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Talking Less and Moving the Market More: Is this the Recipe for Monetary Policy Effectiveness? Evidence from the ECB and the Fed

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Abstract
This paper examines and compares the communication strategies of the Federal Reserve and the European Central Bank, and their effectiveness. First, we do a comparative study exercise. We find that on monetary policy committee meeting days both the ECB and the Fed can move market rates using either monetary policy or news shocks. However, the response of the long-end of the American term structure to the surprise component of Fed's statements is significantly larger than the reaction of European long-term yields to ECB's announcements. This result is intimately related to the higher transparency of U.S. Fed statements compared to ECB announcements rather than to the different institutional mandate of the two central banks. Second, we investigate the cross-effects, i.e. the Fed's ability to move European interest rates and the corresponding ECB's capacity to move American rates. We find that the Feb has been more able to move the European interest rates of all maturities than the ECB to move American rates. This finding is tied to the predominance of dollar fixed income assets rather than to an attempt of the ECB to mimic the Fed.

Keywords: European Central Bank, U.S. Federal Reserve, central bank communication, monetary policy and news shocks, term structure of interest rates
JEL Classification: E52, E58

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"Central bank communication is important for financial market participants because it forms the basis for their extrapolations regarding future policy actions, actions that might impact on the value of financial assets. (...) Central bank communication is efficient if it enables market participants to understand the monetary policy that the central bank intends to implement."
Bini Smaghi (Speech, 20 November 2007)

"I do not think that we are mirroring the Fed".
Duisenberg, Introductory Statement to the press conference – Q&A (8 June 2000)
"I do not comment on the decisions made by other central banks. Now, as far as this central bank is concerned, I do want to emphasise, or rather re-emphasise, that we base our monetary policy decisions on an analysis of both monetary and other economic developments inside and outside the euro area. (...) In other words: we make our own decisions."
Duisenberg, Introductory Statement to the press conference – Q&A (1 February 2001)

1 Introduction

What is more effective in the USA and in Europe between central bank's words and deeds in moving asset prices? Is the European Central Bank (henceforth ECB) rhetoric more credible than the U.S. Federal Reserve (henceforth Fed) communication? What is the effect of a hawkish ECB announcement on American interest rates? Alternatively, what is the impact of an unexpected Fed policy rate cut on European money market rates? Have these relationships been stable over time? This paper attempts to answer these questions.

Understanding the links between monetary policy and the term structure of interest rates is crucially important for understanding the monetary policy transmission mechanism. Moreover, since the shares of the U.S. and E.U. economy together represent more than 34 percent (respectively 20% and 14%) of world GDP based on purchasing power parity. it is entirely clear that the conduct of monetary policy in these two countries must be closely monitored. This paper is an empirical study on the effect of monetary policy decisions and central banks' announcements on the full spectrum of the American and European yield curve during monetary policy committee meeting days over the sample period January 1999 through June 2006.

The value added of this work to the empirical literature on the effectiveness of central bank communication is three-fold. First, we analyze the importance of the Fed's words as opposed to its monetary policy deeds. Second, we compare the ability of the ECB against the Fed in affecting the level of their domestic term structure through their monetary policy decisions and statements. Third, we investigate the cross-effects, i.e. the Fed's ability to move European interest rates of all maturities and the corresponding ECB's capacity to move American rates.

Our main findings can be summarized as follows. First, we find several differences between the ECB and the Fed decision-making process in both the frequency of their Board meetings, and number and magnitude of policy rate changes. On the one hand, the ECB Governing Council has met much more often than the Federal Open Market Committee (FOMC). On the other hand, the Fed has changed its policy rate, the Fed funds rate, more frequently and by relatively larger magnitudes compared to the ECB. Furthermore, we find that the communication policy of the ECB and the Fed is substantially different. The Fed's statements contain fewer words, ranging from one fifth to one twentieth, than ECB's announcements. However, despite the low number of words, the tone of the Fed's monetary policy stance is fairly unambiguous. This finding suggests that clarity about future policy intentions may not be directly related to the length of the announcement and the details provided therein.

Second, we provide a glossary to interpret the FOMC balance of risks statements, i.e. its announcements regarding the likelihood of a future increase or decrease in the target rate. Moreover, we pin down the surprise component of this announcement, specifically the difference between what the Fed announces with respect to what the market expects the Fed to announce. We show that the unexpected component of the Fed's words and deeds systematically drives asset prices. In fact, the surprise part of the Fed's monetary policy decisions and statements can explain at least 80% of American money market interest rate dynamics, and around 10% of long-term interest rate changes.

Third, we do a comparative study exercise between the ECB ability to move European rates against the Fed capacity to move American rates. The response of the long-end of the American term structure to the surprise component of Fed's statements is significantly larger than the reaction of European long-term yields to ECB's announcements. This finding is intimately related to the higher transparency of U.S. Fed statements compared to ECB announcements rather than to the different institutional mandate of the two central banks.

