The effects of a greater central bank credibility on interest rates level and volatility response to news in the U.K.

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Abstract

This paper investigates the impact of British macroeconomic and monetary news on English interest rates level and volatility. These news correspond to Bank of England (BoE) target variables news and to unexpected monetary policy rate changes. It analyzes whether the market rate response to these news has changed since the Bank of England (BoE) was granted operational independence in May 1997. It also checks if this credibility measure has increased the predictability of BoE decisions by the market. The results reveal that after May 1997, financial markets appears better able to anticipe BoE policy decisions than before May 1997. However, Bank of England target variable news announcements and policy rate changes diffusion influence more English interest rate volatility after May 1997. This results suggests that the credibility and/or transparency of BoE might have decreased after 1997. However, the closer evolution of the realized inflation around the target fixed by the BoE and the evolution of the transparency and credibility index suggest that the BoE transparency and credibility degree increase since 1997 compare to the period prior to 1997. One possible explanation of this last results rests on uncertainty created by the several financial crises (the Asian crisis (July 1997), the Russian crisis (August 1998), the bursting of the technology and internet bubble in 2002 in USA).

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1 Introduction

Aside from its negative effect on the conduction of monetary policy by the central bank[1], high interest rate volatility blurs the prevision of the monetary policy stance by financial market participants. In order to provide a stable environment for financial market which facilitates to reach its target, central banks seek to reduce interest rates variability (Goodfriend, 1990; Froyen and Waud, 1995; Goodhard, 1996; Woodford, 1999)[2,3]. Indeed, it is easier for policy makers to reduce uncertainty that they create themselves rather than uncertainty due to other factors. To reduce financial instability and variabilities of their variables objectives, central banks started to communicate more information about the conduct of their policy and to enforce their credibility (Faust and Svensson,2001; Dodge, 2002; Longworth, 2002). Greater credibility of central bank helps to reduce financial speculation and reduce the heterogeneity of market operators expectations about future monetary authorities decisions and future evolution of the objective variables. These consequences of a greater credibility should enhance the predictability of the central bank rate changes. In addition, a greater credibility should reduce the uncertainty related to monetary policy and then reduce the effects of news related to monetary policy on financial market volatility.

Several authors argue that financial market volatility reflects uncertainty about monetary policy stance. Most of these researchers have focused on the role of macroeconomic news announcements, related to monetary policy, as a source of financial market volatility and particularly interest rates market (Fleming and Remolona, 1997; Jones *et al.*,1998; Lee, 2002). A large part of these authors suppose constant financial market response to news. However, market interest rate reaction to these news strongly depends on central bank transparency and credibility degrees (Haldane and Read, 1999, 2000; Ellingsen and Söderström, 2001; Gravelle and Moessner,

[1]Interest rates instability influences the economic situation and the central bank target variables and then importunes the monetary policy conduct.

[2]The job of central bankers is to conduct monetary policy in order to promote price stability, sustainable growth, and a stable financial system.

[3]There have been a number of papers documenting and analysing so-called "interest rate smoothing" (Goodhart, 1996 and Woodford, 1999). See Sack and Wieland (2000) for a literature reviews. Although the primary focus of that literature is the observed tendency for the smoothing of policy rates, part of the motivation for such behavior has been to provide a stable environment for financial markets.

2001; Parent, 2003; Connoly and Kohler, 2004; Tuysuz, 2006, 2007). Thus, a greater transparency or credibility should affect interest rate reaction.

An increasing number of academic papers analyze the effects of a greater transparency or credibility on financial market. Most of these papers have focused on the theoretical and empirical aspects of monetary policy transparency. These studies mainly consider the effects of a greater transparency on the reaction of interest rate levels to macroeconomic and monetary news related to the monetary policy and on the predictability of central bank decisions (Haldane and Read, 2000; Kuttner, 2001; Poole *et al.*, 2002; Lange *et al.*, 2003; Poole and Rasche, 2003; Parent, 2003; Swansson, 2004). Concerning the effects on the volatility, only Nolan and Chadha (2001), Clare and Courtenay (2001a,b) and Tuysuz (2007) examine the effects of a greater transparency on the impact of these news on financial market volatility.

In contrast with the previous studies, the number of academic papers on the effects of a greater credibility is more less than this on the effect of a greater transparency. Several authors analyze the effects of credibility on the overall output. There is general agreement that independent, transparent, accountable, and credible central banks are able to deliver better overall policy outcomes (Alesina, 1988; Grilli, Masciandaro, and Tabellini, 1991; Cukierman, 1992; Cukierman, Webb, and Neyapti, 1992; Alesina and Summers, 1993; Jonsson, 1995; Loungani and Sheets, 1997; Eijffinger et al., 1998). As for the effects on financial market, authors as Alesina and Summers (1993) show that higher central bank independence may be associated with lower interest rate variability, suggesting that more credible regimes enjoy less variable interest rates. And concerning the effects of a greater credibility on financial market reaction to news, it was analyse only by Chadha and Nolan (2001) and Clare and Courtenay (2001a,b). However, Clare and Courtenay consider the exchange rate and the futures contracts. And Chadha and Nolan (2001) do not take the main macroeconomic news related to Bank of England.

While financial market volatility reflects uncertainty about monetary policy stance (Jones *et al.*, 1998; Lee, 2002)), the objective of this paper is to explore the effect of a greater central bank credibility on interest rate level and volatility response to its fundamental related to the monetary policy. More precisely, this paper investigates whether the British interest rates level and volatility response to English macroeconomic and monetary news has changed since the Bank of England (BoE) was granted operational independence in May 1997. In addition, it also analyses the impact of

the adoption of instrument independence by the BoE on the ability of financial markets prediction about this Bank decisions. For the present analysis, two kinds of daily interest rate series (3, 6 and 12 months rates and 3, 5, 7 and 10 years rate) and several macroeconomic news related to BoE target variables were used. Macroeconomic news include BoE target variables and the official interest rate decisions about English monetary policy. All these data cover the period ranging from the first of January 1994 to 28 February 2003. Interest rate dynamics are evaluated with a GARCH (1,1) approach, proposed by Bollerslev (1986). To take into account the impact of the new credibility measure, interest rates dynamics are evaluated for the sub-periods preceding and following May 1997. Such an approach per sub-periods was used by the majority of the authors analyzing the impact of monetary policy rate changes on rates dynamics by taking into account new measurements of transparency and/or credibility (see for example Urich and Wachtel, 2001; Chadha and Nolan, 2001; Clare and Courtenay, 2001; Lee, 2002; Parent, 2003).

The paper proceeds as follows. Section 2 presents how a new credibility measure influences the response of the interest rate level and volatility to central bank target variables news and to monetary policy decisions. It also put in evidence that a greater credibility improve the ability of financial markets to anticipate central bank decision. Section 3 presents the data used for the analysis. In section 4, the examination of the data suggests that the ability of financial markets to anticipate Bank of England decisions changes improved after 1997. Section 5 presents the model used to evaluate the response of interest rate level and volatility to macroeconomic and monetary news (model GARCH). Section 6 analyzes the results, and finally, section 7 concludes.

2 How a greater credibility can affect interest rate response to news?

Market operators reaction to central bank target variables news depends mainly on how this agents understand the effective conduct of the monetary policy and how they acknowledge the capacity of the central bank (Haldane and Read, 1999, 2000; Ellingsen and Söderström, 2001; Gravelle and Moessner, 2001; Parent, 2003; Connoly and Kohler, 2004). In another way, market interest rate level and volatility response to central bank target variables news and to monetary policy rate changes depends

strongly on the central bank transparency and credibility. Consequently, a greater credibility should affect the interest rates level and volatility response to macroeconomic news announcements and to the unexpected part of the monetary policy rate changes. In addition, this measure should also affect the market predictability of the central bank monetary policy decisions. These effects of a new credibility measure are presented in what follows.

