INTERACTIONS BETWEEN US AND UK INTEREST RATES AND NEWS SPILLOVERS: THE IMPACT OF THE EMU

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ABSTRACT

This paper studies interactions between UK and US interest rates. We determine how interest rates' means and volatilities react to key economic/financial news. We analyse the integration of the American and British economies by studying spillover and feedback effects between rates and news spillovers. The factors that account for the most variations in interest rates are, for both countries, monetary policy decisions, price levels and unemployment. Moreover, the reaction of UK (resp. US) interest rates to US variables declined (resp. increased) in recent years. This can gain sense if one takes into account the emergence of the EMU as a new economic power.

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KEYWORDS: Interest Rates, News Spillovers, Multivariate GARCH, United States, United Kingdom, Euro Area.

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1. INTRODUCTION

Macroeconomic and monetary news is an important determinant of financial asset prices and particularly of interest rates (Fleming and Remolona, 1997, 1999; Li and Engle, 1998; Balduzzi et al., 1999; Bollerslev et al., 2000). Most existing studies only consider domestic macroeconomic and monetary news. However, increased real, monetary and financial integration has enlarged interest rates' fundamentals. As a result, nowadays, interest rates are in a large part also explained by what is observed on foreign markets. The relevant information mainly corresponds to the macroeconomic and monetary news of the dominant country at the world and/or regional level. Foreign news can affect domestic asset prices through real and/or monetary channels as well as through the financial channel. Among others, Ehrmann and Fratzscher (2002, 2005) have shown that the impact of foreign determinants may evolve over time as the level of integration between countries changes. Then, events such as the creation of the European Monetary Union (EMU) could have impacted on the level of integration between countries.

The aim of this paper is to analyse empirically the interactions between American and British interest rates as well as their responses to domestic and foreign news. Such an analysis has not been undertaken yet. Indeed, most of the existing empirical studies merely focus on the sole relation between interest rates[3] or only considered the reaction of interest rates to domestic news.[4] As Ehrmann and Fratzscher (2002, 2005) underline, little attention has been given to the question of whether and why domestic asset prices react to foreign news. These authors along with Goldberg and Leonard (2003) analyse the relation between US and euro area short-term interest rates as well as the reaction of those rates to domestic and foreign macroeconomic news. Kim and Sheen (2000) study the response of Australian interest rates to domestic and US macroeconomic news. Similarly, Gravelle and Moessner (2001) consider the reaction of Canadian interest rates to domestic and US macroeconomic news.

Precisely, we test whether the creation of the European Monetary Union (EMU) impacted on the relation between US and UK interest rates and the spillover of macroeconomic and monetary news between the two countries. Of course, these are primarily the member states of the EMU, who are impacted by the European integration. However, monetary union can indirectly affect the dynamics of non-euro area interest rates. Indeed, in terms of size, degree of openness and commercial relationships with its partners, the European Union displays characteristics that are similar to the United States (Ehrmann and Fratzscher, 2002, 2005). The euro area might replace the US as the dominant country at the world level. In addition, the creation of (the) EMU is an important event, especially for the United Kingdom, Sweden and Denmark. Indeed, these countries are or have been members of the

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[3] See for example Hartman (1984), Swansson (1987, 1988), Karfakis and Moschos (1990), Fung and Isberg (1992), Gardner and Perraudin (1993), Hassapis et al. (1999), Clinebell et al. (2000), Bajo-Rubio et al. (2001), Laopodis (2004), Skintzi and Refenes (2006) and Christiansen (2007).
[4] See for instance Fleming and Remolona (1997, 1999), Jones et al. (1998), Li and Engle (1998) and Bollerslev et al. (2000).

European Monetary System (EMS)[5] and their adhesion to the EMU remains a possibility in the future.

As far as we know, the impact of the EMU on the reaction of asset prices to domestic and foreign variables has only been analysed by Erhmann and Fratzscher (2002, 2005) and Goldberg and Leonard (2003). Moreover, these authors only consider the relation between US and euro area markets. Other authors have considered the effects of the European monetary integration on the interaction between asset price dynamics, without taking into account the impact of domestic and foreign news (Fratzscher, 2002; Billio and Pelizzon, 2003; Hardouvelis et al., 2006; Christiansen, 2007).

By measuring the reaction of financial investors to domestic and foreign macroeconomic and monetary news as well as to foreign asset prices, we can measure whether the integration[6] of the American and British economies has evolved with the advent of the EMU. Although the United States can be considered as the dominant country at the world level, we do not assume that there is a one-way relationship between the two interest rates, as Karfakis and Moschos (1990), Gardner and Perraudin (1993), Kim and Sheen (2000), Gravelle and Moessner (2001), Parent (2003) and Christiansen (2007) have shown that since the setting up of the EMU, US interest rates have started to react to euro-area news. In addition, in the empirical studies a bi-directional effect has been underlined between the US and the other financial markets (Hassapis et al., 1999; Bajo-Rubio et al., 2001; Laopodis, 2004). Owing to these results, we then allow American variables to influence British ones as well as the other way round. For this, British (resp. US) interest rates' reaction to domestic and foreign news is modelled through a bivariate VAR-GARCH model.

In the second section of this paper, we discuss further how the greater interdependence between economies has modified the way interest rates are determined. Section 4 is devoted to the description of the econometric model we use to evaluate the interest rates' dynamics. Our data set is then described in section 3, where we also provide preliminary statistics. Finally, we present and discuss the estimation results.

2. HOW ECONOMIC AND FINANCIAL INTEGRATION MODIFIED THE DETERMINANTS OF INTEREST RATES

Foreign macroeconomic and monetary news influence domestic interest rates mainly through three channels: financial, real and monetary channels. In theoretical and empirical studies foreign variables are supposed to be the variables of the dominant countries at the world level (America) and/or at the regional level. The channels through which foreign news are transmitted and the choice of foreign news are presented in the following.

