Interactions between interest rates and the transmission of monetary and economic news: the cases of US and UK.

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Abstract

In recent years, economies have become more and more interdependent. The constitution of commercial and monetary unions has increased the level of coordination of public decisions. On the other hand, some countries still have an strong influence at the world or regional levels. This paper studies the evolutions of UK and USA interest rates markets as well as their interactions during the last decade. Thus, we determine empirically the main determinants of interest rates in both countries using several explanatory variables among which, macroeconomic, monetary and financial variables. In particular, it is of interest to determine whether interest rates react and how to the publication of key economic and financial figures. We thus considered in this paper the effects of news, as measured by the difference between anticipated and observed data, on the interest rates means and volatilities. Determining the interest rates dynamics from their

national determinants also allow us to evaluate the degrees of transparency and credibility of central banks in both countries. Second, we are interested in measuring the degree of integration of American and British economies by analyzing the spillover and feedback effects between interest rates as well as news spillover effects. In order to take into account the evolutions of interest rates values as well as their volatilities, we use a VAR model where the error term is specified as a multivariate GARCH. Contrary to previous papers in the same area, we do not assume that there is a "small" and a "big" country as we allow any causality to be determined by the data. We find that factors that account for most variations in interest rates are, for both countries, the monetary policy decisions, the price levels and the rate of unemployment. Moreover, the reaction of UK interest rates to US variables tend to be less important in recent years, while we observe the contrary the other way round. Those seemingly contradictory results can gain sense if one takes into account the emergence of EMU as a new economic power.

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1 Introduction

Last decades have witnessed dramatical changes in the degree to which industrialized economies are connected with each other. From the real point of view, the creation of free-trade zones has increased commercial interdependencies at the regional level. Also, the advent of monetary systems like the EMU contributed to make monetary policies more intricate at the regional as well as at the world level. Lastly, financial integration has made easier speculation on foreign markets, thus offering a larger choice of assets to market operators.

All those changes that took part in recent years have led to enlarge the range of interest rates determinants. Now, to understand the formation of interest rates is an important objective for both economic and financial agents. The former are willing to evaluate the profitability or their investments while the latter need to properly anticipate interest rates in order to rationally make their choices of portfolio. This paper aims to determine whether interest rates dynamics are significantly influenced by foreign determinants and not only the traditional domestic ones. Among possible determinants, macroeconomic and monetary news play an important role that has already be stressed in former studies. Indeed, those announcements have an impact on the perception that financial and economic agents have on their environment. If they convey some unexpected information, it will be taken into account and influence the interest rates dynamics. However, as Ehrmann and Fratzcher (2003) noticed, little attention has been given yet to the effect of foreign news on domestic assets prices. This is why we adopted a multivariate setting in this

paper rather than the univariate one that is usually retained. By measuring the reaction of market agents to domestic and foreign announcements, we can measure the level of financial integration between economies and how it evolved in the passed years. For this purpose, we have chosen to restrict ourselves to the case of United States and Great Britain interest rates. That is, the types of integration we emphasize here are the real and financial integrations rather than monetary integration. Although, United States can be thought of a dominant country at the world level, we do not assume that there is a one-way relationship between both interest rates. Indeed, by our choice of modelization we allow American variables to influence British ones as well as the other way round. We try in this paper to assess whether changes in the perceived economic situation in a given country can influence foreign interest rates.

The aim of this paper is twofold. First, we wish to empirically determine which domestic or foreign determinants are the most relevant in explaining US and UK interest rates. Among possible determinants, we are particularly interested in unanticipated variations of the key economic factors and unexpected monetary policy decisions. Second, we would like to determine whether the creation of the EMU impacted significantly the former relationship.

In the second section of this paper, we discuss in more details how the greater interdependency 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 dataset is then described in section 3, where we also provide some preliminary statistics.

At last, we present and discuss the estimation results.

2 How Economic and Financial Integration Modified the Interest Rates Determinants

2.1 Interactions between Interest Rates

The conjugacy of decompartmentalization, deregulation and decentralization has widened the range of investment possibilities offered to market actors. The possibility of easily invest on foreign markets has increased the choices of instruments available to these operators. Gains opportunities are immediately materialized by changes in their portfolios as they are no longer restricted by the need to resort to financial intermediaries. Thus interest rates in different countries are much more closely linked nowadays than they used to be when these arbitrage possibilities were more difficult.