2.1 Impacts on interest rates response to central bank target variables news

According to Geraats (2000, 2002), Jensen (2001) and Clare and Courtenay (2001a, b), a new credibility measure should improve the central bank transparency degree[4]. More precisely, Jensen shows theoretically that a central bank which manages to maintain the inflation rate close to its target can be optimally transparent. In another way, Jensen find that fully credible central bank is also optimally transparent. As for Geraats, she argues that a greater credibility improves central bank political transparency[5] and then the general transparency. Indeed, political transparency is enhanced by institutional arrangements, like central bank independence and central bank contracts; because they ensure that there is no undue influence or political pressure to deviate from stated objectives. In another world, central bank independence and central bank contracts increase market operators acknowledge the capacity of

[4]Many theoretical and empirical works show that monetary policy transparency has the potential to enhance the credibility, reputation and flexibility of central banks (Saxton, 1997; Geraats, 2000; Faust and Svensson, 2001; Cukierman, 2001; Geraats *et al.*, 2006). However, the influence of the credibility on the transparency was considered only by authors, as Geraats (2000, 2002), Jensen (2001) and Clare and Courtenay (2001a, b).

[5]Geraats distinguish five aspects of transparency : political, economic, procedural, policy and operational transparency. Political transparency refers to openness about policy objectives. Economic transparency focuses on the economic information that is used for monetary policy. This includes the economic data the central bank uses, the policy models it employs to construct economic forecasts or evaluate the impact of its decisions, and the internal forecasts the central bank relies on. Procedural transparency is about the way monetary policy decisions are taken. Policy transparency means a prompt announcement of policy decisions. In addition, it includes an explanation of the decision and a policy inclination or indication of likely future policy actions. Operational transparency concerns the implementation of the central bank's policy actions. In the same way that Geraats, another authors as Gerbasch and Hahn (2000) and Faust and Svensson (2000) define different types of transparency.

central bank to fulfill its objectives, thus to maintain the inflation rate close to its target. Consequently, market operators expectation about future inflation will be less heterogeneous and closer to the level fixed by the central bank. Thus, central bank independence or central bank contracts should imply a reduction of uncertainty related to the monetary policy and a decrease the heterogeneity of the investors' expectations about the future orientation of the monetary policy and about the future evolution of the target variables. These effects expressed itself by a smaller interest rates volatility reaction to central bank target variables news and by a greater response of these rates level to these news.

Empirically, several authors, as Alesina (1988), Grilli, Masciandaro, and Tabellini (1991), Cukierman (1992), Cukierman, Webb, and Neyapti (1992), and Alesina and Summers (1993), Jonsson (1995), Loungani and Sheets (1997) and Eijffinger et al. (1998), among other, find evidence of a negative correlation of central bank independence with lower and more stable inflation. Concerning the effects on financial markets, Alesina and Summers (1993), using cross section evidence, show that interest rate variability is decreasing with higher central bank independence, suggesting that more credible central banks benefit from less variable interest rates. As for the relation between the credibility and the response of financial markets to news, it was taken into account only by Clare and Courtenay (2001a, 2001b) and Chadha and Nolan (2001). Clare and Courtenay investigate whether the reaction of British futures contracts and exchanges rates to English macroeconomic news announcements has changed since the Bank of England was granted operational independence in May 1997. Their results indicate that there may well have been changes in the way that financial markets incorporate key economic data into securities prices. In particular, they document an increase in the speed of the reaction to interest rate announcements. As for Chadha and Nolan (2001), they analyse the impacts of numerous change in English monetary policy conduct, and particularly the independence of the Bank of England, on short-term interest rate volatility reaction to announcement of the Bank of England interest rate decisions, of publications of the minutes of the Monetary Policy Committee (MPC) meetings and of the publications of the quarterly Inflation Report. However, Clare and Courtenay analyze only the dynamics of the future contracts and the exchange rate, and Chadha and Nolan consider few explanatory variables.

2.2 Impacts on the interest rates response to central bank decisions

A greater credibility and then a better market understanding of monetary policy should improve the accuracy of market forecasts of central bank policy decisions. A number of researchers have focused on the role of a new transparency measure on the ability of financial markets to predict monetary policy decisions (Tabellini, 1987; Dotsey, 1987; Rudin, 1988; Blinder, 1998; Kuttner, 2001; Haldane and Read, 2000; Poole *et al.*, 2002; Lange *et al.*, 2003; Poole and Rasche, 2003; Swansson, 2004; Tuysuz, 2006, 2007). For the United States, Poole and Rasche (2003), Urich and Wachtel (2001), Lange *et al.* (2003), Swansson (2004) and Tuysuz (2007) demonstrated that predictability of the Fed's actions increased after the 1994 decision to announce changes in Fed policy rates immediately after Federal Open Market Committee (FOMC) meetings. However, the impact of a new credibility on the degree of foresees ability was not retained in the empirical studies.

The less uncertain and the better predictability of central bank decisions should reduce interest rates response to monetary policy decisions. According to Kuttner (2001), only the unexpected part of the central bank decisions provide news informations about monetary policy to markets operators' and then influence interest rates dynamic. In addition, a greater credibility should reduce investors' expectations about inflation and thereby decrease also interest rates response to monetary policy decisions. Indeed according to Fisher (1930) hypothesis nominal interest rate is expressed as the sum of expected constant real interest rates plus expected rate of inflation. On the other hand, in situation of fully credibility, the decrease of the policy rate, for example, will not generate a rise of interest rates. The increase in the degree of credibility thus reduces the impact of monetary policy rate changes on interest rates level. Empirically, several authors analyse the impact of a greater transparency on financial markets reaction to monetary policy actions (Urich and Wachtel, 2001; Kuttner, 2001; Coppel and Connolly, 2003)[6]. However, the impact of a greater credibility on the financial market reaction to central bank actions was retained only by Chadha and Nolan (2001) and Clare and Courtenay (2001).

On the volatility level, a new credibility measure influences interest rates volatility

[6]For example, Haldane and Read (2001) found that the introduction of inflation targeting in the United Kingdom appears to have coincided with a marked dampening in yield curve responses, suggesting greater transparency and predictability as the Bank of England monetary framework changed.

response to central bank decisions diffusion (Chadha and Nolan, 2001; Clare and Courtenay, 2001a,b; Lee, 2002). Indeed, uncertainty related to monetary policy and heterogeneity of investors anticipations depend negatively on central bank credibility degree.

3 Data Description and Preliminary Tests

This section presents the dataset and its statistical properties. The empirical part uses data series on interest rates, macroeconomic announcements and unexpected variations of key interest rates.

3.1 Interest rates series

Two kinds of daily interest rate series are considered: a short term rate (London Interbank Offered Rates; LIBOR) and a Government bond rate corresponding to maturities of respectively 3, 6 and 12 months and 3, 5, 7 and 10 years. These series cover the period ranging from the first of January 1994 to February, 28^{th}, 2003. This data corresponds to the quotes at local time market closure: 17:30 AM GMT.

In order to determine the order of integration of these series we carry out a series of unit-root tests. Three different kinds of unit-root tests are performed: the standard ADF test, the Zivot and Andrews (1992) test and finally the Seo (1999) test. According to the results of the ADF test, displayed in table 6, we cannot reject the null hypothesis of unit root for any of the four series. These results are confirmed for the Zivot and Andrews test as well as the Seo test. The Seo statistic allows to take into account for structural changes in the series while the former accounts for the presence of conditional heteroskedasticity. Indeed, using Box-Pierce, Ljung-Box and LM statistics (see table 7), the null hypothesis of homoskedasticity is rejected at the 5% level for all assets considered in our study. Thus, all interest rate series present a unit root and interest rates differentials will be used in the empirical analysis. These interest rate series are also conditionally heteroscedastic.