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[5] The UK was a member of the EMS until September 1992.
[6] The types of integration we emphasize here are real and financial integrations rather than monetary integration.

With financial integration, interest rates in different countries have become much more closely linked. In this international framework, investors take into account every factor susceptible to influencing domestic and foreign interest rates. They are particularly careful to consider monetary authorities' decisions about the official interest rate. Therefore, any news that may affect the official rate is taken into account by investors who will adapt their expectations about the future decisions of monetary authorities and the future evolution of interest rates accordingly (Haldane and Read, 1999; Clare and Courtenay, 2001; Ellingsen and Söderström, 2001). Given that, market operators will be able to trade off between the assets from different financial markets. This attention to domestic as well as foreign news explains the rapid transmission of news across countries.

Foreign news can also influence domestic interest rates through monetary and real integration. In monetary integration, foreign news may be relevant for domestic monetary policy authorities if external variables, such as the exchange rate, are considered by those authorities as important objectives. However, since we are restricted here to US and UK interest rate evolutions, this kind of explanation will not be discussed further. Real integration induces on the one side a certain level of interdependence between economies and the transmission of shocks on the other (Cooper, 1985; Lindbeck, 1993; Ehrmann and Fratzcher, 2005). Through its influence on the domestic economic situation and thus on the domestic monetary policy, news primarily affecting the economic partner will indirectly affect the domestic interest rates' dynamics. As the United States and the United Kingdom have strong commercial relationships, news from one country can affect the other one's interest rates through real interactions.

It is a well-accepted fact that short-term interest rates mainly depend on variables related to monetary policy and medium- and long-term rates are more linked to financial market variables, mainly foreign interest rates. Owing to these facts, foreign macroeconomic and monetary news transmitting through real and monetary channels should influence short-term more than long-term interest rates. The latter are affected by foreign news via the financial channel.

Given the high level of financial integration, market operators are mainly vigilant regarding the evolution of the financial and economic situation in the dominant country at the world and/or the regional level. The financial assets of these dominant countries can act as a reference or as a hedge. The real integration of economies also explains the influence exerted on a given country by its main economic partners. However, empirical literature generally considers the US as the main economic partner.[7]

The creation of the European Monetary Union in January 1999 has put forward a new economic power that may have to be taken into account. Indeed, as shown by Erhmann and Fratzscher (2002, 2005), the European Union displays characteristics (size, degree of openness and commercial relationships with its partners) that are similar to those of the United States. As a result, there should be a new balance of international and regional influences from the United States and the euro zone.

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[7] See e.g. Becker et al. (1995); Kitchen (1996); Kim and Sheen (2000); Gravelle and Moessner (2001) and Ehrmann and Fratzscher (2002, 2005).

Then, this event could affect the relation between the US and the economies even outside the EMU. In particular, the United Kingdom as well as Sweden and Denmark could be more affected by the evolutions of this new power.

3. DATA DESCRIPTION AND PRELIMINARY TESTS

In our empirical study, we use data series for interest rates, macroeconomic news and unexpected variations of the Federal Reserve's (Fed) official rate, which are presented in the following.

3.1. INTEREST RATES SERIES

We use two kinds of daily interest rate series: a short-term rate (Treasury bills and LIBOR) and a Government bond rate. These interest rates correspond to maturities of, respectively, 6 months and 5 years. They cover a period ranging from 1 January 1994 to 28 February 2003. With the exception of the UK short-term interest rates, they correspond to the quotes at local-time market closure. The closing quote for the LIBOR is set to 11 a.m. GMT. For the US Treasury bill market and the Government bonds, we use quotes that are determined at 17:30 Eastern Standard Time (EST). The time difference between EST and CET is 5 hours. This difference matters since it determines the information set available to the agents on each market.

The order of integration of our series is determined through the standard ADF test, Zivot and Andrews's (1992) test and Seo's (1999) test. According to these statistics (see table 6 in the Appendix), we cannot reject the null hypothesis of unit root for any of the interest rate series.[8] In addition, the results obtained with Box–Pierce, Ljung–Box and LM statistics (see table 5 in the Appendix) enable us to reject at the *5%* level the null hypothesis of uncorrelated errors extracted from the estimation of the assets considered in our study with an autoregressive model. Thus, all our interest rate series present a unit root and we will use interest rate differentials rather than the gross series in our empirical study. These interest rate series are also conditionally heteroskedastic.

3.2. ANNOUNCEMENTS AND SURPRISES

The literature on the impact of news on financial markets is based on the idea that in efficient markets, current asset prices reflect all the relevant predictable information. Thus, asset prices should only react to the unexpected macroeconomic news. In the remainder of this paper, we will accordingly define the news as the difference between the observed and expected values of the variables of interest. As expectations cannot be observed directly, proxies are needed. In the literature,

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[8] First, the standard ADF test allowing for a constant and a trend component. According to the results displayed in table 6 (Appendix), we see that we can not reject the null hypothesis of unit root for any of our four series. Looking at the *t*-statistics for the model with only constant (model B) and the model with only trend (model C) terms, we see that both hypotheses are rejected at the *5%* level, whatever the series considered. These results are confirmed when the Zivot and Andrews as well as the Seo statistics are used.

several authors, such as Balduzzi et al. (1999), Kim and Sheen (2000) and Erhmann
and Fratzscher (2002, 2005), use the surveys published by the Money Market
Service (MMS), Bloomberg or Reuters. For this study, we use the surveys published
by Reuters and the MMS for, respectively, UK and US macroeconomic
announcements.[9] Market participant expectations are then proxied by taking the
median value for each variable of interest.