In this international framework, market investors take into account every factors that are susceptible to significantly influence domestic and foreign interest rates. They are particularly careful to the monetary authorities decisions about key interest rates. Therefore, any event that may lead to a shift in those interest rates is taken into account by market investors who will adapt their expectations accordingly. Thus, the observation of shocks affecting the central bank objectives allows the investors to forecast its future decisions and the future evolution of domestic interest rates (Haldane and Read, 1999; Ellingsen and Söderström, 2001). In the same way, observing the shocks that influence future foreign monetary decisions will shed some light

on the expected dynamics of foreign interest rates. Given those anticipations of domestic and foreign interest rates, 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. This phenomenon has been qualified of 'meteor shower' by Engle et al. (1990). Thus an unexpected modification of monetary policy by, for instance US central bank, will also affect other countries markets through capital flows.

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 some disagreements in the way that agent interpret this information. As Aumann (1976) put, they "agree to disagree". In other words, public announcements can lead to a certain degree of heterogeneity in investors beliefs and expectations. Their reactions will thus differ and this heterogeneity will induce an increased volatility of interest rates.

As we have seen, in an international framework, market operators are more vigilant to the evolutions of the economic situation in foreign countries. Of particular interest are the economic news emanating from dominant countries at the world or regional level. Indeed, due to the influence these countries exert on their neighbours and the rest of the world, the assets of these countries can act as reference or as hedge. On the other side, most countries anchor their currency to the one of leader countries. Investors attitude toward exchange risks can therefore explain the relationship between

interest rates of dominant and anchored countries (French and Poterba, 1991; Svensson, 1992; de la Bruslerie and Mathis, 1997; Lewis, 1999; Hardouvelis et al., 2006).

As we shall see in the next subsection, there are also indirect effects resulting from the real and monetary integrations of economies.

2.2 News Spillovers Through Real and Monetary Integration

We have seen in the previous section that investors arbitrage between assets from domestic and foreign countries can act as a channel of news transmission. This is however not the only channel, as foreign news can also influence domestic assets values through monetary and real integration. Monetary integration results from the will of a group of countries to coordinate they monetary policies. In such a case, 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 consider in this study, the comparison between the US and UK interest rates evolution, this kind of explanation will not be discussed any longer. However, because these countries have strong commercial relationships, news affecting, say US economy, can influence British interest rates through the real interactions between both countries.

Real integration induces on the one side a certain level of interdependence between economies and the transmission of shocks on the other (Cooper, 1985; Ehrmann and Fratzcher, 2005). According to Lindbeck (1993), in-

ternationalization results in a stronger influence of domestic production and consumption activities on the economic situation of other countries. Through its influence on domestic economic situation and thus on the domestic monetary policy, news primarily affecting the economic partner will indirectly affect the domestic interest rates dynamics.

Most studies that have empirically assessed the impact of news emanating from the dominant country, namely, United States, have considered a one-way relationship (Becker et al., 1995; Kitchen, 1996; Kim and Sheen, 2000; Gravelle and Moessner, 2001). That is, they rested on the assumption that American interest rates were solely explained by domestic factors. However, some studies have put forward the increasing influence of other countries/regions such as Ehrmann and Fratzcher (2005) and Goldberg and Leonard (2003).

The most important change in international equilibria that occurred in the last years is the creation of European Monetary Union, that is, the adoption of a common currency by 11 European countries. As shown by Ehrmann and Fratzcher (2003) and Ehrmann and Fratzcher (2005), this conferred to the EU an importance that is similar in several respects to that of the United States. Indeed, whether be it in terms of size, of degree of openness and of commercial relationships with its partners, European Union displays characteristics that are similar to the United States counterparts. As a result, there should be a reequilibrium of international and regional influences from United States and the Euro zone.

3 Data Description and Preliminary Tests

In our empirical study, we used data series for interest rates, macroeconomic announcements and unexpected variations of key interest rates. Our dataset and its statistical properties are presented in what follows.