3.2 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 market participants. Indeed, if

announcements only comfort agents in their expectations they will not induce any behavioral changes. Since the aim of this paper is to study the effect of announcements on the dynamics of interest rates, series that reflect unanticipated variations for the relevant series are needed. These "surprises" are defined as the difference between the observed values for the variables and the values that were anticipated. As anticipations cannot be observed directly some approximation are needed. The surveys published by Reuters for UK macroeconomic announcements are used in this paper. This organization collects every Friday forecasts from a panel of market participants for the following week announcements. Median values for each variable were computed. Those values were retained as proxies of market participant expectations.

In more detail, these variables correspond to possible targets for central banks. That is, primarily, news concerning the inflation rate and the global health of the economies considered. The considered announcements concern unemployment (UE), Consumer Price Index (CPI), Production Price Index (PPI), Production index (PROD), retail sales (RET) and the aggregate M4 (M4). All these macroeconomic and monetary news are announced around 9:30 a.m..

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. 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 are those from the day preceding central bankers decisions. The financial assets allowing this decomposition must show some characteristics (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 two monetary policy meetings. In the case of United Kingdom, assets that can be used to extract the unexpected part of English monetary authorities decisions correspond to the short term forward rates deduced from the two alternative forward curves estimate by the BoE[7] (Ross, 2002). However, the both short term forward rates are available only

[7]BoE estimates two alternative forward curves from two alternatives sets of instruments. One curve is fitted using mostly GC repos and gilt yields (known generically as the VRP curve), while

Table 1: Percentage of expected and unexpected BoE' rate changes

	January 1994 - May 1997	*May 1997 - February 2003*
Actual Change		
- Expected No Change	77.78%	44.00%
- Expected Change	22.22%	56.00%
Actual No Change		
- Expected Change	3.03%	1.89%
- Expected No Change	96.97%	98.11%
Total		
- Incorrect expectation	19.05%	15.38%
- Correct expectation	80.95%	84.62%

from 1997. Our period of study starts in January 1994. 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.

The expected and unexpected part of the policy monetary rate can serve to assess and discuss the predictability of BoE decisions.

4 Effects of a greater credibility on the predictability of the Bank of England policy decisions

In order to check if the Bank of England independence improves the predictability of its decisions, the percentages of the expected and unexpected part of the BoE policy decisions for the sub-periods preceding and following May 1997 are determined. According to the table 1, after the adoption of instrument independence of the BoE in 1997, the financial markets appear better able to anticipe BoE policy decisions than before may 1997. Indeed, only 80.95% monetary policy decisions were anticiped before mai 1997 and 84.62% of decisions are anticiped after this date. These results reveal that market operators better understand the effective conduct of the monetary policy and/or they acknowledge the capacity of the central bank after may 1997 than

the second (known as the bank liability curve) is fitted using synthetic bond prices from interbank offer rates, short-sterling futures, FRAs, and swaps. After adjusting for biases, these curves can be seen as the best measure of the market's expectation of two-week forward rates.

before this date.

In addition, the adoption of instrument independence of the Bank of England in May 1997 should affect interest rates mean and volatility response to economic and monetary news. This impact is analyse in the following sections.

5 Empirical model

Giving the unit-root test in Section 2, interest rates first-differenced response to macroeconomic and policy news has been modelised as follows:

$$\Delta R_t = a + b\Delta R_{t-1} + c\Delta r_\tau^* + \sum_{k=1}^{K} d_k D_{k,t}^a + \sum_{j=1}^{3} e_j JS_t + \epsilon_t, \quad (1)$$

where R_t denotes interest rates differentials in period t. Δr_τ^* and $D_{k,t}^a, k = 1, \ldots, K$ correspond respectively to the unexpected part of the monetary policy rate changes and a set of British macroeconomic news. c and d_k measure these news effects on interest rate level. The index τ is used for the macroeconomics announcements variables instead of t. Depending on the variable, τ will be equal to t or $t-1$. All macroeconomic and monetary variables retained in this paper are announced around 9:30 a.m. (local time) and BoE decisions are diffused around 12:00 a.m. Thus, Government bond rates in period t respond to macroeconomic news and monetary policy decisions announced the same day (period t). In the same way, LIBOR's rates in the period t react to macroeconomic news announced the same day. In contrast, monetary policy decisions diffused in period $t-1$ affect short term rate in period t. In addition to macroeconomic and policy news, three days of the week are take into account; namely Monday (Mo), Wednesday (We) and Friday (Fr).

The term ϵ_t corresponds to the innovation series. Several authors estimate equation (1) supposing that the innovations are a Gaussian white noise (Balduzzi *et al.*, 1999; Bernhardsen, 2000; Ellingsen and Söderström, 2001; Favero, 2001; Kearney, 2001; Caporale and Williams, 2002; Parent, 2003). In the same line, equation (1) was estimated, first by supposing that the innovations are a Gaussian white noise and Engle Arch LM statistics was then applied to check whether the innovations ϵ_t are conditionally homoscedastic. Table 8, in the Appendix, enables to reject the null hypothesis and then accept the hypothesis that the interest rates volatility is conditionally heteroscedastic. Since Bollerslev proposed the GARCH models in 1986,

numerous authors used such model to take into account the persistence in conditional variances of financial market. As these authors, we also apply the GARCH approach of Bollerslev to estimate the conditional variances of the interest rates. This model can be expressed as:

$$h_t = w + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1} + \gamma Dum_{r_\tau^*} + \sum_{k=1}^{K} \theta_k Dum_{k,t}^a + \sum_{j=1}^{3} \lambda_j JS_t. \quad (2)$$

As in the mean equation (Eq. 1), the influence of macroeconomic and policy variables are taking into account. Contrary to the mean equation, dummies instead of actual news in order to avoid multicollinearity with the conditional mean regressors are used. More precisely, $Dum_{r_\tau^*}$ is equal to 1 during central bank decisions announcement days. In the same way, each dummy variable $Dum_{k,t}^a$, for $k = 1, ..., K$, is equal to 1 during the announcement days of the variable k.

6 Empirical results

In order to take into account the impact of the adoption of instrument independence of the BoE, interest rates dynamics have been estimated as described by equations (1) and (2) for the sub-periods preceding and following May 1997[8]. The results are presented and discussed in what follows.

6.1 Interest rate reaction to macroeconomic and monetary news

Over the period former to the BoE independence, interest rates level react particularly to the unemployment, producer price index and retail sales news (see Table 1). On the second sub-period, it is interesting to note that unemployment and producer price index news have lost all the impact they had before 1997. During this period, market interest rates react mainly to production and retail sales news. Unemployment news influence negatively interest rates dynamic whereas retail sales and

[8]Such an approach per under-period was used by the majority of the authors analyzing the impact of the monetary policy rate changes on the dynamics of interest rates by taking account of new measurements of transparency and/or credibility of the central bank (Urich and Wachtel, 2001; Lee, 2002; Tuysuz, 2007). It was also used by Parent (2003), who studies the impact of the shocks of the variables relating to the Canadian monetary policy on the level of the rates of the market.

producer price index have positive impact on interest rates level. The sign of these impacts is in accordance with theoretical expectancies. For instance, the negative effect of unemployment news can 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. As for producer price index, it can serve as a proxy for the inflation level. Thus, a positive surprise corresponds to an underestimation of the inflation level and market investors will revise their expectations about BoE monetary policy rate. Lastly, the retail sales can be used as a component of the economic activity. Most theories predict that an unexpected increases in real activity and inflation should increase bond rates (Hess,2001; Andersen, Bollerslev, Diebold and Vega, 2004). More precisely, if increasing economic activity is coupled with increasing investments, and thus with a higher demand for capital, interest rates should rise given a finite elasticity of capital supply. Information about higher economic activity might also alter agents' expectations of future inflation rates, since inflation could be spurred by an overheating economy. Thus, an unexpected increase in retail sales then in real activity could drive interest rates up through higher real rates and/or higher inflation expectations.