The macroeconomic variables retained in this paper correspond to possible targets
for central banks:[10] that is, primarily, news concerning the inflation rate and the real
economy. For the United Kingdom, the considered announcements concern
unemployment, the Consumer Price Index (CPI), the Production Price Index (PPI),
industrial production, retail sales, and monetary aggregate M4 (M4). As for the
USA, the considered announcements concern unemployment, the Consumer Price
Index, the Production Price Index, GDP, the Consumer Confidence Index, and retail
sales. These variables are announced around 9:00 a.m. local time (see figure 1 and
table 7 in the appendix).

The unexpected part of monetary policy decisions has been approximated through
two methods in the literature. The first method uses surveys as previously discussed
for macroeconomic announcements. The alternative is to approximate central banks'
decisions through some carefully chosen asset quotations. Precisely, as suggested by
Krueger and Kuttner (1996) and Kuttner (2001), future fund rate prices provide the
most suitable proxy for FED expected decisions.[11] Following Kuttner's
methodology, we extract the unexpected part of US monetary authorities' decisions,
considering that this unexpected component is reflected by the difference between
the future prices on the announcement day and the day before. This relationship
between the forecast error ($\Delta r_t^{*,na}$) and the futures contracts' interest rates (f) can be
written as:

$$\Delta r_t^{*,na} = \frac{T}{T-\tau}(f_t - f_{t-1})$$

(1)

where T is the number of days in the month and τ is the day of the month.

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[9] Every Friday, both organizations collect forecasts from a panel of market participants for the following
week's announcements.
[10] The sets of retained variables slightly differ between the US and the UK for data availability reasons.
[11] We can also use surveys as previously discussed. However, future fund rate prices are preferable to the
surveys since, as pointed out by Ehrmann and Fratzscher (2002, 2005), the weekly frequency of surveys
prevents us from taking into account the most recent expectations. On the other hand, the asset prices
used in this study are those from the day preceding the central bank decisions. In addition, the prices of
futures contracts on FED funds are a reasonable choice as they meet the requirements put forward by
Brooke et al. (2000), namely (i) their maturity is close to that of the key interest rate, (ii) they are liquid
assets and (iii) their maturity is shorter than the time interval between Federal Open Market Committee
(FOMC) meetings.

In the case of the United Kingdom, given our period of study, no asset meets every requirement for being a suitable proxy.[12] We thus relied on the Reuters poll for this country, although this means that agents' expectations are only known on a weekly frequency. As shown by, e.g., Gravelle and Moessner (2001) or Erhmann and Fratzscher (2002), survey expectations prove to be unbiased and efficient.

As in Balduzzi et al. (1997) and Ehrmann and Fratzscher (2002), we measure the market surprise for each variable with a standardized difference between the actual and expected values of the announcement on that variable. That is, if X_t denotes a variable announced at time t and $E(X_t / I_{t-1})$ its expected value before the announcement, then the surprise will be computed as:

$$S_t = \frac{X_t - E(X_t / I_{t-1})}{\sqrt{V(X)}} \tag{2}$$

where $V(X)$ is the variance of the announcement series.

4. THE ECONOMETRIC MODEL

The aim of this paper is to assess the impact of the EMU on the relation between American and British rates on the one side and on the news spillovers on the other. Following Ehrmann and Fratzscher (2002) and Laopodis (2004), we allow for the presence of feedback effects on the conditional means as well as on the conditional volatilities. These effects have been accounted for through a bivariate VAR-GARCH modelization in which 'surprises' (news) are explicitly introduced in the conditional means and variances.[13]

The VAR part of our model takes the following form:

$$\Delta r_t^{US} = a^{US} + b_{11} \Delta r_{t-1}^{US} + b_{12} \Delta r_t^{UK} + \sum_{i=1}^{N} c_1^i S_\tau^{i,US} + \sum_{j=1}^{M} c_1^j S_\tau^{j,UK} + \varepsilon_t^{US}$$

$$\Delta r_t^{UK} = a^{UK} + b_{21} \Delta r_{t-1}^{US} + b_{22} \Delta r_{t-1}^{UK} + \sum_{i=1}^{N} c_2^i S_\tau^{i,US} + \sum_{j=1}^{M} c_2^j S_\tau^{j,UK} + \varepsilon_t^{UK} \tag{3}$$

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[12] Assets that can be used to extract the unexpected part of English monetary authorities' decisions can be found in Ross (2002). However, data for these assets are not available for our period of study.

[13] Not only do shocks affecting fundamentals influence the conditional mean but also the conditional volatility of interest rates. The effects on the volatility depend on the type of information (private or public), and on the knowledge and beliefs of financial agents. In the case of public information, there may exist divergent interpretations between agents. As Aumann (1976) put it, market observers 'agree to disagree'. Their reactions will thus differ and this heterogeneity will induce an increased volatility in interest rates.

