Interest Linkages between the US, UK and German Interest Rates: Should the UK join the European Monetary Union?

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ABSTRACT

In light of continuing mixed results in the literature, this paper re-examines the German Dominance Hypothesis (GDH) and considers whether the UK should join the Eurozone . For this purpose short term interest rates relationships between the UK, Germany, the Eurozone and the USA for the period January 1982 to June 2007 are studied. The policy implication of a loss of monetary autonomy for the UK in favour of Germany or the European Central Bank (ECB) would give support to the UK joining the EMU as an economic response. From the early 1980's the Bundesbank's responsibility was to use money growth targets to keep the average inflation rate down in the long run. This long run objective suggests that an appropriate methodology for testing the GDH is to test whether the German stochastic trend is a driving stochastic trend. In other words we determine whether a permanent shock to the German interest rate has a permanent effect on the UK interest rate. To this end the structural shocks in a VECM are identified by imposing long-run restrictions of the type developed in King, Plosser, Stock & Watson (1991). We apply the same techniques to testing whether the UK has suffered a loss of monetary autonomy in favour of the ECB.

JEL Classification Code: C32, C52, E43.

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1. Introduction

The idea that the German central bank conducted monetary policy independently and that other EU countries adjusted to German policy settings, in particular German interest rates, is referred to as the 'German Dominance Hypothesis' (GDH). In an interesting paper Kirchgässner & Wolters (1995) investigate the GDH using cointegration techniques applied to data covering the period 1980 to 1988. They motivate their study by noting that: (i) while it might be thought that autonomy in monetary policy formulation is optimal for a country, it is theoretically possible that dominance by the monetary authority of another reputable and credible country might have economic benefits[1]; (ii) while dominance by one country in the European Monetary System (EMS) was a theoretical possibility, only an empirical study can determine if it actually happened; (iii) there are mixed results in the empirical literature on the GDH; (iv) appropriate econometric methodology applied to relevant data sets may help resolve uncertainty concerning economic hypotheses in general and the GDH in particular. Kirchgässner & Wolters' motivation for studying the GDH is also ours. Focussing in particular on data and methodological issues we note that tests of the GDH which rely on short run causality tests between interest rates, such as those in von Hagen & Fratianni (1990), Kimbris & Miller (1993), and Hassapis et al. (1999) may not be entirely satisfactory because short run causality among interest rates is to be expected, possibly due to the causal influence of variables missing from the model. However, from the early 1980's the Bundesbank's responsibility was to use money growth targets to keep the average inflation rate down in the long run. The Bundesbank was not responsible for every movement in the price level in the short

[1] See for instance the recent discussion in Liu & Pappa (2005).

run. The technique used in this paper is therefore to test whether the German stochastic trend is a *driving stochastic trend*, in other words whether a permanent shock to the German interest rate has a permanent effect on the UK interest rate. The same technique can also be applied to test whether the UK has suffered a loss of monetary autonomy in favour of the European Central Bank (ECB) after the formation of the Eurozone. Consequently tests for cointegration between German, Eurozone, US and UK nominal short term interest rates are performed, using the Johansen procedure, over the pre-German reunification period, the post-reunification period and the Eurozone period. The structural shocks in the VECM are identified by imposing long-run restrictions of the King et al. (1991) (KPSW) type. This methodology appears to be new in the literature devoted to studying the GDH. The period under study is also interesting since it covers the inception of the Eurozone, German reunification, the UK joining the ERM (in September 1990) and a series of exchange rates crises in Europe between 1992 and 1993. If it is found that the UK has lost some control over its monetary policies during the period preceding or following the formation of the European Monetary Union (EMU), a major policy implication would be that it might be advantageous for the UK to join the EMU and become one of the decision makers in the ECB. Lack of empirical support for the loss of monetary autonomy may, conversely, weaken the case for Britain joining the EMU.

This paper is organised as follows. We initially focus on the GDH. Section 2 presents a brief review of previous studies of the GDH and also summarizes our empirical methodology. Section 3 implements the methodology and presents the empirical results for the GDH tests and also the Eurozone dominance hypothesis test. Section 4 offers some concluding remarks.