As for the BoE policy rate, in each sub-period the unexpected part of monetary policy decisions influence positively interest rates and the amplitude of this effect is decreasing with maturity (see Table 2) (*c*). This positive effect has already been shows by empirical studies such as Cook and Hahn (1989), Kuttner (2001), Kim and Sheen (2000) or Lee (2002). This observation supports the expectations theory of the term structure[9]. In addition, table 2 point out an important increase in interest rate reaction to unexpected policy decisions after 1997. Indeed, the unexpected policy decisions influence only the 3-years and 5-years interest rates before 1997. In contrast, after 1997, short term and medium term interest rates react to policy decisions. In addition, the overall size of interest rate response to unexpected changes in the BoE rate tends to increase after 1997. To illustrate this effect, the 12-month interest rate reaction to unexpected policy decisions was 0.084 before 1997 whereas this reaction increases down to 0.4478 after 1997.

[9]The expectations theory says that a long term interest rate should be equal to the average of the short term interest rates over the same period of time plus a term premium; thus, an increase in the first couple of short rate should drive up the long rate in a lesser extent.

It appears that agents are more sensitive to economic growth and unemployment chocks during the both sub-periods. During the first sub-period, there was greater uncertainty concerning unemployment and economic growth than there was about inflation. The period prior to 1997 was marked by a relatively low English inflation rate (see fig. 1 in appendix). This rate oscillated around 2%. Contrary, the unemployment rate was important (see fig. 2 in appendix). During this period, the BoE increased more their main interest rate that decreased them. These decisions of the British monetary authorities allowed to maintain the inflation rate close to her target but they affected negatively the economic growth and unemployment. These observations can explain the greater uncertainty concerning the unemployment and the economic situation prior to 1997. After 1997, market operator's sensitivity to unemployment disappeared. During this second period, these agents seemed to be more sensitive to economic growth chocks. As for the first sub-period, our results can be explained by the greater uncertainty concerning the economic growth than there was about unemployment rate and inflation rate. These both rates were relatively low after 1997. However, this period was marked by an important decrease and increase of the gross domestic product rate (see Fig. 3 in appendix). These observations can explain the sensitivity of financial agents to economic growth chocks during the second period.

Finally, the last observation concerns the dynamic of interest rate volatility. Table 5 shows that Wald test enables to reject the null hypothesis of integrated GARCH model (IGARCH). However, the sum of the GARCH coefficients ($\alpha+\beta$) is quite high. In another world, the importance of the sum of the GARCH coefficients suggests quite important autocorrelated interest rate volatility. However, this event could not be explained by uncertainty related to the BoE monetary policy. Indeed, during the both sub-periods, macroeconomic and monetary variables announcements do not have important impact on interest rates volatility. These results are in accordance with results obtained by Jones *et al.* (1998). These authors find that the impact of macroeconomic announcements on interest rate volatility does not persist at all, consistent with the immediate incorporation of information's into prices. According to these authors, macroeconomic announcement days do not explain Government bond rate persistence.

6.2 Transparency and credibility of the Bank of England - discussion

The result that the effects of macroeconomic news announcements on interest rate volatility increase in the second sub-period suggests that BoE credibility and/or transparency decrease since May 1997. The greater impact of BoE decisions announcements on market rate level and volatility after 1997 suggests also the decrease of BoE credibility and/or transparency degree. Indeed, according to section 2, in the period following the implementation of a new credibility measure, interest rate volatility should be less influenced by the announcements on macroeconomic and monetary variables (Chadha and Nolan, 2001; Clare and Courtenay, 2001a,b; Tuysuz, 2007). Similarly, a greater credibility should imply a decrease of interest rate level reaction to unexpected monetary policy rate changes.

A smaller credibility means that BoE does not manage to respect inflation stability around its target. However, British inflation rate evolution after May 1997, represented in figure 1 in the appendix, does not emphasize any inflationary tendency during the second sub-period. This observation suggests, then, that which can call into question the BoE credibility. In addition, using Cukierman and Meltzer (1986)[10,11] methodology, we construct BoE credibility degree from 1994 to 2003. Table 2 shows that BoE credibility degree increase over time. These both observations suggest that the BoE credibility degree has not decrease since 1997.

Table 2: BoE credibility and transparency degree evolution (1994-2003)

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Credibility degree									
1	0,99	1	1	1	1	1	1	1	1
Transparency degree									
				0,73	0,80	0,80	0,80	0,80	0,80

The index of credibility (resp. transparency) takes a value between 0 and 1.

The index of credibility (transparency) takes a value of 1 if central bank is fully credible (transparent).

The index of credibility (transparency) takes a value of 0 if central bank is not credible (transparent).

[10] In the literature, the most frequently used methodology to construct credibility index is the methodology proposed by Cukierman and Meltzer (1986) (Faust and Svensson, 1998; Hutchison and Walsh, 1998; Cecchetti and Krause, 2002).

[11] Cukierman and Meltzer (1986) methodology is presented in appendix.

The stronger effects of macroeconomic and monetary news announcement days on the interest rates volatility could also be explained by a decrease of the BoE transparency degree. However, after May 1997, Bank of English is amongst the most transparent central bank (Chadha and Nolan, 2001; Clare and Courtenay, 2001; Dincer and Eichengreen, 2007). Indeed, since 1997 the final objective of monetary policy has been made explicit and passed to an independent central bank, the date of the Monetary Policy Committee meetings are known around a year in advance, the decision of the BoE is announced at a set time, often with an explanation for the decision, minutes detailing voting patterns are published and regular quarterly forecasts of the intermediate variable under a variety of assumptions are published. In particular, it makes known the voting record of the nine members of the Monetary Policy Committee (MPC), along with a detailed summary/commentary of the MPC's deliberations. In addition, according to Dincer and Eichengreen (2007)[12], the Bank of England transparency degree was about 73% in 1998 and 88% between 1999 and 2005 (table 2). In sum, these both observations suggest that the greater effects of macroeconomic and monetary news on market volatility cannot be explained by the degree of transparency.

In accordance with Chadha and Nolan (2001)[13] observations, the arguments presented in the both previous paragraph suggest that the stronger effects of British macroeconomic and monetary news announcements on interest rates volatility could not be explained neither by a decrease of BoE credibility nor by a decrease of BoE transparency. A possible explanation of the amplification of the policy decision im-

[12]Several authors construct central bank transparency index (Fry et al., 2000; Mahadeva and Sterne, 2000; Bini-Smaghi and Gros, 2001; Siklos, 2002; De Haan, Amtembrink and Waller (2004), Eijffinger and Geraats, 2006; Dincer and Eichengreen, 2007). Among these authors, Dincer and Eichengreen construct a transparency index for a large number of country (124) and for a long period (from 1998 to 2005). For this reason, we use their transparency index.