Given the unit-root test in section 3, the first difference of interest rates is considered: Δr_t^{US} and Δr_t^{UK}, representing respectively the first-difference American and British interest rates in period t. Since the British markets' closure is prior to the American one,[14] the contemporaneous interest rate differential is used for the UK in the US equation, rather than that of the preceding period. S_τ^i, i=1,…,N and S_τ^j, j=1,…,M respectively correspond to the unexpected parts of the American and British macroeconomic and monetary variables, with *N=7* and *M=7*. The index τ is used for the economic and monetary announcement variables instead of t. Depending on the variable under consideration, τ will be equal to t or *t-1*. This is illustrated by figure 1.[15]
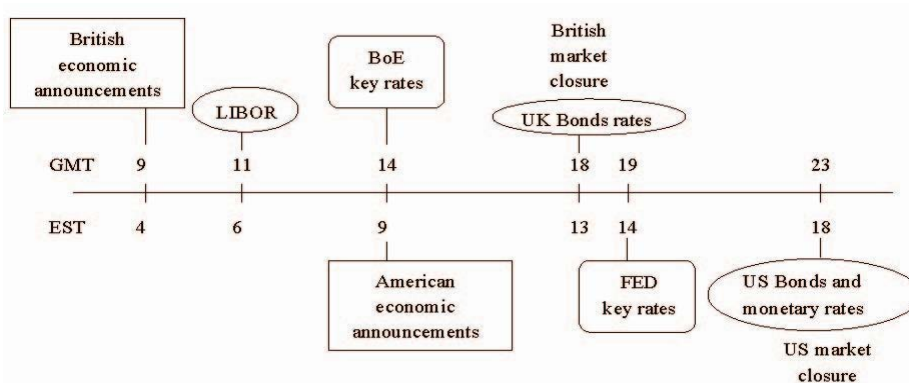

Figure 1: Announcement times

The error terms (ε_t^{US} and ε_t^{UK}) are assumed to follow a bivariate GARCH in order to take into account the heteroskedasticity that characterizes daily interest rate data.[16] Owing to the important number of parameters to estimate, we constrain the conditional variance matrix to be diagonal; we then suppose that the conditional covariance ($h_{12,t}, h_{21,t}$) is null. Specifically, our model, describing the dynamic of

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[14] Our data are collected daily at the closure time of the corresponding markets.

[15] Figure 1 shows that the British bond rate is influenced by contemporaneous American and British macroeconomic and monetary news whereas the short-term British rate reacts to the news from the previous day. British rates are influenced by the American rates from the previous day. As for US short- and long-term rates, they react to domestic and British macroeconomic and monetary news revealed the same day as well as to British interest rate quotes the same day too.

[16] The last section showed that our series are indeed conditionally heteroskedastic. Moreover, it is a well-known fact that daily interest rates series are best modelled by a GARCH(1,1) (Bollerslev, 1986; Bollerslev et al., 1992).

US and UK interest rates' conditional volatility (h_t^{US}, h_t^{UK}), takes the following form:[17]

$$h_t^{US} = c_1^2 + a_{11}^2 \varepsilon_{t-1}^{US\,2} + a_{12}^2 \varepsilon_t^{UK\,2} + b_{11}^2 h_{t-1}^{US} + b_{12}^2 h_t^{UK} + \sum_{i=1}^{N} d_1^i D_\tau^{i,US} + \sum_{j=1}^{M} d_1^j D_\tau^{j,UK},$$

$$h_t^{UK} = c_2^2 + a_{21}^2 \varepsilon_{t-1}^{US\,2} + a_{22}^2 \varepsilon_{t-1}^{UK\,2} + b_{21}^2 h_{t-1}^{US} + b_{22}^2 h_{t-1}^{UK} + \sum_{i=1}^{N} d_2^i D_\tau^{i,US} + \sum_{j=1}^{M} d_2^j D_\tau^{j,UK}, \qquad (4)$$

$$h_{12,t} = h_{12,t} = 0$$

where the dummy variables, $D^{i,US}$, $i=1,...,N$, are equal to 1 on American i^{th} macroeconomic announcement days and to 0 otherwise. In the same way, $D^{j,UK}$, $j=1,...,M$ are dummy variables equal to 1 on British j^{th} macroeconomic announcement days and to 0 otherwise. The impact of shocks affecting foreign interest rates on the domestic conditional volatility is measured by the parameters a_{12}^2 and a_{21}^2. Volatility spillovers from one market to the other are synthesized by parameters b_{12}^2 and b_{21}^2. Finally, the impact of foreign macroeconomic and monetary news announcement days on the domestic interest rates' variances are measured by the parameters d_1^j ($j=1,...,M$) and d_2^i ($i=1,...,N$).

The estimation is performed in a stepwise manner, that is, the VAR part is first estimated using the maximum likelihood method. The residuals are then used to estimate the GARCH equations of the model. Parameters estimate from those steps then serve as seeds for a global estimation of the model.

5. ESTIMATION RESULTS

We have estimated the interest rates' dynamics as described by equations (3) and (4) for the subperiods preceeding and following January 1999. We can now present our estimation results and try to put forward some economic interpretations. Two aspects are discussed in the following. The first aspect concerns direct interactions between American and British interest rates and the second aspect is the transmission of economic and monetary news.

5.1. INTERACTION BETWEEN INTEREST RATES

Table 1 shows that, in the first subperiod, the variations in US short-term rates are explained by those of the UK rates and vice versa. In the second subperiod, though, we can only observe an influence of US rates on British ones.

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[17] The coefficients are squared in order to ensure the semi-definite positiveness of the conditional variance matrix.