2. An Error Correction Model of Interest Rates Linkages Between UK, Germany, Eurozone and USA

2.0 Previous literature on the GDH

There have been mixed results from studies of the GDH. For instance support for the GDH is found by Giavazzi & Giovannini (1989), Artis & Nachane (1990), Karfakis & Moschos (1990), Kirchgässner & Wolters (1993), Henry & Weidman (1994), Hassapis et al. (1999), Caporale & Pittis (1995), Hansen (1996), Ma & Kanas (2000), Zhou (2003), Muller (2003), Barassi et al. (2005), Baum & Barkoulas (2006) and Feridun (2006). In contrast the GDH is rejected by de Grauwe (1989), Fratianni & von Hagen (1990, 1990a), von Hagen & Fratianni (1990), Katsimbris (1993), Kanas (1997), Katsimbris & Miller (1997), Uctum (1999), Caporale & Williams (2000) Dick et al. (2000), Laopodis (2001), Camarero & Ordonez (2001). Gardner & Perraudin (1993), Katsimbris & Miller (1993), Kirchgässner & Wolters (1995), Artis & Zhang (1998), Cherif (2002), Bajo-Rubio & Montavez-Garces (2002), Kirchgässner (2003), Laopodis (2004), Holmes (2005) and Booth & Cetin (2005) are equivocal concerning the validity of the GDH. In light of the state of the literature, we are motivated to study the GDH using a somewhat novel empirical methodology.

2.1 Formulating the German Dominance Hypothesis

A standard way to test the GDH is to note that if the hypothesis is true then interest rates of other EMS countries will be cointegrated with the German interest rate, and that the German interest rate will play a leading or 'causal' role in the EMS, (see Baum & Barkoulas 2006, 470). However, Caporale et al. (1996) have argued that cointegration alone may not be informative in this context because it only implies that a linear combination of interest rates is stationary and not that the interest rates converge. Although we adopt the cointegration approach, one innovation in this paper is to argue that the concept of ‘dominance’ embodied in the GDH can be examined by studying the *timing* and *shape* of impulse responses to innovations and shocks. A second innovation is that, given the Bundesbank’s long run inflation objectives, an appropriate test of the GDH is to test whether the German stochastic trend is a driving stochastic trend. Equivalently we ask whether a permanent shock to the German interest rate has a permanent effect on the UK interest rate.

2.2 Institutional and historical context

An essential backdrop to any empirical study of interest rate behaviour in Europe during the period preceding the formation of the EMU is an understanding of the peculiar nature of the European Exchange Rate Mechanism (ERM) with its implication for the exchange rate arrangements and monetary policy regimes between the countries in the system. Essentially rules based, the ERM attempted to limit the scope for discretionary policy action on the part of member states. There is a voluminous literature on this subject, (see for instance Frenkel & Goldstein, 1991; Goodhart, 1990; Bovenberg et al., 1991; Giovannini, 1995; Argy, 1994). Following the Single Europe Act of 1990-1992 and the elimination of capital controls, participants in the EMS were under a regime of quasi-fixed exchange rates and full capital mobility, a situation not compatible with independent monetary policies. In such an environment the EMU could be considered as a response to this loss of independence, since member countries could regain some control through their voting power in the European Central Bank. The ERM was understood to be asymmetric in its operation with Germany playing the dominant role. The German leadership hypothesis argues that during the pre-Eurozone period the Bundesbank set its monetary policy to achieve internal price stability in the long run while the peripheral countries varied their monetary policies so as to hold to the Deutsch mark peg (Artis & Nachane, 1990; Goodhart, 1990). An implication of this is that member states in the ERM, other than Germany, lost their independence in the setting of monetary policy. The UK joined the ERM only in September 1990. Beginning in September 1992 exchange rates markets in Europe were shaken by a succession of crises in which speculative attacks saw the withdrawal of a number of currencies from the ERM including Sterling.

2.3 Econometric methodology

To test the GDH we begin by specifying a general structural vector autoregressive model with Gaussian errors as follows[2]:

$$Az_t = A_1 z_{t-1} + ... + A_k z_{t-k} + \mu + \psi D_t + v_t \quad (1)$$

where z_t is an n×1 vector of variables, $v_t \sim NIID(0,I)$ and D_t is a vector of deterministic variables (seasonal dummies, intervention dummies, etc...). The reduced form of the structural model (1) is:

$$z_t = A_1^* z_{t-1} + ... + A_k^* z_{t-k} + \mu^* + \psi^* D_t + \varepsilon_t \quad (2)$$

where $A_i^* = A^{-1} A_i$, $\mu^* = A^{-1}\mu$, $\psi^* = A^{-1}\psi$, $\varepsilon_t = A^{-1} v_t$, and $\text{cov}(\varepsilon_t) = A^{-1}(A^{-1})' = \Sigma$.

Equation (2) can be re-parameterized in the error-correction form as:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + ... + \Gamma_{k-1} \Delta z_{t-k+1} + \Pi z_{t-1} + \mu^* + \psi^* D_t + \varepsilon_t \quad (3)$$

where $\Pi = (A_1^* + ... + A_k^* - I)$ and $\Gamma_i = -(A_{i+1}^* + ... + A_k^*)$.

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[2] Fisher et al. (1995) and Fisher (1996) provide an exposition of the KPSW procedure to identify the structural shocks with permanent effects in an estimated VECM.