[13]Chadha and Nolan (2001) find that the British market interest rate volatility higher after May 1997. These authors argue that the highest level of interest rate volatility has been associated with the period of inflation targeting following the adoption of central bank independence (May 1997). These authors examine whether this volatility is attributed to the information flows related to British monetary policy. Their results suggests that information flows in the form of minutes of policy meetings, published inflation forecasts and announcements of the Bank of England interest rates decisions, show little sign of affecting, jointly or individually, the volatility of short-term nominal interest rates. Chadha and Nolan argue that the higher interest rate volatility could not be explained by the decrease of BoE credibility.

pact on interest rates volatility rests on uncertainty related to economic and financial situation (Banerjee, 1992; Bikchandani *et al.*, 1992; McQueen and Roley, 1993; Fleming and Remolona, 1997; Veronesi, 1999). According to these authors, the main macroeconomic and monetary news can strongly influence market operators behaviour not only during of monetary policy uncertainty but also during economic or/and financial instability. Thus, without questioning the credibility and transparency of the BoE, various financial crises occurring after 1997[14] and the economic situation may have created uncertainty on financial market which explains the greater impact of the BoE's decisions on interest rates volatility. Specially, by affecting negatively the English economy and of other industrialized countries (Lahrèche-Révil, 2002; Heitz *et al.*, 2004) the Asian crisis and the Russian crisis created uncertainty. The uncertainty related to the financial situation results from the different financial crisis and more particularly the Russian crisis and the bursting of the technology and internet bubble in 2002 in USA. These both crises had a generalized effect on a world. In sum, uncertainty about the British economic activity combined with financial uncertainty could explain the greater effect of news on interest rate volatility.

7 Conclusion

This paper investigates the impact of the Bank of England independence on financial market reaction to news related to the monetary policy. Specifically, it analyzes the effects of this new credibility measure on the reaction of British Treasury rate and Government bond rate level and volatility to news related to the Bank of England policy. These news correspond to the BoE target variables news and to unexpected part of the policy rate changes. It also analyzes how a greater credibility influences the predictability of the BoE rate changes. The results obtained suggest that since May 1997, period where the BoE was granted operational independence, market participants have been able to anticipate better the decisions of the British monetary authorities. Contrary to the theoretical waiting of a greater credibility effects, our results show that the effects of the announcements of the BoE target variables news and policy rate decisions diffusion on interest rate volatility increase after 1997. *A priori*, these results can suggest a decrease of the BoE transparency and/or credibil-

[14] For example the Asian crisis (July 1997), the Russian crisis (August 1998), the Brazilian crisis (January 1999) and the Argentina crisis (November 2001).

ity degree after 1997. However, the closer evolution of the realized inflation around the target fixed by the BoE and the evolution of the transparency and credibility index suggest that the BoE transparency and credibility degree increase since 1997 compare to the period prior to 1997. Giving these observations and the results obtained by Banerjee (1992), Bikchandani *et al.* (1992), McQueen and Roley (1993), Fleming and Remolona (1997) and Veronesi (1999), the greater impact of macroeconomic and monetary news announcements on interest rates volatility can be explain by the uncertainty related to the financial crisis (the Asian crisis (July 1997), the Russian crisis (August 1998) and the bursting of the technology and internet bubble in 2002 in USA). In sum, the effect of the macroeconomic and monetary news on market volatility depends on monetary policy uncertainty as well as economic and/or financial uncertainty.

Table 3: Estimation results (interest rate mean)

	94-97							97-03						
	3-month	6-month	12-month	3-year	5-year	7-year	10-year	3-month	6-month	12-month	3-year	5-year	7-year	10-year
a	**-0.0043***	-0.0014	0.0027	-0.0037	-0.0024	**-0.0054***	0.0008	**-0.003****	-0.0042	0.0004	0.0005	0.0013	0.0014	0.0011
	(−2.07)	(−1.35)	(1.41)	(−1.27)	(−0.82)	(−2.00)	(0.23)	(−1.88)	(−1.48)	(0.25)	(0.28)	(0.67)	(0.71)	(0.55)
b	-0.0613	-0.0226	0.0578	**0.1075***	**0.0627****	0.0330	-0.0123	**-0.1570***	-0.0033	**0.1039***	**0.0905***	**0.0561***	0.0369	0.0238
	(−0.91)	(−0.45)	(1.10)	(3.04)	(1.86)	(1.02)	(−0.31)	(−3.62)	(−0.05)	(3.73)	(3.25)	(2.17)	(1.47)	(0.97)
c	0.0918	0.1462	0.0842	**0.2060***	**0.1240***	0.0451	-0.0186	**0.5319***	**0.4942***	**0.4478***	**0.2125***	0.1042	0.0298	-0.0336
	(0.73)	(1.33)	(0.68)	(2.50)	(2.07)	(0.81)	(−0.29)	(7.65)	(6.22)	(8.72)	(2.66)	(1.48)	(0.43)	(−0.50)
d_{cho}	**0.0000***	**0.0000***	**0.0000***	**0.0000***	**0.0000***	**0.0000***	**0.0000***	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(−2.93)	(−3.70)	(−3.19)	(−3.14)	(−2.91)	(−2.70)	(−2.54)	(1.59)	(1.34)	(0.78)	(0.61)	(0.09)	(0.01)	(0.12)
d_{ipc}	-0.0192	**0.076****	-0.0116	**0.118****	0.0229	0.0262	**0.0997***	**0.0313***	**0.0713***	**0.0907***	0.0875	0.0612	0.0506	0.0291
	(−0.44)	(1.78)	(−0.52)	(1.86)	(0.53)	(0.75)	(2.22)	(2.00)	(3.50)	(8.81)	(1.38)	(1.11)	(1.01)	(0.73)
d_{ppii}	0.0016	0.0042	0.0142	**0.0276***	**0.0308***	**0.0250***	**0.0229***	0.0009	-0.0004	**0.007****	0.0051	0.0055	0.0050	0.0020
	(0.19)	(0.61)	(0.84)	(2.93)	(3.68)	(2.97)	(2.29)	(0.27)	(−0.07)	(1.89)	(0.76)	(0.83)	(0.77)	(0.30)
d_{ppio}	0.0151	**0.0736***	0.0395	0.0153	-0.0065	0.0008	0.0097	-0.0090	**-0.032****	-0.0097	-0.0048	-0.0007	-0.0005	-0.0079
	(0.48)	(3.47)	(1.07)	(0.41)	(−0.18)	(0.02)	(0.26)	(−0.32)	(−1.96)	(−0.81)	(−0.20)	(−0.03)	(−0.03)	(−0.47)
d_{vd}	**0.0190***	**0.0218***	**0.0354***	**0.0629***	**0.0488***	**0.0313****	0.0226	**0.0139***	0.0131	**0.0286***	**0.0250***	**0.014****	0.0095	0.0036
	(2.25)	(2.10)	(2.11)	(3.80)	(2.97)	(1.80)	(1.02)	(2.25)	(1.07)	(4.11)	(3.01)	(1.69)	(1.13)	(0.39)
d_{prod}	0.0008	0.0146	0.0131	**0.023****	0.0125	0.0037	0.0061	0.0032	**0.016****	**0.0180***	**0.0262***	**0.0238***	**0.0220***	**0.0187***
	(0.22)	(1.13)	(0.56)	(1.67)	(0.91)	(0.28)	(0.33)	(1.44)	(1.74)	(2.26)	(3.60)	(3.71)	(3.41)	(2.94)
d_{m0}	0.0039	0.0061	-0.0044	0.0083	0.0178	**0.0307***	**0.037****	**0.0124***	0.0053	-0.0062	**-0.0171***	**-0.016****	-0.0104	-0.0078
	(0.71)	(1.53)	(−0.61)	(0.54)	(1.28)	(2.16)	(1.70)	(4.13)	(0.37)	(−0.78)	(−2.23)	(−1.88)	(−1.08)	(−0.78)
d_{m4}	**0.0276***	**0.0221***	**0.022****	0.0244	0.0240	0.0114	0.0088	-0.0050	**-0.0297***	-0.0009	**0.012****	0.0098	0.0065	0.0050
	(2.39)	(2.31)	(1.95)	(1.61)	(1.51)	(0.83)	(0.45)	(−0.57)	(−2.83)	(−0.08)	(1.84)	(1.08)	(0.81)	(0.72)
e_{mon}	**0.0086***	**0.0075***	0.0011	**0.0104***	0.0078	**0.0118***	0.0032	0.0004	**0.006****	-0.0023	-0.0028	-0.0042	-0.0044	-0.0037
	(2.25)	(2.26)	(0.36)	(1.97)	(1.50)	(2.28)	(0.51)	(0.32)	(1.65)	(−1.19)	(−0.94)	(−1.39)	(−1.48)	(−1.21)
e_{wen}	**0.006****	-0.0018	-0.0062	-0.0011	-0.0054	-0.0004	-0.0022	0.0013	-0.0001	-0.0018	-0.0041	**-0.005****	**-0.006****	-0.0050
	(1.99)	(−0.56)	(−1.59)	(−0.18)	(−0.93)	(−0.07)	(−0.33)	(0.49)	(−0.04)	(−0.72)	(−1.20)	(−1.68)	(−1.87)	(−1.49)
e_{fri}	0.0028	**0.005****	-0.0060	0.0078	0.0045	0.0056	0.0044	-0.0008	0.0044	-0.0053	**-0.006****	**-0.0077***	**-0.0077***	**-0.007****
	(1.04)	(1.71)	(−1.42)	(1.37)	(0.76)	(0.94)	(0.65)	(−0.37)	(1.00)	(−1.38)	(−1.88)	(−2.22)	(−2.15)	(−1.85)

