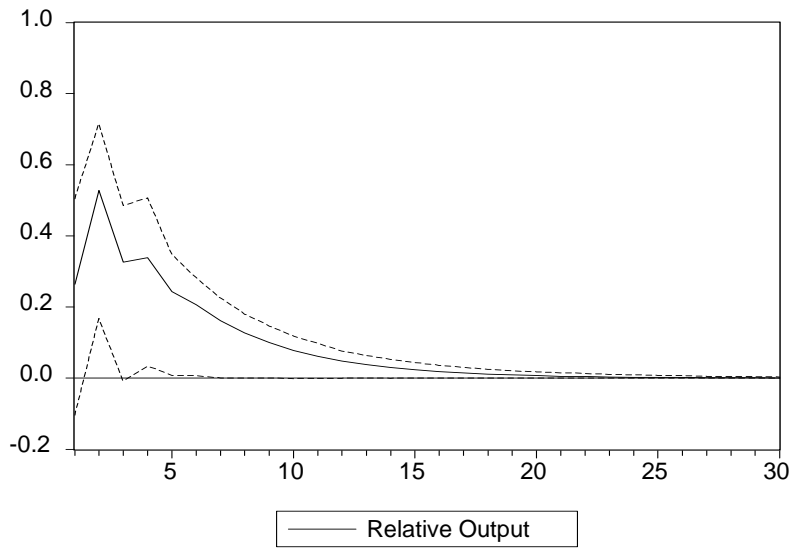
Figure 3: Accumulated Impulse Responses to a Nominal Shock (ε_n)

Relative Output

Real Exchange Rate

Relative Price Level

16

Table 5: Variance Decompositions for the Long-Run SVAR Model

Variable	Quarter(s) Ahead	Shock		
		Supply Shock	Demand Shock	Nominal Shock
Δy_t	1	89.1	3.7	7.2
	5	89.9	2.9	7.2
	10	90.0	2.9	7.2
	15	90.0	2.9	7.2
	20	90.0	2.9	7.1
	25	90.0	2.9	7.1
	30	90.0	2.9	7.1
Δq_t	1	19.3	70.1	10.6
	5	17.8	64.4	17.8
	10	17.8	64.4	17.8
	15	17.8	64.4	17.8
	20	17.8	64.4	17.8
	25	17.8	64.4	17.8
	30	17.8	64.4	17.8
Δp_t	1	33.0	31.6	35.4
	5	33.9	29.6	36.5
	10	34.3	29.4	36.3
	15	34.3	29.4	36.3
	20	34.3	29.4	36.3
	25	34.3	29.4	36.3
	30	34.3	29.4	36.3

The variance decompositions for the SVAR model are shown in Table 5. They provide information on the role played by different structural shocks in explaining the variability of the three series at different horizons. Looking at Table 5, supply shocks account for about 90 percent of the variance of relative output, Δy_t. By contrast, almost none of the variation of Δy_t is explained by (non-monetary) demand and nominal (monetary) shocks. Technological shocks therefore not only dominate variations of GDP in the long-run, but they are also important for short-term output movements. Thus, the results are very favourable to real-business cycle theory. On the other hand, this result contradicts Neo-Keynesian theory which suggests that at least in the short-run output fluctuations should be mainly due to demand shock innnovations.[15] The forecast error variance decompositions for Δp_t indicate that all three structural innovations (ε_s, ε_d and ε_n) contribute in comparable quantities in explaining the variance of relative inflation. Finally, the results from real exchange rate (Δq_t) decomposition suggest that demand shocks and therefore controllable policy

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[15] The result that supply shocks are the most important factor for variation in the forecast errors of relative GDP is very similar to the results in Clarida and Gali (1994).

shocks account for about two-thirds of the variance at all horizons.[16] On the other hand, the role played by supply shocks (nominal shocks) is in the range of 17 - 20 (10 - 20) percent. Given these results, a first conclusion can be outlined. The fact that only 20 percent of the real exchange rate variance is accounted for by ε_s, while 90 percent of the variance of relative output is accounted for by ε_s seems to suggest that the real ECU exchange rate has not played the shock absorber role that the optimal currency literature suggests.[17] In other words, the supply shocks that caused international macroeconomic imbalances do not seem to have been the shocks that were moving real ECU exchange rate and therefore the potential loss of the sterling may have been exaggerated by studies using bivariate SVAR models and focusing exclusively upon demand and supply shocks.[18] One potential explanation for this finding is the high sensitivity of the UK´s trade to real exchange rate changes.[19]