The model in (3) can also be rewritten in a vector moving average form:

$$\Delta z_t = C(L)(\varepsilon_t + \mu^* + \psi^* D_t) \qquad (4)$$

where C(L) can be developed as C(L) = C(1) + C*(L) (1 - L) for some polynomial C*(L). From (4) we obtain:

$$z_t = z_0 + C(1)\sum_{i=1}^{t}\varepsilon_i + C(1)\mu^* t + C(1)\sum_{i=1}^{t}\psi^* D_i + C^*(L)(\varepsilon_t + \psi^* D_t) \qquad (5)$$

Subject to identification, a structural moving average representation can be derived from (5):

$$\Delta z_t = C(L)(A^{-1}v_t + \mu^* + \psi^* D_t) = \Phi(L)v_t + C(L)(\mu^* + \psi^* D_t) \qquad (6)$$

where $\Phi(L) = C(L)A^{-1}$.

Note that C(1) measures the permanent effects of the reduced form shocks on the levels of the series and that $\Phi(1)$ measures the permanent effects of the structural shocks on the levels of the series. In our particular study we have three series (n=3): z_{1t} = US interest rate, z_{2t} = German interest rate, and z_{3t} = UK interest rate. Assuming that at most one cointegrating relationship among those three series can be found to identify the structural shocks we can impose as in Fisher (1996) that:

$$\Phi(1)v_t = [K|0]v_t \qquad (7)$$

where K is a (3x2) matrix with columns orthogonal to the cointegrating vector and 0 is a (3x1) null vector. Those identifying restrictions impose the condition that there are two structural shocks with permanent effects given by the columns of K and there is one transitory structural shock. The A matrix in (1) can be partitioned conformably to $\Phi(1)$ with its first two rows as A_m. Then we can derive:

$$C(1) = \Phi(1)A = KA_m \qquad (8)$$

and

$$C(1)\Sigma C(1)' = KK' \tag{9}$$

We need one additional restriction on the parameters in K to identify the shocks with permanent effects. We assume that K is lower triangular, thus imposing the condition that the US interest rate is affected by one structural shock only in the long-run. Since $C(1)\Sigma C(1)'$ is not of full rank we need to rewrite K as K= $\tilde{K}\theta$ where the columns of $\tilde{K}$ are specified a priori and are orthogonal to the cointegrating vector. θ is a (2x2) lower triangular matrix of parameters to be estimated. We denote by D the (2x3) matrix which solves $C(1) = \tilde{K}D$: $D = (\tilde{K}'\tilde{K})^{-1}\tilde{K}'C(1)$. Note that for such a matrix $\tilde{K}D\varepsilon_t = \tilde{K}\theta v_{m,t}$ where $v_{m,t}$ = $(v_{1t} \quad v_{2t})$' and $D\Sigma D' = \theta\theta'$. The lower triangular Choleski decomposition of $D\Sigma D'$ yields the unknown elements of θ which can be used to derive K. The two structural shocks with permanent effects are given as $v_{m,t} = A_m \varepsilon_t$ where $A_m = \theta^{-1}D$. The dynamic impacts of the two structural shocks with permanent effects are obtained from the first two columns of $\Phi(L)$ which are given by:

$$\Phi(L)_m = C(L)\Sigma A_m' \tag{10}$$

Finally consider the computation of C(L) given the parameters in (3). Yang (1998) shows that :

$$C(L) = [\beta_\perp, \beta(1-L)][\Gamma(L)\beta_\perp, B(L)\beta]^{-1} \tag{11}$$

$\beta_\perp$ is an nx(n-r) matrix such that $\beta'\beta_\perp = 0$, $\Gamma(L) = I_3 - \sum_{j=1}^{k-1}\Gamma_j L^j$ and

$B(L) = \Gamma(L)(1-L) + \Pi L$.

In the presence of cointegration, B(L) cannot be directly inverted. Using the method described in Yang (1998) to invert an invertible matrix polynomial, $[\Gamma(L)\beta_{\perp}, B(L)\beta]^{-1}$ can be computed and consequently C(L) and the dynamic impacts on z_t of the two structural shocks with permanent effects can also be derived.

3. Empirical Results

3.1. The Data

Figure 1 displays, respectively, the monthly short term interest rates taken from the OECD and International Financial Statistics for UK, Germany, Eurozone and the United States between January 1982 and June 2007.

[Figure 1 about here]

For the UK and the United States, the series is the certificates of deposit, for Germany the 3-month FIBOR until December 1998 and the 3-month Euribor from January 1999. The Phillips-Perron, Augmented Dickey-Fuller and KPSS tests[3] for unit roots were performed and are available on request. The series were also tested for second order unit roots (I(2)). All series were found to be I(1).