TABLE 1: SHORT-TERM INTEREST RATES: CONDITIONAL MEAN

Variables	1994-1998 US		UK		1999-2003 US		UK	
Constant	0.001	(0.379)	0.000	(0.769)	**-0.002**	**(0.071)**	-0.001	(0.611)
Δr^{US}	**0.050***	**(0.072)**	**0.188****	**(0.000)**	**0.144****	**(0.000)**	**0.185****	**(0.002)**
Δr^{UK}	**0.061****	**(0.033)**	-0.002	(0.936)	0.020	(0.183)	**-0.149****	**(0.000)**
r^*_{UK}	-0.002	(0.149)	**0.003****	**(0.016)**	0.000	(0.980)	**0.010****	**(0.001)**
Unemploy.UK	0.001	(0.594)	-0.002	(0.179)	0.003	(0.344)	0.000	(0.958)
CPI UK	0.003	(0.334)	**0.007****	**(0.009)**	-0.001	(0.709)	0.005	(0.192)
PPI UK	-0.001	(0.639)	0.001	(0.387)	0.002	(0.153)	-0.001	(0.816)
Production UK	0.001	(0.431)	0.002	(0.139)	-0.000	(0.735)	0.001	(0.717)
Retail Sales UK	0.000	(0.799)	**0.004****	**(0.013)**	-0.000	(0.921)	0.003	(0.313)
M4 UK	0.001	(0.546)	0.001	(0.738)	0.009	(0.366)	-0.004	(0.864)
r^*_{US}	**0.209****	**(0.000)**	0.038	(0.484)	**0.352****	**(0.000)**	0.112	(0.339)
Unemploy.US	**-0.177****	**(0.000)**	-0.000	(0.994)	**-0.115****	**(0.009)**	-0.030	(0.731)
CPI US	**0.006***	**(0.066)**	-0.001	(0.802)	-0.000	(0.936)	-0.000	(0.979)
PPI US	0.002	(0.474)	**0.004***	**(0.050)**	0.004	(0.459)	0.003	(0.788)
GDP US	0.007	(0.396)	0.010	(0.177)	**0.016****	**(0.042)**	0.004	(0.777)
Consumer Confidence Index US	0.038	(0.159)	0.027	(0.316)	**0.055****	**(0.033)**	0.018	(0.724)
Retail Sales US	**0.007****	**(0.000)**	-0.002	(0.232)	-0.007	(0.356)	-0.003	(0.836)

*, ** indicate significance at the 10% and 5% levels. Numbers in () represent the p-values

Our results reveal a similar feedback effect at the volatility level for the short-term interest rates on the period prior to 1999 (table 3). That is, the conditional variances of both American and British short-term rates are significantly influenced by the other country's volatility and squared error.[18] The amplitude of the US (resp. UK) short-term rate variance reaction to the UK (resp. US) conditional variance is more (resp. less) pronounced in the second subperiod than prior to January 1999. As for the reactions of these variances to the foreign squared error, they are not significant in the period posterior to 1999.

Unlike what is observed for the short-term rates, table 2 shows a bi-directional effect between the conditional means of US and UK long-term interest rates for both subperiods. However, the magnitude of the US rate reaction to the UK rate is more pronounced in the period following January 1999. In contrast, the UK's interest rate level reacts less to US rate variation. On the volatility side, there is a unidirectional influence of American rates' volatility and squared error over British rates' volatility

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[18] This effect can be observed for both subperiods, except for the squared error spillover effects, which are not statistically significant in the second subperiod.

in the first subperiod (table 4). However, after 1999, each conditional variance reacts only to the domestic factors.

TABLE 2: LONG-TERM INTEREST RATES: CONDITIONAL MEAN

Variables	1994 – 1998 US	UK	1999 – 2003 US	UK
Constant	0.896 (-0.000)	0.999 (-0.000)	0.233 (-0.002)	0.924 (0.000)
Δr^{US}	0.803 (-0.006)	0.000 (0.239)	0.284 (-0.030)	0.000 (0.146)
Δr^{UK}	0.000 (0.365)	0.239 (-0.034)	0.000 (0.623)	0.905 (0.004)
r^{*}_{UK}	0.975 (0.000)	0.151 (0.003)	0.015 (-0.006)	0.053 (0.004)
Unemploy.UK	0.300 (0.002)	0.005 (-0.007)	0.827 (0.001)	0.931 (0.000)
CPI UK	0.720 (-0.001)	0.005 (0.011)	0.671 (-0.001)	0.519 (0.002)
PPI UK	0.727 (-0.001)	0.205 (0.003)	0.509 (0.001)	0.885 (-0.000)
Production UK	0.656 (-0.001)	0.378 (0.002)	0.329 (-0.002)	0.042 (0.003)
Retail Sales UK	0.325 (-0.002)	0.044 (0.005)	0.181 (-0.003)	0.389 (0.002)
M4 UK	0.152 (0.004)	0.613 (-0.002)	0.717 (-0.006)	0.230 (0.015)
r^{*}_{US}	0.006 (0.202)	0.011 (0.212)	0.941 (-0.006)	0.710 (-0.026)
Unemploy.US	0.000 (-0.258)	0.127 (0.088)	0.148 (-0.094)	0.937 (-0.004)
CPI US	0.518 (0.003)	0.043 (0.010)	0.589 (0.002)	0.215 (0.003)
PPI US	0.995 (0.000)	0.080 (0.006)	0.139 (0.013)	0.956 (-0.000)
GDP US	0.611 (-0.005)	0.641 (0.005)	0.373 (0.011)	0.188 (0.012)
Consumer Confidence Index US	0.010 (0.096)	0.397 (0.035)	0.034 (0.081)	0.146 (0.044)
Retail Sales US	0.004 (0.007)	0.012 (0.006)	0.057 (-0.022)	0.913 (-0.001)

*, ** indicate significance at the 10% and 5% levels. Numbers in () represent the p-values

Unlike what is observed for the short-term rates, Table 2 shows a bi-directional effect between the conditional means of US and UK long-term interest rates for both subperiods. However, the magnitude of the US rate reaction to the UK rate is more pronounced in the period following January 1999. In contrast, the UK interest rate level reacts less to US rate variation. On the volatility side, there is a unidirectional influence of American rates' volatility and squared error over British rates' volatility in the first subperiod (table 4). However, after 1999, each conditional variance reacts only to the domestic factors.

5.2 MACROECONOMIC AND MONETARY NEWS SPILLOVERS

We now present our estimation results concerning the effects of news disclosure on the interest rates and their volatilities. In a first subsection, the results for American

rates are described and interpreted. The British case is discussed in the second
subsection.