Notes: The values in (.) are the t-statistics proposed by Bollerslev and Wooldridge (1992)**?**.

* and ** indicate that the corresponding coefficient is statistically significant at the 5% and 10 % level, respectively.

$\Delta R_t = a + b\Delta R_{t-1} + c\Delta r_t^* + \sum_{k=1}^{K} d_k D_{k,t}^a + \sum_{j=1}^{3} e_j JS_t + \epsilon_t$

UE: unemployment; CPI: consumer price index; PPI: producer price index, PROD: production index; RET: retail sales; M4: aggregate M4

Table 4: Estimation results (interest rate volatility)

	94-97							97-03						
	3-month	6-month	12-month	3-year	5-year	7-year	10-year	3-month	6-month	12-month	3-year	5-year	7-year	10-year
w	**0.0010***	0.0000	**0.0004***	0.0003	0.0001	0.0001	**0.0044***	**0.0012***	**0.0032***	**0.0003***	**0.0006***	**0.0006***	**0.0007***	**0.0007***
	(5.09)	(0.60)	(2.56)	(0.68)	(0.37)	(−0.25)	(5.42)	(11.58)	(13.88)	(25.25)	(2.76)	(3.37)	(3.96)	(3.44)
α	**0.2053***	**0.3588***	**0.2079***	**0.0506***	**0.0440***	**0.0393***	**0.1467***	**0.1485***	**0.3420***	**0.0719***	**0.0492***	**0.0291***	**0.0301***	**0.0305***
	(2.19)	(2.84)	(3.23)	(3.43)	(2.99)	(3.42)	(3.06)	(3.49)	(10.51)	(9.49)	(3.22)	(3.05)	(3.48)	(3.21)
β	**0.5667***	**0.5388***	**0.6464***	**0.9313***	**0.9440***	**0.9512***	**0.5929***	**0.5941***	**0.5581***	**0.6436***	**0.8906***	**0.9494***	**0.9446***	**0.9372***
	(4.81)	(6.25)	(10.07)	(40.04)	(46.73)	(57.56)	(4.91)	(8.09)	(48.47)	(23.70)	(26.56)	(63.39)	(73.62)	(69.57)
γ	0.0011	0.0040	0.00256	0.0012	**0.0018***	**0.0017***	0.00010	0.0001	**0.0136***	**0.0033***	**0.0009***	**0.0008***	**0.0007***	**0.0007***
	(0.29)	(0.67)	(0.36)	(1.19)	(2.11)	(1.97)	(0.04)	(0.12)	(9.57)	(4.21)	(2.10)	(2.21)	(2.01)	(1.94)
θ_{cho}	**-0.001****	-0.0005	0.00030	0.0001	0.0001	-0.0004	-0.0020	0.0000	**0.0002****	**0.0008***	**-0.001***	-0.0003	-0.0002	-0.0004
	(−1.73)	(−1.41)	(0.60)	(0.16)	(0.08)	(−0.68)	(−1.42)	(−0.03)	(1.72)	(3.75)	(−1.74)	(−0.72)	(−0.66)	(−1.01)
θ_{ipc}	0.0001	0.0006	**-0.0010***	-0.0001	**-0.0012***	**-0.001 ****	-0.0015	**-0.0014***	**-0.0016***	**0.0006***	**0.0009***	0.0003	0.0001	0.0001
	(0.27)	(1.16)	(−2.61)	(−0.25)	(−2.27)	(−1.80)	(−1.36)	(−4.39)	(−7.26)	(4.86)	(2.51)	(0.73)	(0.42)	(0.38)
θ_{ppii}	0.0004	**-0.0076***	0.0002	-0.0022	-0.0002	0.0000	-0.0013	0.0000	0.0001	0.0026	0.0009	0.0007	**0.001****	**0.0009***
	(0.19)	(−4.55)	(0.12)	(−1.62)	(−0.27)	(0.00)	(−0.55)	(0.00)	(0.01)	(0.77)	(0.99)	(1.26)	(1.95)	(2.35)
θ_{ppio}	0.0007	**0.0074***	0.002551	0.0017	0.0002	0.0002	-0.0013	0.0000	-0.0012	-0.0029	-0.0010	-0.0007	**-0.0010***	**-0.0010***
	(0.59)	(4.00)	(1.46)	(1.37)	(0.35)	(0.29)	(−0.57)	(0.00)	(−0.08)	(−0.87)	(−1.03)	(−1.18)	(−2.04)	(−2.41)
θ_{vd}	0.0000	-0.0001	0.0011	**-0.0019***	-0.0010	-0.0009	**-0.0020***	**-0.0014***	**-0.0002****	-0.0001	**-0.0009***	-0.0003	-0.0003	-0.0002
	(0.08)	(−0.45)	(1.58)	(−2.47)	(−1.43)	(−1.36)	(−2.38)	(−8.14)	(−1.68)	(−0.77)	(−2.34)	(−1.10)	(−1.01)	(−0.71)
θ_{prod}	**-0.0005***	0.0005	0.001	**-0.0012****	**-0.0015***	**-0.0016***	**-0.0021***	-0.0001	0.0005	**0.0010***	**-0.0008***	-0.0003	-0.0002	-0.0003
	(−6.49)	(0.93)	(1.40)	(−1.95)	(−2.28)	(−3.13)	(−2.29)	(−0.42)	(1.63)	(6.27)	(−2.02)	(−1.29)	(−0.97)	(−1.23)
θ_{m0}	**-0.0011***	-0.0002	**0.0012***	-0.0003	**-0.001****	**-0.001****	**-0.0048***	**-0.0014***	**-0.0010***	**0.0003***	0.0006	-0.0002	-0.0003	-0.0003
	(−6.80)	(−0.74)	(2.13)	(−0.39)	(−1.65)	(−1.71)	(−5.93)	(−7.10)	(−8.88)	(4.29)	(0.74)	(−0.56)	(−0.89)	(−0.67)
λ_{lu}	0.0001	0.0005	**-0.0011***	0.0000	**-0.001****	**-0.001****	**-0.0026***	-0.0009	**-0.0029***	**-0.0015***	**-0.0009***	**-0.0013***	**-0.0016***	**-0.0016***
	(0.40)	(1.03)	(−3.76)	(−0.07)	(−1.73)	(−1.69)	(−2.68)	(−1.07)	(−9.83)	(−17.28)	(−2.20)	(−3.48)	(−4.18)	(−3.99)
λ_{me}	**-0.0010***	**0.0011***	-0.00001	**0.0022***	**0.002****	**0.0022***	-0.0015	-0.0002	**-0.0042***	**0.0001****	-0.0002	-0.0006	**-0.001****	-0.0005
	(−3.56)	(3.05)	(−0.24)	(2.49)	(1.86)	(2.85)	(−1.10)	(−0.77)	(−10.97)	(1.81)	(−0.35)	(−1.53)	(−1.92)	(−1.19)
λ_{ve}	**-0.0014***	0.0001	0.0002	0.0004	0.0003	0.0006	**-0.0032***	0.0000	**-0.0036***	**0.0014***	**-0.0011***	**-0.0008***	**-0.0008***	**-0.001****
	(−5.19)	(0.53)	(0.39)	(0.50)	(0.35)	(0.81)	(−3.17)	(−0.02)	(−13.42)	(9.17)	(−2.53)	(−2.09)	(−2.04)	(−1.80)