5. Concluding Remarks

Attention has been drawn to some potential drawbacks of EMU for UK macroeconomic policy. In particular, the paper has focused on the diminishing capability that would exist inside EMU to ensure a smooth adjustment in the event of an over- or undervalued real exchange rate. The paper has used a trivariate structural VAR models to trace out the responses to structural supply, demand, and nominal shocks in Euroland vs. the UK over the period 1981Q1 to 1997Q4. The identification of the model is achieved by imposing long-run restrictions, while leaving short-run dynamics to be determined by the data generating process.[20] The observed dynamic adjustment of the variables in response to the shocks is largely consistent with the stylized predictions of the

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[16] The importance of the demand innovations for real exchange rate fluctuations is a possible explanation for the emphasis in the European *Stability and Growth Pact* limiting the fiscal autonomy of Euroland countries by restricting fiscal deficits to 3 percent of GDP.

[17] The degree of real ECU exchange rate variability explained by ε_s even overstates the potential loss of the the sterling vis-à-vis the euro because it is only the nominal component of the real ECU exchange rate that will no longer exist in Euroland.

[18] See, for example, Bayoumi and Eichengreen (1992) and Funke (1997b). The potential loss of the sterling is also exaggerated by studies comparing the variability of real exchange rates within Europe with the variability of relative prices across regions within a given country since this literature has not asked whether the real exchange rates have actually moved in response to the shocks that cause macroeconomic imbalances [see, for example, DeGrauwe and Vanhaverbeke (1991) and von Hagen and Neumann (1994)].

[19] Carlin et al. (1999) find that UK´s exports experience considerably higher sensitivity to real exchange rates than do the EMU core countries.

[20] A major advantage of long-run restrictions is that they do not impose contemporaneous restrictions. Keating (1990) has shown that contemporaneous "zero" restrictions are inappropriate in an environment with forward-looking agents who have rational expectations.

two-country model. The forecast error variance decompositions indicate that most of the variation in relative output is explained by supply shocks while the shocks driving the real ECU exchange rate are mainly non-monetary demand shocks in nature. There is therefore good reason to believe that the UK economy will not be harmed by joining the euro.[21] On the other hand, the costs to the UK of being outside EMU are numerous. First, there is no UK voice in the ECB and Euro11. Until the country becomes a member of Euroland, it will have only second-fiddle status in the poltical concert of Europe. Second, there would be transaction costs. Since membership is going to ensue eventually, and the trasition costs will therefore be incurred in any case, the country will loose out on the benefits of lower transaction costs for a number of years. Before acceding to the single European currency, however, sterling has to join the EU´s exchange rate mechanism for at least two years.[22] Looking ahead, this implies that the government would have to change the instructions to the Bank of England which so far is told to set interest rates to meet an inflation target, not track an exchange rate. An additional message of the paper for private and public decision-makers is that greater prudence and flexibility will be highly desirable in this new environment, in order to minimise the costs of EMU.

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[21] The paper is not concerned with warnings over a safe euro entry level for sterling. Wren-Lewis and Driver (1998) have suggested that sterling´s "fundamental equilibrium exchange rate" against the deutschmark lies between DM 2.10 and DM 2.50. This is well below the rate of DM 2.84 in 1997. It is probable, however, that there will be disagreement between Britain and the euro-zone countries over the exchange rate at which Britain joins the euro. Britain may want sterling to be brought in at a lower rate than euro-zone governments would like. Governments on both sides will want to give companies a one-off pricing advantage.

[22] Participation in the ERM for two years is one of the Maastricht criteria. However, allowances have been made for Finland and Italy, which rejoined the ERM in November 1996, less than two years before positive recommendations for EMU membership were made. Furthermore, it is unclear what the relevant ERM bands for latecomers would be: 2.25% or 15%.

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