5.2.1. ANNOUNCEMENT EFFECTS IN THE UNITED STATES

According to tables 1 and 2, before January 1999, the conditional means of US
short- and long-term interest rates are only sensitive to domestic macroeconomic
and monetary news. More precisely, one can see that the relevant news is that
concerning the FED interest rate, the unemployment rate, retail sales, the CPI and
the Consumer Confidence Index. With the exception of unemployment news, all of
this news has a positive impact on the interest rates. The signs of these impacts are
in accordance with theoretical expectations. Indeed, a positive surprise variation of
the CPI corresponds to an underestimation of the inflation level so market investors
will thus revise their expectations about the FED's monetary policy. The negative
effect of unemployment news can be explained if market operators trust the
monetary authorities with regard to their capacity to control inflationary shocks. In
other words, they have enough confidence in the central bank to achieve its
employment target by reducing interest rates without imperilling their inflation
objective. Concerning the FED's monetary policy decisions, this positive effect has
already been shown by several theoretical and empirical studies, like those by Grilli
and Roubini (1995), Obstfeld and Rogoff (1995), Kim (1999), Kim and Roubini
(2000) and Kim (2001).[19]

In the second subperiod, the American short-term rate is still influenced by domestic
news only (policy rate, unemployment, GDP and CPI) (table 1). For the long-term
rate, one can observe a slightly decreased influence of this news (table 2). Indeed,
posterior to 1999, the long-term rate only reacts to the retail sales and Consumer
Confidence Index news. Finally, we can observe that contrary to the first period,
there is now an impact of the unexpected UK monetary policy decisions on the long-
term rates.

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[19] In the same way, the increase in impact has already been observed by several studies, like those of
Cook and Hahn (1989), Kim and Sheen (2000), Kuttner (2001) or Lee (2002).

TABLE 3: SHORT-TERM INTEREST RATES: CONDITIONAL VOLATILITY

Variables	1994- US		1998 UK		1999 - US		2003 UK	
Constant	0.033**	(0.000)	0.003**	(0.000)	0.031**	(0.000)	0.027**	(0.000)
ε^2_{US}	0.111*	(0.057)	1.253**	(0.000)	0.091**	(0.001)	0.136	(0.118)
ε^2_{UK}	0.158*	(0.050)	0.190**	(0.000)	-0.089	(0.107)	0.266**	(0.000)
h_{US}	0.017	(0.911)	0.075**	(0.000)	0.018**	(0.004)	0.058**	(0.000)
h_{UK}	0.058*	(0.044)	0.441**	(0.000)	0.073**	(0.000)	0.350**	(0.000)
r^*_{UK}	0.012	(0.276)	0.005	(0.117)	0.000	(0.958)	0.054	(0.195)
Unemploy.UK	0.000	(0.914)	0.000	(0.999)	0.013*	(0.086)	0.022**	(0.010)
CPI UK	0.001	(0.160)	0.004	(0.185)	0.003	(0.218)	0.039	(0.116)
PPI UK	-0.000**	(0.001)	0.002*	(0.077)	0.010*	(0.079)	0.133**	(0.000)
Production UK	-0.000	(0.760)	0.003*	(0.059)	0.063**	(0.021)	0.112**	(0.001)
Retail Sales UK	0.002	(0.581)	0.004**	(0.011)	0.081**	(0.010)	0.057**	(0.000)
M4 UK	0.002*	(0.083)	0.014**	(0.000)	0.087**	(0.007)	0.040**	(0.000)
r^*_{US}	0.004	(0.526)	0.010	(0.426)	0.035	(0.235)	0.028**	(0.013)
Unemploy.US	0.003**	(0.012)	0.008	(0.380)	0.003**	(0.001)	0.004	(0.219)
CPI US	0.004**	(0.000)	0.005	(0.697)	0.407**	(0.005)	0.059**	(0.000)
PPI US	0.004	(0.408)	0.042	(0.523)	0.016	(0.322)	0.291**	(0.000)
GDP US	0.001**	(0.048)	0.005**	(0.000)	0.461**	(0.019)	0.066**	(0.000)
Retail Sales US	0.017	(0.377)	-0.000	(0.111)	0.004	(0.773)	0.206**	(0.000)
Consumer Confidence Index US	0.005	(0.199)	0.001**	(0.009)	0.220**	(0.001)	0.002**	(0.000)

*, ** indicate significance at the 10% and 5% levels. Numbers in () represent the p-values

Tables 3 and 4 show that, before 1999, the conditional variances of US short- and long-term interest rates are influenced by the domestic announcement days of the unemployment rate, the CPI and the GDP. Retail sales announcements also influence positively the long-term rate volatility. In the second subperiod, the conditional variance of the short-term rate reacts nearly to the same announcements days, except that the size of this reaction is more important. As for the variance of the 5 year rate, it does not react to any announcement days of domestic macroeconomic and monetary news in the period following January 1999.

While British macroeconomic and monetary news does not affect US interest rates' means,[20] there is a significant effect of British announcement days on the US volatilities. More precisely, our results in table 3 reveal that the conditional variance

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[20] Except for the unexpected UK monetary policy decisions on the long-term rates during the second subperiod.

of the 6 month US rate reacts significantly to the announcement days of variables related to the British inflation rate, measured by PPI and the M4 aggregate, in the period prior to January 1999. The amplitude of this reaction increases in the second subperiod. In contrast, the conditional volatility of the 5 year US rate does not react to British announcement days in the first subperiod, while after 1999, this variance only reacts to the announcement of British PPI.