3.1 Interest rates series

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

In order to determine the order of integration of our series we carry a series of unit-root tests. Three different kind of unit-root tests are performed: the standard ADF test, Zivot and Andrews (1992) test and last, Seo's (1999) test. First, the standard ADF test allowing for a constant and a trend component. According to the results displayed in table 6 on page 34, 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 constant (model B) and trend (model C) terms,

we see that both hypothesis are rejected to the 5% level, whatever the series considered. Those results are confirmed when Zivot and Andrews as well as Seo's statistics are used. The former statistic allows to account for structural changes in the series while the latter accounts for the presence of conditional heteroskedasticity. Indeed, using Box-Pierce, Ljung-Box and LM statistics (see table 5 on page 34), the null hypothesis of homoskedasticity is rejected at the 5% level for all assets considered in our study. Thus, all our interest rates series present a unit root and we will use interest rates differentials rather than the gross series in our empirical study. These interest rates series are also conditionnaly heteroscedastic.

3.1.1 Announcements and surprises

According to Balduzzi et al. (1997), it is not the announcement *per se* that is important, but rather the information it conveys to the market participants. Indeed, if announcements only comfort agents in their expectations they will not induce any behavioral changes. Since we are interested in the effect of announcements on the dynamics of interest rates we need series that reflect unanticipated variations for the relevant series. Those "surprises" are computed as the difference between the observed values for the variables and the values that were anticipated. Of course, anticipations cannot be observed and we have to use some approximation in order to carry out our study. Following Balduzzi et al. (1999), we chose to use the surveys published by Reuters and the Money Market Service (MMS) for, respectively, UK and US macroeconomic announcements. Both organizations collect every Friday forecasts from a panel of market participants for the following week announcements.

We computed the median values for each variables and retained these values as our proxies of market participant expectations.

Let us now describe the news variables in more detail. They correspond to the variables which represent possible targets for the central banks. That is, primarily, we are interested in news concerning the inflation rate and the global health of the economies considered. For United Kingdom, our model includes observations for announcements on unemployment, Consumer Price Index, Production Price Index, retail sales and the aggregate M4. As for USA, the considered announcements concern unemployment, Consumer Price Index, Production Price Index, GDP, consumption and retail sales.

Concerning the unexpected part of monetary policy decisions, two methods have been used in the literature for their computation. The first method uses surveys as previously discussed for macroeconomic announcements. The alternative is to approximate central banks decisions through some carefully chosen assets quotations. Precisely, for US surprises, we followed the methodology proposed in Kuttner (2001). This author suggests that Fed funds future prices constitute a suitable proxy for the Fed's expected actions. This solution was preferred to the use of surveys since, as pointed by Ehrmann and Fratzcher (2003), (2005), the weekly frequency of those surveys prevent from taking into account the most recent expectations. On the other side, the assets prices used in our study are those from the day preceding central bankers decisions. Fed funds future contracts prices are a reasonable choice for our proxy as they meet the requirements put forward by Brooke et al. (2000), namely (i) its maturity is close to that of the key interest rate, (ii)

it is a liquid asset and (iii) its maturity is shorter that the time interval between FOMC meetings. Moreover, as shown by Krueger and Kuttner (1996), future prices provide an efficient measure for the Fed funds rate forecasts. Indeed, the forecast errors are uncorrelated with the other variables observed at the contract's pricing time. Following Kuttner methodology, we thus extracted the unexpected part of monetary authorities decisions, considering that this unexpected component is reflected by the difference between the futures prices on the announcement day and the day before. More precisely, the relationship between the forecast error ($\Delta r_t^{*,na}$) and the futures contract's rates can be written:

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

where f denotes the futures contract's interest rate, T is the number of days in the month under consideration and τ is the day of month.

In the case of United Kingdom, one can not find any asset meeting all the requirements for being a suitable proxy, along with data covering the whole period of study[1].We thus relied on the Reuters poll for this country, although this means that the agents expectations are only known on a weekly frequency. As shown in, e.g., Gravelle and Moessner (2001) or Ehrmann and Fratzcher (2005), survey expectations prove to be unbiased and efficient.