3.2. Pre-German Reunification Period: January1982 - December 1989

This period also predates the UK joining the ERM. The model in (3) is estimated using the logarithms of the short term interest rates for Germany, the UK and the USA. In the UK interest rates fluctuated from 14% in early 1982 to 8% in 1986 and back to 15% in late 1989. To pick up some of these large fluctuations we included

[3] For descriptions of these tests see, respectively, Phillips & Perron (1988), Dickey & Fuller (1979) and Kwiatowski et al. (1992).

four dummy variables taking the value 1 in August 1982, July 1984, January 1985, and June and July 1988. Finally one dummy variable taking the value -1 in October and 1 in November 1987 is also necessary to pick up the October 1987 stock market crash.[4] The number of lags is set to k = 2, a value chosen using the LR tests for reducing the number of lags. The minimisation of the usual information criteria and the autocorrelation of the residuals were also considered in the choice of k. The constant is not restricted to the cointegrating space (such a choice was confirmed by testing the joint hypothesis of both the rank order and the deterministic components). Residual diagnostics statistics for the VAR model are available on request. There was no evidence of autocorrelation, non normality or ARCH effects for the unrestricted model. This was also confirmed by histograms and correlograms of the estimated residuals. In Table 1 the trace statistics are presented together with the Bartlett corrections (Johansen, 2000).

[Table 1 about here]

On the basis of both statistics it is possible to accept that there is no cointegration. As there is no cointegrating relationship, an unrestricted VAR model in first difference would be preferred to a VECM model. In that sense we can say that there is no long run causation among those three series. From this analysis we conclude that there was no sign of German dominance in the long run over the period prior to German reunification, i.e. January 1982 to December 1989.

[4] The program CATS in RATS was used to obtain all the estimation results reported in the paper (Dennis, 2006).

3.3. Post Reunification Period: January 1990-December 1998

During the January 1990 to December 1998 period, the UK was a member of the ERM from January 1990 to September 1992. We start the post-reunification period from January 1990. For the January 1990-December 1998 period the vector error-correction model in (3) is estimated. Four dummy variables taking the value 1 in July, September and October 1992 and January 1993 capture the ERM crises. The number of lags is set to k = 2. The constant is not restricted to the cointegrating space. Residual diagnostics statistics for the VAR model are available on request. There was no evidence of autocorrelation, non normality or ARCH effects as reflected in the univariate statistics. In Table 2 the trace statistics are presented together with the Bartlett corrections (Johansen 2000). The estimated cointegrating vector β and the speed of adjustment vector α are also given in Table 2.

[Table 2 about here]

On the basis of both tests it is possible to accept that there is one cointegrating vector. The diagnostic tests for the restricted model are available on request.

As there is one cointegrating relationship, there are two structural shocks which have permanent effects on the levels of the series. We achieve identification of the two structural shocks with permanent effects by imposing the restriction that one of the structural shocks has no long-run effect on the US interest rate. Thus in the long-run, v_{1t} is the only shock which can have an effect on the US interest rate, this shock will be called the US shock. In Table 3 the decomposition of the forecast-error variance is presented at 3-month, 6-month, 12-month, 24-month, 36-month and 90-month forecast horizon.

[Table 3 about here]

In the long-run, the US shock explains around 48.7 per cent of the forecast-error variance of the German rate and 43.6 per cent of the UK short term interest rate. After three months, however, the US shock explains only 0.6% of the German rate and 29% of the UK rate. The second permanent shock v_2, explains after three months, 74.1 per cent of the forecast-error variance of the German short term interest rate and 58.2 per cent of the UK short term interest rate. Therefore we interpret this shock as a German shock since initially it explains most of the forecast-error variance of the German interest rate. In the long run the second permanent shock explains 50 per cent of the German interest rate and 53 percent of the UK interest rates. In that sense we can say that there is no strong evidence of "German dominance" in the long run over the UK during the post-reunification period. In the long run the UK is affected almost equally by the German shock and the US shock.

The lack of support for the GDH found above is confirmed by an impulse response analysis. Figure 2 shows the effect of one standard deviation permanent shocks on the levels of the US, German and UK interest rates together with one standard error confidence band.

[Figure 2 about here]

A one standard error second permanent shock triggers an increase of around 2 per cent for the US interest rate after four months, which settles down to zero after 35 months as expected, given the identification restriction. This same shock increases the German interest rate immediately by around 3 per cent, reaching 3.5 per cent after 15 months. The UK interest rate increases to around 3 per cent after three months and then plateaus at around 2 per cent. It thus appears that post reunification increases to the German rates were not perfectly matched by the UK rates and that there was no need to increase the UK interest rate by more than the German rate to preserve the value of the British pound. This is in accordance with Figure 1 which shows that from 1991 the spread between the UK and the German interest rate is much smaller than between 1983 and 1989. The German interest rate even surpasses the UK rate between August 1992 and June 1994. This is of course explained by the necessity to keep the German rate relatively high in order to raise capital for the reunification of Germany post 1989. The first permanent shock increases the US interest rate by over 5 per cent after five months. The German response is a slow decrease which reaches 5 per cent after 60 periods. The UK interest rate decreases initially by 2 per cent but then increases by just under 2 per cent in the long run. Over that period the US decreased interest rates following the economic down turn in 1990 at a time when the German interest rates increased due to an increase in demands for funds post reunification. By the end of 1993 the US interest rate increased in order to cool an overheated stock market, at the same time the German rate stayed on its downward path. Over the full period, business cycles are not synchronised between the US and Germany and to a lesser degree between the US and the UK.