TABLE 4: LONG-TERM INTEREST RATES: CONDITIONAL VOLATILITY

Variables	1994- US		1998 UK		1999- US		2003 UK	
Constant	**0.044****	**(0.000)**	**0.041****	**(0.000)**	**0.050****	**(0.000)**	**0.034****	**(0.000)**
ε^2_{US}	**0.358****	**(0.000)**	**0.204****	**(0.000)**	0.099	(0.821)	**0.412****	**(0.000)**
ε^2_{UK}	0.301	(0.420)	**0.572****	**(0.000)**	0.094	(0.319)	0.074	(0.516)
h_{US}	-0.055	(0.423)	**0.196****	**(0.000)**	**0.160****	**(0.004)**	0.049	(0.709)
h_{UK}	0.029	(0.685)	0.063	(0.245)	-0.036	(0.941)	**0.145****	**(0.000)**
r^*_{UK}	0.002	(0.156)	0.016	(0.645)	0.002	(0.617)	0.011	(0.428)
Unemploy.UK	-0.001	(0.538)	-0.000	(0.983)	0.001	(0.662)	0.003	(0.213)
CPI UK	-0.000	(0.864)	-0.001	(0.839)	-0.000	(0.863)	**0.003***	**(0.067)**
PPI UK	-0.001	(0.216)	**0.003***	**(0.095)**	0.000	(0.845)	0.003	(0.254)
Production UK	-0.000	(0.674)	0.000	(0.783)	0.005	(0.236)	**0.013***	**(0.053)**
Retail Sales UK	0.000	(0.996)	0.000	(0.946)	**0.007****	**(0.000)**	0.000	(0.697)
M4 UK	0.001	(0.153)	0.014	(0.450)	0.007	(0.201)	0.006	(0.122)
r^*_{US}	0.007	(0.602)	0.000	(0.815)	0.007	(0.120)	0.013	(0.296)
Unemploy.US	**0.007****	**(0.000)**	**0.002****	**(0.040)**	0.003	(0.105)	0.003	(0.160)
CPI US	**0.001****	**(0.010)**	0.001	(0.873)	0.003	(0.235)	-0.000	(0.970)
PPI US	-0.000	(0.818)	0.013	(0.383)	-0.000	(0.997)	0.003	(0.386)
GDP US	**0.004****	**(0.005)**	**0.007****	**(0.000)**	0.001	(0.112)	**0.015****	**(0.010)**
Retail Sales US	**0.002****	**(0.026)**	-0.000	(0.537)	0.003	(0.514)	-0.001	(0.754)
Consumer Confidence Index US	0.001	(0.143)	**0.005****	**(0.001)**	0.003	(0.112)	**0.004***	**(0.081)**

*, ** indicate significance at the 10% and 5% levels

The reaction of the conditional variances of interest rates to the news announcement days reflects the knowledge of financial agents about the conduct of the monetary policy by the Fed (transparency) as well as their trust in the central bank to achieve its goal (credibility) (Chadha and Nolan, 2001; Clare and Courtenay, 2001; Tuysuz, 2007). Precisely, the reaction of short-term rates to news depends more on the central bank transparency (Haldane and Read, 2000), and the reaction of the long-term rate to news is more related to the central bank's credibility (Thornton, 1998). Given that, our results reveal that the Fed is not fully transparent but is credible,

mainly after 1999.

It appears that investors seemed to be more sensitive to variables related to the US real activity than to variables related to the inflation during both the subperiods. The strong reaction of the conditional mean and variance of interest rates to news related to the real activity can be explained by the fact that the unemployment rate was relatively high in the first half of the 1990s (mainly during 1991 and 1992) and after the US economic recession in 2001.[21] In addition, given the high GDP growth rate in the US during the 1990s, the main fears were about 'overheating' and therefore about inflation, which is why financial agents could have reacted more to news about the real activity. These facts can then explain our results.

5.2.2. ANNOUNCEMENT EFFECTS IN THE UNITED KINGDOM

In the first subperiod, unlike the case of the United States, both British interest rates react to domestic news as well as that concerning the US economy in the first subperiod (tables 1 and 2). On the domestic level, interest rates respond positively to news on CPI and retail sales. The short-term interest rate is also positively influenced by the unexpected part of the Bank of England's decisions, and the long-term rate negatively by the unemployment rate news. The sign of these effects matches theoretical expectations. In addition to domestic news, British short- and long-term rates' levels also react to the US news (see tables 1 and 2). This impact is mostly obvious for the long-term interest rate, which significantly depends on the US CPI and retail sales news as well as on the unexpected part of the Fed's decisions. By contrast, the short-term rate is only influenced by the US PPI.

After 1999, the decrease in the impact of news is obvious for both maturities. Indeed, the short-term rate now only reacts to the domestic unexpected part of the Bank of England's (BoE) decisions, as shown by table 1. In the same way, table 2 shows that the long-term rate reacts to the unexpected part of the BoE's decisions and to the production news. In other words, in the second subperiod, UK short- and long-term rates do not react significantly to US news. In addition, our results reveal that domestic news about the real sector still has a significant effect on the interest rates' mean. This result can be explained by the important instability of the English GDP after 1999. Contrary to GDP, the unemployment and inflation levels were relatively stable and low during the second subperiod.

As for the conditional volatility, in the first subperiod, short-term variance reacts more on the announcement days of domestic news than the reaction of the long-term rate variance (tables 3 and 4). The conditional variances of both rates react nearly to the same US announcement days (GDP and Consumer Confidence Index), except that the 5 year variance also reacts on the release day of the US unemployment rate.

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[21] Since the 1990s the FED has managed to maintain the economic growth. However, this economic growth has not induced an important decline in the unemployment rate. This weak link creates uncertainty about the delay and the magnitude of the effect of growth on the unemployment rate. Thus, there is a higher reaction of interest rates' variance on the announcement days of the unemployment rate during high uncertainty periods.