As in Balduzzi et al. (1997) and Ehrmann and Fratzcher (2003), we measured market surprise for each variable by a standardized difference between

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

actual and expected value 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

As discussed in the previous sections, our aim is to account for the interdependence between American an British interest rates variations. We also wish to take into account news spillovers in this international framework and assess the impact of EMU creation. Following Ehrmann and Fratzcher (2003), Ehrmann and Fratzcher (2005) and Laopodis (2004), we allowed for the presence of feedback effects on conditional means as well as conditional volatilities[2]. Those effects have been accounted for through a bivariate VAR-GARCH modelization in which "surprises" are explicitly introduced in the conditional means and variances.

The VAR part of our model takes the following form:

[2]In many empirical works, the authors consider a unidirectional influence from dominant countries interest rates on the other countries rates (Karfakis and Moschos, 1990; Gardner and Perraudin, 1993; Kim and Sheen, 2000; Christiansen, 2003). However, when such a restriction is not imposed, most studies conclude in favor of a feedback effect (see *e.g.* Hassapis et al., 1999; Bajo-Rubio et al., 2001; Ehrmann and Fratzcher, 2003; Ehrmann and Fratzcher, 2005; Laopodis, 2004)

$$\Delta r_t^{US} = a_1 + b_{11}\Delta r_{t-1}^{US} + b_{12}\Delta r_t^{UK} + \sum_{i=1}^{N} c_{11}^i S_\tau^{i,us} + \sum_{j=1}^{M} c_{12}^j S_\tau^{j,uk} + \epsilon_t^{us} \quad (3)$$

$$\Delta r_t^{UK} = a_1 + b_{11}\Delta r_{t-1}^{UK} + b_{12}\Delta r_{t-1}^{US} + \sum_{j=1}^{M} c_{11}^j S_\tau^{j,uk} + \sum_{i=1}^{N} c_{12}^i S_\tau^{i,us} + \epsilon_t^{uk}$$

where Δr_t^{US} and Δr_t^{UK} denote respectively the American and British interest rates differentials in period t. $S_\tau^i, i = 1, \ldots, N$ and $S_\tau^j, j = 1, \ldots, M$ correspond to the unanticipated part of a set of respectively American and British economic and monetary variables.

Before examining the structure of error terms, we can draw a few remarks about equation (3). First, we consider interest rates differentials since, as we saw in the last section, interest rates display a unit root. Also the reader may have noticed that the contemporaneous interest rate differential is used for UK in the US equation, rather than that of the preceding period. This is explained by the time frame where announcements occur. Indeed, our data are collected daily at the closure time of the corresponding markets. Since the British market closure precedes the American one, the corresponding contemporaneous interest rate enters the information set of agents intervening on the American interest rate market.

The same line of reasoning can be used to explain why the index τ is used for the economics and monetaries announcements variables instead of t. Depending on the variable, τ will be equal to t or $t-1$. This is illustrated by figure 1[3].

[3]This figure shows for instance that the British bonds rate is influenced by contemporaneous American and British news whereas the short term interest rate react to the