3.4. Eurozone : June 1999-June 2007

The first five months following the inception of the Eurozone are very volatile, therefore we choose to start our analysis from June 1999. From July 2007 US interest rates dropped sharply due to the sub-prime mortgage crisis. Because of the extreme volatility in financial markets since then we end our sample period in June 2007. For the June 1999-June 2007 period the vector error-correction model in (3) is estimated. The number of lags is set to $k = 2$. The constant is not restricted to the cointegrating space. Residual diagnostics statistics for the VAR model in levels are available on request. There was no evidence of autocorrelation, but some evidence of non normality and ARCH effects as reflected in the univariate statistics. In Table 4 the trace statistics are presented together with the Bartlett corrections. The estimated cointegrating vector β and the speed of adjustment vector α are also given in Table 4.

[Table 4 about here]

On the basis of both tests it is possible to accept that there is one cointegrating vector. The diagnostic tests for the restricted model are also available on request. As there is one cointegrating relationship, there are two structural shocks which have permanent effects on the levels of the series. We achieve identification of the two structural shocks with permanent effects by imposing the restriction that one of the structural shocks has no long-run effect on the US interest rate. Thus in the long-run, v_{1t} is the only shock which can have an effect on the US interest rate, this shock will be called the US shock. In Table 5 the decomposition of the forecast-error variance is presented at 3-month, 6-month, 12-month, 24-month, 36-month and 90-month forecast horizon.

[Table 5 about here]

In the long-run the US shock explains around 48.0 per cent of the forecast-error variance of the Eurozone rate and 63.0 per cent of the UK short term interest rate. After three months, however, the US shock explains only 26.0% of the Eurozone rate and 12.3% of the UK rate. The second permanent shock, v_2, explains after three months 69.9 per cent of the forecast-error variance of the Eurozone short term interest rate and 83.8 per cent of the UK short term interest rate. It cannot therefore be argued that the second permanent shock is a Eurozone shock. In the long run the second permanent shock explains 51.8 per cent of the Eurozone interest rate and 36.5 percent of the UK interest rates. In the long run the UK is mostly affected by the US shock. There is certainly no evidence that the UK has lost monetary autonomy in favour of the ECB.

The same conclusion can be reached by examining Figure 3 which shows the effect of one standard deviation permanent shocks on the levels of the US, Eurozone and UK interest rates together with one standard error confidence band.

[Figure 3 about here]

A one standard error second permanent shock triggers an increase of around 5 per cent for the US interest rate after five months, which settles down to close to zero after 60 months as expected given the identification restriction. This same shock increases the Eurozone interest rate immediately by around 2 per cent, reaching 4 per cent after 5 months. The UK interest rate increases to around 3 per cent after five months and then plateaus at around 2 per cent. It thus appears that increases in Eurozone rates were not perfectly matched in the long run by the UK rates and that there was no need to increase the UK interest rate by more than the Eurozone rate to preserve the value of the British pound. A one-standard error first permanent shock decreases the US interest rate by around 4 per cent after four months, the effect turns positive after 14 months and reaches 12% after 60 months. The Eurozone response is a slow decrease which reaches 5 per cent after 60 periods. The UK interest rate increases by just around 4 per cent in the long run. Over that period the US Fed, the ECB and the Bank of England changed interest rates, but not necessarily in a co-ordinated manner. As our Figure 1 shows however, US and UK policy moves are very similar, both in timing and direction. For that reason we will focus on the differences between US and ECB policy making. As Sardoni and Wray (2006; p. 452) point out, most central bankers operate in the context of the 'new monetary consensus' (NMC) – a consensus that is based on (an adaptation of) the Taylor rule, a belief that only the supply side matters in the long run and consequently that in the long run, money is neutral. Nevertheless, different central banks have molded the NMC to their particular cultures and circumstances. For instance the authors argue that actual policy formulation at the US Fed is based on five principles: (i) transparency (ii) gradualism (iii) activism (iv) inflation control and (iv) the notion of a 'neutral' interest rate i.e a rate that 'neither provokes inflation nor slows down the economy'[5]. It can be argued that the notion of a neutral rate is important in explaining the 2004 US rate increases. For although the overnight rate had been at 1% for about four years without provoking unsustainable growth, wage or price inflation, nevertheless in 2004 the Fed began raising rates because it was felt that 'the neutral rate was far above the current rate'[6]. In addition, as Sardoni and Wray (2006; p. 459) note, the Fed's adoption of 'transparency' and 'gradualism' as part of its policy setting principles means that to some extent its actions become bound by market expectations. Consequently, US rates began to rise in mid 2004 not so much because of developments in the real economy but because markets expected rate rises[7]. Upward movements in US rates from the middle of 2004 therefore appear driven by a search for 'a neutral rate' and a desire not to disappoint financial market expectations.