Notes: The values in (.) are the t-statistics proposed by Bollerslev and Wooldridge (1992)**?**.

* and ** indicate that the corresponding coefficient is statistically significant at the 5% and 10 % level, respectively.

UE: unemployment; CPI: consumer price index; PPI: producer price index, PROD: production index; RET: retail sales; M4: aggregate M4

Table 5: Wald test

	94-97							97-03						
	3-month	6-month	12-month	3-year	5-year	7-year	10-year	3-month	6-month	12-month	3-year	5-year	7-year	10-year
$\alpha + \beta$	0.7720	0.8976	0.8543	0.9819	0.9880	0.9905	0.7396	0.7427	0.9001	0.7155	0.9398	0.9785	0.9747	0.9677
Wald test														
$\alpha + \beta = 1$	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

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Appendix

Central bank credibility index

Cukierman and Meltzer (1986) authors define monetary policy credibility as "the absolute value of the difference between the policymaker's plans and the public's beliefs about those plans". In this approach, the credibility index can be expressed as:

$$\begin{aligned} Cre &= 1 && if \quad E(\pi) < \pi^t, \\ Cre &= 1 - \frac{E(\pi) - \pi^t}{0.2 - \pi^t} && if \quad \pi^t < E(\pi) < 20\%, \\ Cre &= 0 && if \quad E(\pi) > 20\%. \end{aligned}$$

The more the expected inflation ($E(\pi)$) diverges from the level of the target inflation (π^t), the less credible the central bank is ($Cre \to 0$). In the same vein, if the expected inflation is smaller than or close to the target level of inflation, then the credibility of the central bank attains its maximum value ($Cre \to 1$).

Some authors, as Cecchetti and Krause (2002), while using this approach, supposed the same level for the inflation target for all the countries they retained in their empirical analysis. In addition, they also assume that the expected inflation used in order to construct the credibility index is based on the realized inflation of the previous period. Contrary to these authors, we fix the same inflation target for the industrialized countries and the same target for the emerging countries. For the industrialized countries, we suppose that the inflation target is 2.125[15], which corresponds to the average of the target fix by some central bank of industrialized countries practicing inflation target. As for the emerging countries, we suppose that the inflation target is equal to 3.25[16]. Furthermore, the expected inflation is obtained using data from Datastream.

[15] 2.125 corresponds to the average value of the inflation target level fixed by industrial countries, as United Kingdom and Australia, during 90s.

[16] 3.25 correspond to the average value of the inflation target level fixed by emerging countries, as Brazil and Mexico, during 90s.

Table 6: Test of unit root

	ADF					ZandA			SEO		
	C		B		A	C	B	A	**Model 2**	**Model 1**	**Model 0**
	$\widehat{\rho}$	$\widehat{\beta}$	$\widehat{\rho}$	$\widehat{\mu}$	$\widehat{\rho}$						
3 month	-1.176	-0.000*	0.483	-0.003*	-0.912*	-2.576*	-2.083*	-2.572*	-1.650*	-0.521*	-1.433*
		(−2.931)		(−0.65)		[03/97]	[07/97]	[09/96]	[0.58]	[0.58]	[0.58]
6 month	-1.589	-0.000*	0.116	-0.002*	-0.770*	-2.711*	-2.236*	-2.982*	-1.607*	-1.010*	-0.577*
		(−2.89)		(−0.25)		[03/97]	[08/97]	[09/96]	[0.49]	[0.50]	[0.51]
12 month	-2.075	-0.000*	0.197	-0.002*	-0.701*	-2.838*	-2.602*	-3.374*	-1.723*	-0.698*	-1.476*
		(−3.45)		(−0.32)		[10/96]	[01/00]	[09/96]	[0.62]	[0.62]	[0.59]
3 year	-3.867	-0.000*	-0.418	0.002*	-0.695*	-4.818*	-4.019*	-4.549*	-0.530*	0.197*	-1.717*
		(−4.29)		(0.29)		[07/99]	[10/01]	[06/99]	[0.58]	[0.59]	[0.57]
5 year	-3.817	-0.000*	-0.439	0.002*	-0.741*	-4.908*	-4.139*	-4.709*	-0.496*	0.152*	-1.959*
		(−4.14)		(0.30)		[06/99]	[10/98]	[06/99]	[0.62]	[0.62]	[0.62]
7 year	-3.803	-0.000*	-0.410	0.001*	-0.835*	-5.018*	-4.637*	-5.098*	-0.160*	-0.14*	-2.09*
		(−4.04)		(0.24)		[05/99]	[10/98]	[06/99]	[0.63]	[0.63]	[0.64]
10 year	-3.636	-0.000*	-0.502	0.002*	-0.794*	-5.007*	-4.634*	-5.147*	-0.856*	-0.392*	-1.85*
		(−3.81)		(0.33)		[11/97]	[10/98]	[04/97]	[0.65]	[0.64]	[0.65]

* and ** indicate that the corresponding coefficient is statistically significant at the 5% and 10 % level, respectively.

The values [./.] in the central part of the table correspond to the month and the year of the change.

The value [.] in the right hand of the table corresponds to the value of ρ.

Table 7: Statistical properties of daily U.K. interest rate variations

	3 month	6 month	12 month	3 year	5 year	7 year	10 year
Lyung-Box (LB) test on the squared residuals							
$LB_{Q2}(1)$	80.00*	460.69*	18.53*	29.75*	27.71*	25.75*	33.90*
$LB_{Q2}(5)$	89.00*	497.68*	21.50*	78.61*	171.79*	187.98*	203.69*
$LB_{Q2}(10)$	92.01*	506.40*	21.73*	151.00*	297.53*	343.10*	371.06*
Box-Pierce (BP) test on the squared residuals							
$BP_{\epsilon 2}(1)$	79.87*	459.92*	18.50*	29.70*	27.66*	25.71*	33.85*
$BP_{\epsilon 2}(5)$	88.84*	496.83*	21.46*	78.42*	171.34*	187.48*	203.17*
$BP_{\epsilon 2}(10)$	91.84*	505.51*	21.69*	150.47*	296.49*	341.89*	369.79*
LM test for ARCH effect (Engle (1982))							
$LM - ARCH(1)$	79.87*	459.92*	18.50*	29.70*	27.67*	25.72*	33.86*
$LM - ARCH(5)$	82.09*	475.61*	20.42*	60.62*	122.15*	133.22*	136.90*
$LM - ARCH(10)$	84.52*	480.94*	20.63*	93.29*	159.97*	172.05*	179.59*

* and ** indicate that the corresponding coefficient is statistically significant at the 5% and 10 % level, respectively.