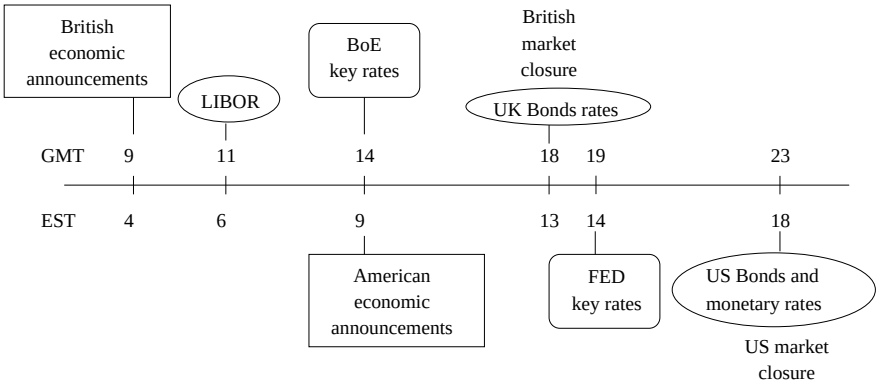

Figure 1: Announcement times

The error terms (ϵ_t^{us} and ϵ_t^{uk}) were modeled as a bivariate GARCH in order to take into account the heteroskedasticity that characterizes daily interest rates data[4]. In addition to traditional GARCH terms, our modelization also include dummies for the announcement dates of the variables that entered the conditional mean. We used dummies instead of actual surprises in order to avoid multicollinearity with the conditional mean regressors. Taking into account public announcement at the volatility level allows us to determine whether this volatility is linked to the agents uncertainty about those variables. It appeared necessary to limit the number of parameters to estimate, which can become quite huge when GARCH components are considered. We thus impose a set of restrictions on the parameters. We constrained our conditional variance matrix to be diagonal. Specifically, our model takes the

announcements from the previous day

[4]The last section showed, that our series are indeed conditionally heteroskedastic. Moreover, it is a well-know fact that daily interest rates series are best modeled by a GARCH(1,1) (Engle, 1982; Engle et al., 1987; Bollerslev, 1986; Bollerslev et al., 1992).

form[5]:

$$
\begin{aligned}
h_t^{US} &= c_1^2 + a_{11}^2\, {\varepsilon_{t-1}^{US}}^2 + a_{12}^2\, {\varepsilon_t^{UK}}^2 + b_{11}^2 h_{11,t-1} + b_{12}^2 h_{22,t-1} + \sum_{i=1}^{N} d_i D_\tau^i + \sum_{j=1}^{M} d_j D_\tau^j, \\
h_t^{UK} &= c_2^2 + a_{21}^2\, {\varepsilon_{t-1}^{US}}^2 + a_{22}^2\, {\varepsilon_{t-1}^{UK}}^2 + b_{21}^2 h_{11,t-1} + b_{22}^2 h_{22,t-1} + \sum_{i=1}^{N} d_i' D_\tau^i + \sum_{j=1}^{M} d_j' D_\tau^j, \\
h_{12,t} &= h_{21,t} = 0, \qquad (4)
\end{aligned}
$$

where $D_i, i = 1, ..., N$ are dummy variables equal to 1 on American announcement days and to zero otherwise. In the same way, $D_j, j = 1, ..., M$ are dummy variables equal to 1 on British announcement days and to zero otherwise. The impact of shocks affecting foreign interest rate on the domestic conditional volatility is measured by 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.

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. We discuss separately the results for the first (before january 1st 1999) and second subsamples.

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

Variable	1994-1998		1999-2003	
	US	UK	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**)**
Unemployment 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)
Unemployment 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)
Consumers 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

Table 1: Short-Term Interest Rates: Conditional Mean

5.1 First Subperiod

Two aspects are discussed in what follows. The first aspect concerns direct interactions between american and british interest rates and the second aspect is the transmission of economic and monetary news.

Interaction between interest rates

Whether short-term or long-term interest rates are considered, on our first subperiod, we can see that variations of US interest rates are explained by observed variations of UK interest rate and vise-versa. That is, there was a feedback effect between US and UK interest rates, at least, prior to the advent of EMU. This plead against the traditional view that considers *a*

priori United States as the dominant country and thus only consider a one-way relationship from US to UK rates. More precisely, a positive variation in a country's interest rates will be followed by a positive variation in the other country's rates.

Table 3 show a similar feedback effect at the volatility level for the short-term interest rates. That is, the conditional volatilities of both american and british short term rates are significantly influenced by the other country's volatility and squarred error. This is not true, however, for long term rates, where there is a unidirectional influence from US to UK rates, as shown by table 4.