The evolution of the volatility effects are similar to what was observed in the case of the United States. That is, our results put forward a great reactivity of short-term rates' volatilities to domestic and US announcements contrasted with their reduced influence on long-term rates' volatility.

6. CONCLUSION

In this paper, we have studied the joint dynamics of interest rates in the United Kingdom and the United States, focusing on the effects of macroeconomic announcements. Our aim was to measure the degree of interdependence between those countries and to study the impact of the creation of the European Monetary Union on this interdependence. In order to capture the dynamic aspects of this relationship at the mean as well as at the volatility level, we used a bivariate VAR-GARCH model.

Our result show that before the advent of the EMU there was a feedback effect between American and English short- and long-term interest rates' means. Similarly, the feedback effect at the volatility level for the short-term rates prior to January 1999 is also significant. In our second subperiod, though, there only remains feedback for long-term rates. However, the magnitude of the reaction of the US rate to the UK rate is more pronounced than the magnitude of the reaction of the UK rate to the US rate. In the same line, the conditional variation of the US short-term rate to the conditional volatility of the UK rate is more important than the response of the UK rate variance in the second subperiod.

According to our results, in the first subperiod, there is a clear dominance of the United States over the United Kingdom. In the second subperiod, though, announcements concerning American variables have nearly lost their impact on the English rates' means and variances, except on the conditional volatility of the short-term rate. We observe a slightly greater impact of English variables over American rates and mainly over the short-term rate.

More generally, the striking result is that there are very few announcements that have an impact on the interest rates' mean in the second subperiod. Similarly, our results reveal that the conditional variances of long-term rates react less on the announcements days of domestic and/or foreign news in the second subperiod. In contrast, the reaction of short-term rates' variances on the release days of domestic and/or foreign news is more pronounced after 1999.

It would thus be interesting to make more precise the role of the EMU creation in this decrease in the news's impact. In order to do so, the same type of study should be carried out for the United Kingdom and the euro area. Indeed, the growing importance of the European Union can account for the reduced influence of news about key American variables on the dynamics of English interest rates.

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APPENDIX

TABLE 5: HETEROSKEDASTICITY TESTS

	United - Kingdom		United - States	
	6 month	5 ans	6 month	5 ans
Ljung-Box				
$Q_{\varepsilon^2}(1)$	9.314	28.072	21.637	7.575
$Q_{\varepsilon^2}(5)$	50.935	178.757	68.677	42.721
$Q_{\varepsilon^2}(10)$	85.139	312.167	108.629	67.707
Box-Pierce				
$Q^*_{\varepsilon^2}(1)$	9.303	28.025	21.600	7.563
$Q^*_{\varepsilon^2}(5)$	50.832	178.288	68.496	42.602
$Q^*_{\varepsilon^2}(10)$	84.916	311.072	108.258	67.465
$Q^*_{|\varepsilon|}(1)$	6.140	30.655	56.125	5.143
$Q^*_{|\varepsilon|}(5)$	73.701	178.289	154.540	67.011
$Q^*_{|\varepsilon|}(10)$	125.172	325.709	222.222	109.136
Engle LM				
$LM(1)$	9.303	28.027	21.602	7.563
$LM(5)$	45.883	126.548	58.702	39.230
$LM(10)$	66.022	166.422	75.829	54.569

Figures in this table correspond to the calculated $\chi(2)$ from the series in variations.

TABLE 6: UNIT-ROOT TESTS T-STATISTICS

	ADF					Zivot &	Andrews		SEO		
	C		B		A	C	B	A	C	B	A
	ρ	β	P	μ	P						
US											
6 month	-1.70	-0.00*	0.72	-0.003*	-0.68*	-4.37*	-3.40*	-4.56*	-1.06	0.36	0.07
		(-3.83)		(-0.96)					[0.65]	[0.65]	[0.64]
5 year	-2.43	-0.00*	-0.34	0.001*	-0.84*	-4.30*	-3.21*	-3.36*	-1.44	-0.22	-1.53
		(-2.94)		(0.18)					[0.60]	[0.59]	[0.59]
UK											
6 month	-1.18	-0.00*	0.483	-0.003*	-0.91*	-2.71*	-2.24*	-2.98*	-1.61	-1.01	-0.58
		(-2.89)		(-0.25)					[0.49]	[0.50]	[0.51]
5 year	-3.82	-0.000	-0.439	0.002	-0.74*	-4.91*	-4.14*	-4.71*	-0.50	0.15	-1.96
		(-4.14)		(0.30)					[0.62]	[0.62]	[0.62]

* and ** correspond to accepting the null hypothesis respectively for the 5% and 10% levels of significance.

TABLE 7: MACROECONOMIC AND MONETARY ANNOUNCEMENTS

Announcement	Usual Release	Frequency	Released by
UK			
Bank of England rate	12:00	monthly	Bank of England
CPI M/M (%)	09:30	monthly	O.N.S.
Industrial Production	09:30	monthly	O.N.S.
M4 M/M	09:30	monthly	Bank of England
PPI M/M (%)	09:30	monthly	O.N.S.
Retail sales (%)	09:30	monthly	O.N.S.
Unemployment rate (%)	09:30	monthly	O.N.S.\hline
USA			
Consumer confidence	10:00	monthly	Conference Board
FED's rate	14:30	8 times/year	FED-FOMC
CPI M/M (%)	08:30	monthly	Bureau of Labor Statistics
PPI M/M (%)	08:30	monthly	Bureau of Labor Statistics
Real GDP	08:30	quarterly	Bureau of Economic Analysis
Retail sales (%)	08:30	monthly	Bureau of Economic Analysis
Unemployment rate (%)	08:30	monthly	Bureau of Labor Statistics

O.N.S.: Office for National Statistics