8 Annexe

Table 8: Statistical properties of innovations (ϵ^1)

	3 month	6 month	12 month	3 year	5 year	7 year	10 year
Lyung-Box (LB) test on the squared residuals							
LB(1)	1.506*	8.803*	0.418*	0.111*	0.046*	0.008*	0.001*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LB(5)	12.572*	67.316*	9.708*	2.946	2.488	1.499	1.731
	(0.01)	(1.60E−14)	(0.02)	(0.40)	(0.48)	(0.68)	(0.63)
LB(10)	13.987**	119.209*	21.434*	11.844	10.598	6.964	10.786
	(0.08)	(4.83E−22)	(0.01)	(0.16)	(0.23)	(0.54)	(0.21)
LM test for ARCH effect (Engle (1982))							
LM-ARCH(1)	74.986*	435.386*	22.412*	34.940*	30.274*	29.560*	35.363*
	(4.74E−18)	(1.09E−96)	(2.20E−6)	(3.40E−9)	(3.75E−8)	(5.42E−8)	(0.00)
LM-ARCH(5)	77.853*	450.439*	24.183*	66.330*	127.051*	138.614*	140.945*
	(2.36E−15)	(3.95E−95)	(0.00)	(5.94E−13)	(1.00E−25)	(3.53E−28)	(0.00)
LM-ARCH(10)	80.365*	456.763*	24.549*	98.848*	163.672*	175.653*	183.233*
	(4.26E−13)	(7.54E−92)	(0.01)	(9.26E−17)	(5.65E−30)	(1.87E−32)	(0.00)
Engle and Ng (1993) sign and size bias statistic							
Sign Bias test	0.000	0.746	0.812	2.502*	0.826	0.000	0.327
Pos. size Bias test	60.315*	246.329*	1.516	21.447*	7.596*	12.504*	12.815*
Neg. size Bias test	11.691*	18.780*	32.328*	1.498	6.707*	2.640*	5.398*
Join test Engle and Ng	89.171*	292.023*	43.574*	30.578*	23.671*	23.135*	27.995*

[1] ϵ correspond to the innovation series in the model Eq. 1.

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

Figure 1: English inflation rate

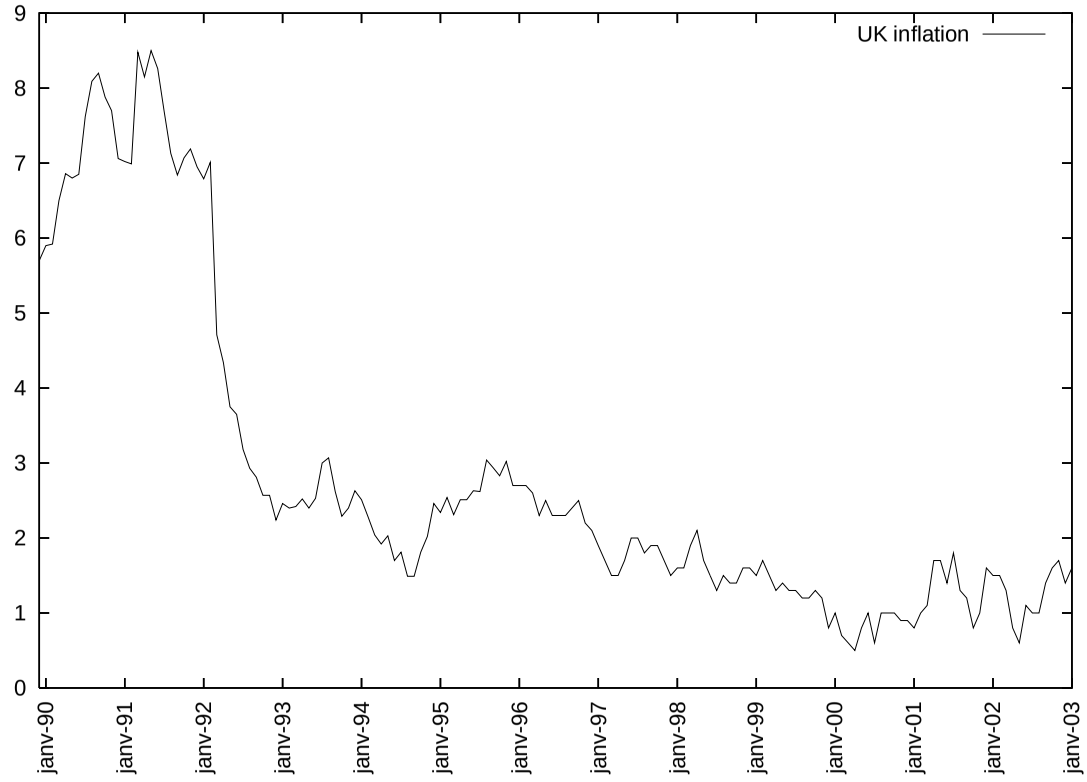

Figure 2: English unemployment rate

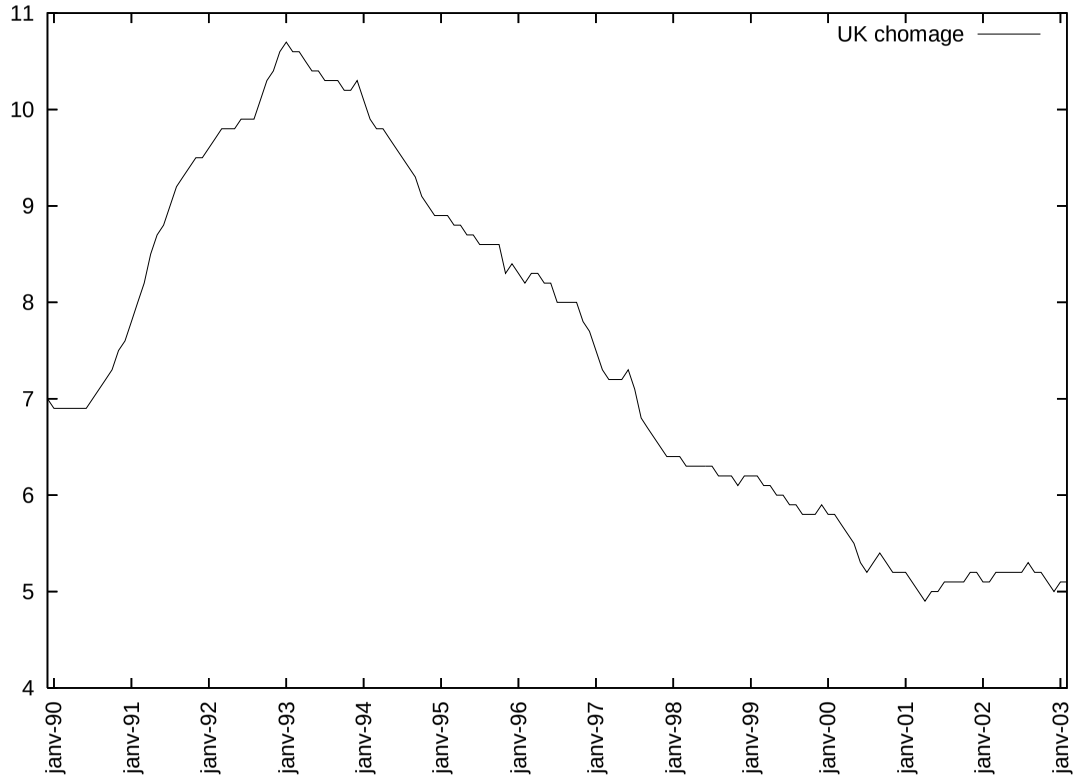

Figure 3: English GDP rate