American interest rates reaction to economic and monetary news

According to tables 1 and 2, before January 1999, American interest rates are only sensitive to domestic variables. More precisely, one can see that, at the 5% level, the relevant news are those concerning the FED interest rate, the unemployment rate and retail sales. Additionally, long term interest rates are also influenced by the consumers confidence index. If we consider the 10% level, there is also a significant positive impact of Consumer Price Index on short-term interest rates. With the exception of unemployment news, all of those news have a positive impact on the Treasury bills and Government bonds rates. This is in accordance with theoretical expectancies. Indeed, the CPI can serve as a proxy for the inflation level. Thus, a positive surprise correspond to an underestimation of the inflation level and market investors will revise their expectations about FED's monetary policy. The negative

effect of unemployment news can also be explained if market operators trust the monetary policies about their capacity to control inflationary shocks. In other words, they have enough confidence in central bank to achieve its employment target by reducing interest rates without imperiling their inflation objective. Concerning FED's monetary policy decisions, we can see that they also influence positively american interest rates and that the amplitude of this effect is increasing with maturity. This positive effect is already shows by several theoretical and empirical studies like Mundell-Fleming-Dornbush (1976), Obstfeld et Rogoff (1995), Grilli et Roubini (1995), Kim (1999), Kim et Roubini (2000) et Kim (2001), Faust *et al.* (2003). In the same way, the increase in impact is already too been observed by several studies like Cook and Hahn (1989), Kuttner (2001), Kim and Sheen (2000) or Lee (2002).

It thus appears that agents seemed to be more sensitive to unemployment shocks than to those that affect inflation (CPI, PPI). There was indeed a greater uncertainty at that time concerning economic growth than there was about inflation. This greater uncertainty can be explained by the strong dollar appreciation, the financial crises that occured after 1994 and by the Federal Reserve policy after 1994. All these events influenced negatively the economic growth and thus unemployment. However, they enabled to maintain the inflation on a rather low level.

On the volatility side, tables 3 and 4 show that US rates dynamics are influenced by domestic announcement days. More precisely, one can see that the relevant announcements days are those concerning the unemployment rate, the Consumer Price Index and the GDP. Retail sales announcements also influence positively the long rate volatility. However, announcements

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

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

Table 2: Long-term interest rates: Conditional Mean

by the Fed of its key interest rates do not introduce any additional heterogeneity in agents behaviors. According to Chadha and Nolan (2001), Tuysuz (2006), this can reveal that market operators acknowledge the capacity of Central Bank to fulfill its objectives. In the same time, the significant effect of objective variables announcements shows that investors are unable to fully understand the effective conduct of the monetary policy. Differently put, our results suggest that the Federal Reserve is credible but lacks some transparency.

While British announcements did not affect US interest rates means, there is some significant effect of British announcements days on the US volatilities.

More precisely, our results in table 3 show that public announcements days for inflation as measured by PPI and the M4 aggregate have an impact on the 6 month US rate. By contrast, UK announcements days have no influence whatsoever on the long-term American rates. This lack of influence was also observed concerning UK past volatilities and squared errors (see page 18, interaction between interest rates).

English rates reaction to economic and monetary news

Variable	1994-1998		1999-2003	
	US	UK	US	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)
Unemployment 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**)**
Unemployment 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**)**
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

Table 3: Short-Term Interest Rates: Conditional Volatility

Unlike the case of United States, we can see in tables 1 and 2 that British interest rates react to domestic news as well as those concerning American

economy. On the domestic level, interest rates respond positively to the announcements on Consumer Price Index and retail sales. Short term interest rates are also positively influenced by unexpected variation of the Bank of England decisions and long term rates negatively by the unemployment level. As in the US case, we also observe a decreasing effect of monetary policy decisions with the maturity. The sign of this effects is in accordance with theorical expectations and the results obtained previously.

In addition to domestic news effects, there is now an impact of foreign news. This impact is mostly obvious for the long term interest rates which can be seen to depend significantly on the US Consumer Price Index and retail sales as well as on the Fed's actions on its interest rates. By contrast, short-term interest rates are only influenced by the US Production Price Index. American news seems thus to be of little importance for explaining short maturities British rates. A possible explanation is that short term interest rates are mostly determined by the domestic monetary policy, whereas long term rates result from market operators decisions. The latter are thus more prone to be affected by foreign news through changes in market participants expectations. Once again, the signs of news effects are conform to what could be expected. For instance, unexpected variation of Fed's decisions has a positive influence on British interest rates. Also, we can see that English rates react positively to inflationary shocks. Price stability being the main objective for the Bank of England, an inflationary shock will be interpreted by market operators as a future raise of key interest rates. Last, positive news of retail sales can be interpreted as an amelioration of the overall economic situation.