Deleted: Over that period the US, ECB and UK decreased interest rates following the 'dot.com' share market down turn in mid 2000. By the end of 2003 the US and UK interest rates increased in order to cool overheated stock and housing markets. The ECB waited until December 2005 to increase interest rates following a rise in consumer credit growth. Taylor & Davradakis (2006) and Mihailov (2006) among others note that UK policy showed more concern with the 'output gap' than it did with potential or actual inflation. The US Fed seemed to steer a similar course while the ECB (as opposed to the Bundesbank) was less than a strict adherent to a Taylor rule approach (see in particular the results in Belke & Polleit, 2007; Mehra & Minton, 2007; Bank of England, 2007).

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[5] See Sardoni and Wray (2006; p. 454).

[6] See Sardoni and Wray (2006; p. 455) for this argument and for further discussion.

[7] To support this point of view Sardoni and Wray (2006) argue that as "… the minutes of the June 30, 2004, meeting make clear, the FOMC's decision to raise rates was based *largely on the market's expectation that rates would be raised*." Sardoni and Wray (2006; p. 459, emphasis added).

The policy framework of the ECB is also conditioned by the NMC, in particular by the belief that money is neutral in the long run. The fundamental objective of the ECB is to ensure price stability, (see Sardoni and Wray (2006; p. 461)). In pursuing price stability however, the ECB is also mindful of real economy, in particular output and employment levels[8]. Given the slow rate of GDP growth and high levels of unemployment in the Eurozone from 2001 to 2004 and given that inflation was at or near the ECB target of 2%, the Bank could, as Sardoni and Wray (2006) point out, begin lowering rates in May 2001. A minimum of 2% was reached in June 2003 and maintained until December 2005 when inflation fears prompted by an increase in consumer credit motivated the rate increase illustrated in Figure 1.

In related work, Christiano *et al.* (2008) use estimated dynamic stochastic general equilibrium models with 'financial frictions', to investigate differences in ECB and Fed policy making. They conclude that there are three broad factors that explain the observed differences. Firstly, the ECB aims for greater 'persistence' in its policy stance than the Fed in the belief that lack of persistence will led to policy having minimal impact on longer–term interest rates. Secondly, the US and the Euro Area were hit by different shocks in the first few years of the new millennium and consequently policy responses by the ECB and Fed, both in their magnitude and their volatility, were naturally different. Thirdly, because European wages and prices were less flexible than those in the US, the ECB didn't have to move as far (or as often) as the Fed did in order to control inflation and inflationary expectations (see Christiano *et al.* (2008; pp. 2477 – 8) for details).

Finally we note that over this period business cycles are also better synchronised between the US, the Eurozone and the UK than in the previous periods. This is found in, for instance, Eickmeier (2007), and Dees et al. (2007). The later study notes however that while financial shocks are transmitted relatively rapidly, particularly

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[8] A European Central Bank document, quoted in Sardoni and Wray (2006; p. 461), remarks that: "… given that monetary policy can affect real activity in the shorter term, the ECB typically should avoid generating excessive fluctuations in output and employment if this is in line with the pursuit of its primary objective [price stability]."

from the US to Europe, the ‘degree of synchronisation does not appear to be as strong in real output, inflation or short-term interest rates’.

4. Conclusion

In this study the relationship between the interest rates of the US, Germany, Eurozone and UK is analysed to determine whether the UK was losing control of its monetary policies in favour of the Bundesbank or the ECB. Cointegration was first tested using the Johansen procedure for those series over the pre-German reunification period, the post-reunification period and the period after the formation of the Eurozone. During the 1982-1989 period no long run relationship between those three series was found and thus there is no evidence that the UK was dominated in the long run by the German monetary policies. During the 1990-1998 period we find that the shock explaining most of the forecast-error variance for the US interest rate explains almost half of the forecast-error variance for the German and UK interest rates. We can thus conclude that UK and Germany were not insulated from US monetary policy during the post-reunification period. During the same period we find that the second permanent shock is possibly a “German” shock and that it has a permanent effect on the UK interest rate which is no stronger than that of the US shock. During the 1999-2007 period we find that in the long-run the shock explaining most of the forecast-error variance for the US interest rate explains almost half of the forecast-error variance for the Eurozone interest rate and 63% of the forecast-error variance for the UK interest rates. The general conclusion, valid over the three periods, is that there is no evidence that the UK lost control over its monetary policies in favour of Germany or the Eurozone even though the UK is not insulated from either the US, Germany or the Eurozone. The major policy implication that follows from the empirical results of this study is that the UK would not be in a stronger position as a member of the EMU than it would be out of it, since the UK does not appear to have lost control over its monetary policies in the long-run.