Fourth, we investigate the cross-effects. We find that in the period under examination the Fed has been more able to move the European interest rates of all maturities than has the ECB to move American rates. The channel through which this transmission process takes place could be the result of two different mechanisms: either financial market participants think that the ECB mimics the Fed or it is simply a consequence of arbitrage, i.e. an effect of the uncovered interest rate parity. We find strong econometric support for the latter possibility.

Finally, we carry out a detailed sensitivity analysis of the above results. We find that the regression estimations are robust with respect to the choice of the econometric method used (generated regressor issue), and fairly stable over time.

The rest of the paper is organized as follows. In the next Section, we describe the dataset. In Section 3, we estimate the impact of the Fed and ECB monetary policy and news shocks on, respectively, American and European interest rates of all maturities. Moreover, we investigate the cross-effects. In Section 4, we perform important robustness checks and sensitivity analysis of our econometric results. In Section 5, we discuss the contributions of this study to the empirical literature related to central bank communication and its effects on financial markets. In Section 6, we suggest some important issues left for future research and conclude.

2 Description of the dataset

We proceed by outlining the data for market interest rates and for the surprise component of monetary policy actions and statements. Then we provide a descriptive analysis of the Fed and ECB's monetary policy decisions and announcements.

2.1 Market interest rates data

The main focus of the paper is on the transmission of monetary policy and news shocks to market interest rates. Therefore, a first important choice is what type of yields to use. We decide to take dollar (euro) libor rates to measure short-term U.S. (European) interest rates, and long-term dollar (euro) interest rate swaps, also known as IRS, to measure long-term U.S. (European) interest rates. We use these data for two main reasons. First, to our knowledge they offer the maximum amount of comparability across U.S. and Europe. Second, we do not have Treasury securities at all maturities, and to come up with yields across the complete maturity spectrum, we have to interpolate between the existing securities and thus to create "synthetic" Treasury securities with the desired maturity date. Moreover, it is not clear to us what Treasuries should be used to measure European yields. However, we acknowledge that the U.S. term structure is usually defined in terms of U.S. Treasury yields, which are more liquid than long-term dollar swaps and thus are likely to provide a better measure of U.S. term structure response to monetary policy and news shocks. For this reason, as a robustness check, we also use U.S. Treasuries (see Gurkaynak, Sack and Wright, 2007, for further details about the estimation procedure of the Treasury yield curve) to measure the American yield curve, and all the econometric results presented in the paper continue to hold. The analysis and empirical modelling is based on daily financial market data.

2.2 Measuring monetary policy shocks

Asset markets are forward looking and tend to incorporate any information about anticipated policy changes. To account for this issue, Kuttner (2001) first separates changes in the target funds rate into *anticipated* and *unanticipated* components, where the latter is defined as the surprise change on monetary policy decision days in the one-month futures rate adjusted for the period left up to its expiry. Then, he estimates the impact of unexpected monetary policy actions on Treasury-bill, -note, and -bond yields through the following regression:

$$r_{k,t+1} - r_{k,t} = \alpha + \beta\, MPS_{t+1} + \varepsilon_{t+1} \tag{1}$$

where the left-hand side approximates the change in the k-month maturity interest rate before and after the monetary policy decision. The error term ε_{t+1} represents factors other than monetary policy that affect market interest rates on event days. These factors are assumed to be orthogonal to the explanatory variables appearing on the right-hand side of the regression. Kuttner (2001) finds that the interest rates' response to unanticipated changes is large and highly significant.

In this paper, we measure the unexpected component of monetary policy decisions, i.e. the monetary policy shock (*MPS*), by the change on the committee days in the one-month ahead money market rate (see for instance Gurkaynak, Sack and Swanson, 2007):

$$MPS_{t+1} \equiv r_{1,t+1} - r_{1,t} \qquad (2)$$

By doing this, we are implicitly assuming that the risk-premium stays constant during Governing Council and FOMC meeting days.[1] An alternative measure of monetary policy shocks, which is free of both the risk premium issue and market noise (cf. Piazzesi and Swanson, 2005), is provided by survey data. As shown by Andersson (2007, Appendix B), these two proxies are very similar, with a correlation coefficient of 0.75 for the ECB target surprise and 0.8 for the Fed target surprises. Moreover, expectations derived from the financial markets are real-time, that is based on the latest available information.