Variable	1994-1998		1999-2003	
	US	UK	US	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)
Unemployment 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)
Unemployment 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)
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

Table 4: Long-Term Interest Rates: Conditional Volatility

Concerning volatility, our results show that in UK, domestic announcements mainly affect short term interest rates volatility. This reflects some uncertainty about monetary authorities reactions to unexpected variations of the main economic indicators. That is to say, The BoE monetary policy is not transparent enough so that agents expectations will display some heterogeneity (Chadha and Nolan, 2001; Tuysuz, 2006). However, for both maturities, the volatility is unaffected by the BoE decisions, which suggests that this central bank is nevertheless credible. In addition, those are mainly the American real sector variables (GDP, confidence index and unemployment)

that impact positively the conditional volatility of short and long English rates.

5.2 Second subperiod

Interactions between interest rates

Like in the first period, there is a bidirectional effect between US and UK long term interest rates. This is not the case however for the short-term interest rates, for which we can only detect an impact from US Treasury bills on the LIBOR.

As for the volatility level, we still observe a feedback effect between volatilies of US and UK short term rates. Contrary to the first period, the spillover effects of the squared error in one monetary market to another monetary market are no more significant posterior to 1999. In the same way, the conditional volatilities of both american and british long term interest rates are not significantly influenced by the other country's volatility and squarred error.

Interest rates reactions to economic and monetary news

As was observed prior to 1999, American short-term rates are still influenced by the sole domestic news (policy rate, unemployment, GDP and Consumer Price Index) (table 1). For the long term rates, one can observe a slightly decreased influence of these news (table 2). Indeed, posterior to 1999, the long-term rates only react to the Retails sales and Consumers Confidence index news. The sign of those effects is in accordance with theoretical expec-

tations and the results obtained previously. As in the first period, american interest rates are thus still sensitive to tne news in the real sector. This reflects a certain level of uncertainty about the American economic growth.

Finally, we can observe that contrary to the first period, there is now an impact of unexpected UK monetary policy on the long term rates.

Concerning English interest rates, the decrease of news impact is obvious for both maturities. Indeed, posterior to 1999, the short-term rates react only to the unexpected UK monetary policy, as shown by table 1. In the same way, table 2 shows that the long-term rates react only to the unexpected UK monetary policy and to the English production news. In other words, the news about the real sector still have some significant effect on the interest rates mean. This result can be explained by the important instability of the English GDP after 1999. Contrary to the GDP, the unemployment and the inflation level were relatively stable and low during the second subperiod.

On the volatility level, results contrast strikingly whether short-term or long-term rates are considered. Table 4 shows that american and english long term volatilities are no more influenced by the American and English announcements posterior to 1999. On the contrary, many of those announcements now have a more significant effect on american and english short rates volatility. As volatility reflects uncertainty and heterogeneity in operators expectations, this could mean that the second subperiod is characterized by a strong degree of heterogeneity in agents expectations as far as monetary policy is concerned but a few uncertainty about the overall economic evolution.

According to Parent (2003) and Tuysuz (2006), the news impact on the

interest rates mean (resp. volatility) depends positively (resp. negatively) on the transparency degree. Accordingly, our results suggest that the FED's and the Bank of England transparency decreased after 1999. However, both central banks are considered as transparent, especially since 1999. Indeed, from 1994 onward, the Federal Reserve has taken several decisions in order to improve its transparency. For instance, since January 1994, the U.S. Federal Reserve publicly announces FOMC policy changes. Also, since may 1999, policy decisions are covered in greater details in press statements that follow every meeting. As for BoE, Chadha and Nolan (2001) and Clare and Courtenay (2001) argue that from May 1997, the Bank of England is amongst the most transparent central banks.

Our results nevertheless show a clear evolution in the English and American interest rates reaction to the news. The creation of the Economic and Monetary Union can be put forward as a possible explanation. This creation indeed resulted in a stronger level of integration between the Euro area and the United States which in turn reduced the reciprocal influence between UK and US.