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Table 1
January 1982 - December 1989

Cointegration Tests					
H_0: r =	n-r	$\hat{\lambda}_i$	Trace	Corrected Trace	Critical values (95%)
0	3	0.14	21.43	20.11	29.80
1	2	0.07	7.08	6.60	15.41
2	1	0.00	0.04	0.03	3.84

The critical values are approximated using the Γ distribution (see Doornik, 1998)

Table 2

January 1990-December 1998

Cointegration Tests					
H_0: r =	n-r	$\hat{\lambda}_i$	Trace	Corrected Trace	Critical values (95%)
0	3	0.23	33.10	30.89	29.80
1	2	0.04	5.52	3.39	15.41
2	1	0.01	0.96	0.70	3.84

Cointegrating Vector

	USA	Germany	UK
β'	1.000	0.791 (3.91)	-2.393 (-8.31)
α'	0.025 (2.89)	-0.023 (-3.19)	0.017 (2.208)

The critical values are approximated using the Γ distribution (see Doornik, 1998)

Table 3

January 1990-December 1998

Decomposition of Forecast-Error Variance

Forecast Horizon	USA			Germany			UK		
	v_1	v_2	Transitory	v_1	v_2	Transitory	v_1	v_2	Transitory
3	56.6	24.7	18.7	0.6	74.1	25.3	29.1	58.2	12.7
	(29.4)	(5.5)	(26.8)	(21.4)	(31.3)	(26.7)	(32.7)	(32.2)	(0.9)
6	67.3	18.4	14.3	0.8	78.4	20.9	23.1	65.0	11.9
	(29.4)	(6.2)	(26.7)	(21.4)	(33.0)	(26.7)	(32.0)	(31.7)	(1.2)
12	78.5	12.0	9.5	5.3	79.6	15.1	16.2	72.5	11.3
	(29.3)	(7.6)	(26.7)	(21.3)	(32.2)	(26.7)	(30.5)	(30.7)	(1.3)
24	89.0	6.1	4.9	19.0	72.8	8.2	10.8	79.2	10.0
	(29.7)	(11.1)	(26.8)	(21.1)	(30.8)	(26.7)	(27.9)	(28.8)	(1.5)
36	93.4	3.7	2.9	29.8	65.3	4.9	13.8	77.9	8.2
	(30.2)	(14.3)	(26.8)	(20.9)	(29.9)	(26.7)	(26.1)	(27.1)	(1.9)
90	98.2	1.0	0.8	48.7	50.0	1.3	43.6	53.1	3.3
	(30.0)	(22.4)	(27.0)	(20.3)	(29.8)	(26.7)	(20.8)	(21.5)	(4.3)

Note: Approximate one-standard errors computed using 1500 bootstrap replications following the procedure described in Runkle (1987) are shown in parenthesis.

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Table 4

June 1999-June 2007

Cointegration Tests					
H_0: r =	n-r	$\hat{\lambda}_i$	Trace	Corrected Trace	Critical values (95%)
0	3	0.376	61.74	55.77	29.80
1	2	0.134	16.87	8.68	15.41
2	1	0.033	3.20	3.11	3.84

Cointegrating Vector			
	USA	Germany	UK
β'	1.000	0.959 (2.70)	-2.240 (-4.01)
α'	-0.036 (-4.81)	0.018 (2.67)	-0.009 (-2.03)

The critical values are approximated using the Γ distribution (see Doornik, 1998)

Table 5
June 1999- June 2007
Decomposition of Forecast-Error Variance

Forecast Horizon	USA			Germany			UK		
	v_1	v_2	Transitory	v_1	v_2	Transitory	v_1	v_2	Transitory
3	42.1	34.2	23.7	26.0	69.9	4.1	12.3	83.8	3.9
	(32.0)	(10.1)	(23.4)	(12.7)	(30.0)	(23.4)	(33.2)	(30.0)	(1.1)
6	34.6	43.2	22.2	28.6	69.0	2.4	11.6	84.9	3.5
	(31.7)	(10.6)	(23.5)	(12.9)	(29.7)	(23.5)	(32.4)	(29.2)	(1.3)
12	23.7	53.1	23.2	32.1	66.6	1.3	15.2	81.9	2.9
	(31.0)	(11.5)	(23.6)	(13.1)	(29.1)	(23.6)	(30.6)	(27.8)	(1.3)
24	24.3	53.9	21.8	36.9	62.4	0.7	26.7	71.2	2.1
	(30.0)	(13.5)	(23.7)	(13.2)	(28.5)	(23.6)	(27.6)	(25.6)	(1.3)
36	47.8	37.3	14.9	40.3	59.2	0.5	37.5	61.0	1.5
	(29.1)	(15.5)	(23.7)	(13.1)	(28.2)	(23.6)	(25.4)	(24.0)	(1.5)
90	90.9	6.5	2.6	48.0	51.8	0.2	63.0	36.5	0.5
	(26.1)	(21.4)	(23.8)	(12.6)	(28.8)	(23.6)	(19.9)	(19.2)	(3.7)

Note: Approximate one-standard errors computed using 1500 bootstrap replications following the procedure described in Runkle (1987) are shown in parenthesis.