6 Conclusion

In this paper, we have studied the joint dynamics of interest rates in United Kingdom and 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 European Monetary Union on this interdependence. In order to capture the dynamical

aspects of this relationship at the mean as well as at the volatility levels we used a bivariate VAR-GARCH model. Our result showed that, before the advent of EMU there was a feedback effect between American and English short and long term interest rates. On our second subperiod, though, there only remains a feedback for long term rates. While those results suggest a strong interdependence between both financial markets and both economies, estimation results on the effects of macroeconomic news temper this first appreciation. Indeed, on the first subperiod, there is a clear dominance of the United States over United-Kingdom, as English macroeconomic news has no effect on American rates, whereas British rates are influenced by both countries announcements. In the second subperiod, though, announcements concerning American variables have lost their impact on the English rates levels and we observe a slightly greater impact of English variables over American rates. 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.

It would thus be interesting to make more precise the role of the EMU creation in this decrease of news 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 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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A Appendix

Preliminary tests

Table 5: Heteroskedasticity Tests

	3 months	6 months	12 months	3 years	5 years	7 years	10 years
United Kingdom							
Ljung-Box							
$Q_{\epsilon 2}(1)$	360.056	9.314	10.715	30.115	28.072	25.898	33.626
$Q_{\epsilon 2}(5)$	360.319	50.935	47.814	81.604	178.757	190.424	206.571
$Q_{\epsilon 2}(10)$	361.865	85.139	84.112	159.988	312.167	348.000	377.395
Box-Pierce							
$Q^*_{\epsilon 2}(1)$	359.454	9.303	10.702	30.065	28.025	25.854	33.570
$Q^*_{\epsilon 2}(5)$	359.716	50.832	47.721	81.410	178.288	189.916	206.044
$Q^*_{\epsilon 2}(10)$	361.255	84.916	83.891	159.424	311.072	346.773	376.103
$Q^*_{\lvert\epsilon\rvert}(1)$	230.105	6.140	1.388	35.134	30.655	20.906	20.264
$Q^*_{\lvert\epsilon\rvert}(5)$	294.222	73.701	60.213	115.383	178.289	180.304	188.603
$Q^*_{\lvert\epsilon\rvert}(10)$	361.339	125.172	103.501	220.302	325.709	342.483	377.153
LM de Engle							
LM(1)	359.458	9.303	10.703	30.066	28.027	25.855	33.570
LM(5)	430.393	45.883	42.586	62.705	126.548	134.640	138.678
LM(10)	430.351	66.022	63.282	97.958	166.422	174.108	182.109

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

Table 6: Unit-Root tests t-statistics

	ADF					ZandA		
	C		B		A	C	B	A
	$\widehat{\rho}$	$\widehat{\beta}$	$\widehat{\rho}$	$\widehat{\mu}$	$\widehat{\rho}$			
United States								
6 months	-1.700	-0.000** (−3.832)	0.720	-0.003** (−0.962)	-0.681**	-4.369**	-3.397**	-4.559**
5 years	-2.432	-0.000** (−2.944)	-0.340	0.001** (0.177)	-0.843**	-4.302**	-3.208**	-3.363**
United Kingdom								
6 months	-1.589	4.171	0.116		-0.770**	-2.711**	-2.236**	-2.982**
5 years	-3.817		-0.439		-0.741**	-4.908**	-4.139**	-4.709**

*, ** et *** correspond to accepting the null hypothesis respectively for the 1%, 5% and 10% levels of significance.

Table 7: Unit-Root Tests with ARCH effects: Seo Statistic

	Model 2	**Model 1**	**Model 0**
United States			
6 mois	-1.064*	0.357*	0.072*
	[0.648]	[0.647]	[0.645]
5 ans	-1.440*	-0.217*	-1.530*
	[0.597]	[0.586]	[0.585]
UK			
6 mois	-1.607**	-1.010**	-0.577**
	[0.49]	[0.50]	[0.51]
5 ans	-0.496**	0.152**	-1.959**
	[0.62]	[0.62]	[0.62]

* et ** correspond to the acceptation of the null hypothesis of unit-root respectively with level 1% and 5%.

values in [.] correspond to the first-order autocorrelation ρ.