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Figure 1: German, UK and US interest rates
January 1982 to June 2007

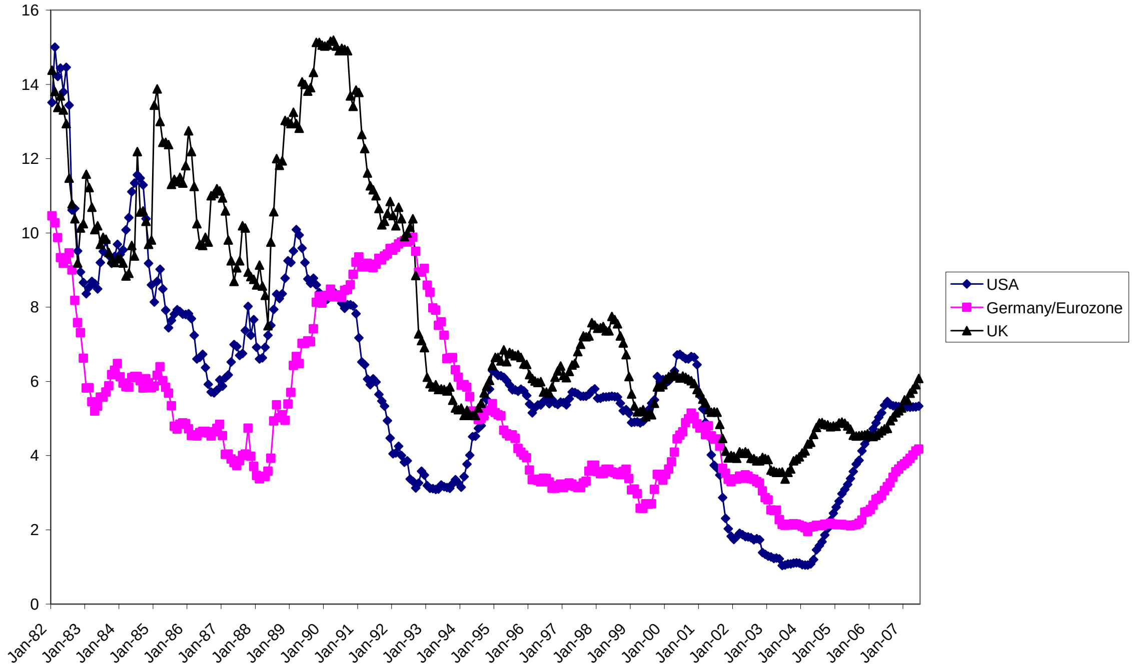

Figure 2. Impulse Responses for US, Germany and UK: Jan 1990 to Dec 1998

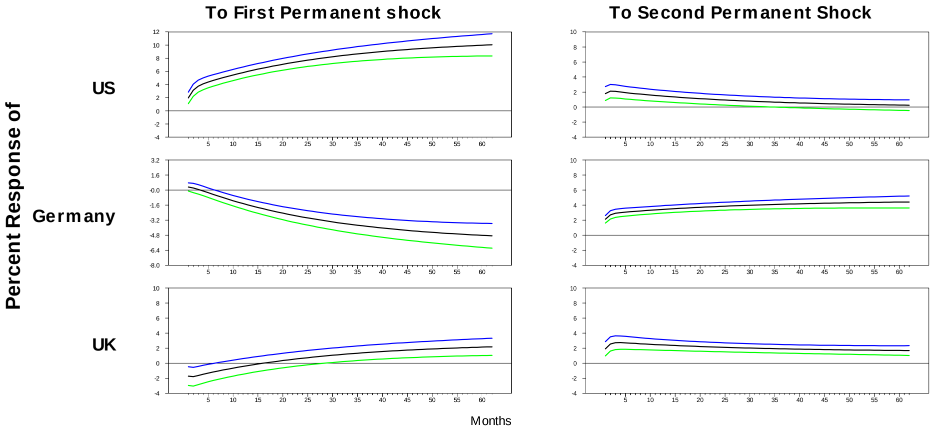

Figure 3. Impulse Responses for US, Germany and UK: June 1999 to June 2007