A recent strand of the literature (see for instance Gurkaynak, Sack and Swanson, 2005, and Rosa and Verga, 2006) show that on the meeting days of the monetary policy committee *two* pieces of news, rather than just one, systematically hit financial markets. First, the new level of the policy rate in force for the following month becomes public information. Second, a press conference that provides both a rational for the policy action and a balance-of-risks assessment of the economic outlook over the foreseeable future takes place. Therefore to explain the change in market interest rate on monetary policy committee meetings, we need to employ the surprise component of *both* central bank words and deeds. In the next Section we propose a methodology to measure both the level (tone) and the surprise component (shock) of central bank qualitative announcements.

2.3 Measuring the tone and the surprise component of central bank announcements

In order to make central bank announcements suitable for statistical computation, we assign a number to each press statement. This number intends to summarize the monetary authority's overall policy stance as communicated by its monetary policy committee.[2] Both the ECB and the Fed employ a limited number of key words or strings, which tend to reappear with some regularity, to describe their future policy intentions. Hence, it is possible to represent explicitly our mapping between words and numbers, hence an ordered scale, through the construction of a glossary (see Rosa and Verga, 2007, 2006, and Rosa, 2006).

[1] This assumption is at least loosely consistent with the finding by Evans and Marshall (1998) that risk premia in US Treasuries are not affected much by monetary policy shocks which tend to occur at FOMC meetings.

[2] The seminal paper of Romer and Romer (1989) pioneered this so called narrative approach. In particular, they examined the records of Federal Reserve policy deliberations in order to identify exogenous (according to their claim) monetary policy shocks. More generally, the classification of statements is often referred to as content analysis (see Krippendorf, 2004 and Weber, 2004): it consists of a set of techniques to extract the content of a message. A similar methodology for the classification of monetary policy statements is also applied among others by Ehrmann and Fratzscher (2007a), Gerlach (2007), Guthrie and Wright (2000), and Jansen and De Haan (2005).

However, since the standardization of the language used is far from perfect and the meaning of some keywords may change over time, we have done the coding of each statement by reading the full press statement, and the glossary only serves to provide a *parsimonious* and *transparent* background of the coding. Although we acknowledge that the ranking of statements according to their assessment (tightening, neutral or easing) of future policy rate setting behaviour is necessarily influenced by personal judgement, the tone of central bank announcements is usually unambiguous, especially for the U.S. Federal Reserve.

The statement is converted into a wording indicator variable, *Index*, on a three-value scale from –1 to +1. The value of zero suggests that the current level of the policy rate is appropriate to maintain price stability over the medium term. The value –1 characterizes an easing period: it is possible that the policy rate will be cut in the near future. On the other hand, the value +1 characterizes a potential future monetary policy tightening. The glossary of the Fed's official statements and their ranking is reported in Table 1, while the corresponding value of *Index* for each Fed monetary policy announcement is reported in a separate Appendix (available from the author upon request), where we also provide a few examples of press releases along with our coding. The glossary of the ECB's statements, together with the coding of its President's press conferences is reported in Rosa and Verga (2006).

Table 1 here

In order to check whether financial markets react to central bank communication, it is crucially important to realize that the news does not consist of the central bank announcement itself but rather of its unexpected component, i.e. the difference between what the central bank declares and what the market expects the central bank to declare. Therefore, to verify empirically the effectiveness of central bank words, we need to proceed in two steps. First, we have to pin down what the market expects the ECB to declare. Second, we investigate the sensitivity of asset prices to the news and monetary policy shock.

We predict future central bank announcements through the following forecasting regression:

$$Index_t^{NEW} = \gamma_1 S_{t-h} + \gamma_2\, Index_t^{OLD} + \varepsilon_t \qquad (3)$$

where γs are regression coefficients, and S_{t-h} stands for the slope of the term structure immediately before the press statement is released, and is proxied by the difference between the three-month-ahead three-month forward rate and the one-month money market rate.[3]

In words, we assume that *Index* follows an AR (1) process: since the economic environment usually does not change too much in the course of one month, also the central bank's balance of risk statement

[3] To compute the slope of the yield curve, we use the 3-month-ahead 3-month forward rate instead of the 6-month rate for two reasons. First, we maximize the degree of comparability between the ECB and the Fed. Libor rates are quoted at 12 a.m. (GMT), while ECB policy decision takes place at 12.45 and its press conference at 13.30. Thus in the European case we need to use high-frequency futures data on the Euribor to measure the real-time slope immediately before the press statement but after the decision (see Rosa and Verga, 2006 for further details) and these futures data represent the 3-month-ahead 3-month forward rate. Second, although all the econometric results are robust to the use of the 6-month rate, we can fit the wording indicator slightly better by employing forward rates.

should exhibit some persistency. However, in estimating Equation (3), there is clearly a frequency issue because data on interest rates are continuous (real-time), while press statements are released either every month (ECB) or on average eight times a year (Fed). We take care of this problem by including an additional regressor in the specification of the right-hand side of (3), specifically the slope of the term structure computed immediately before the central bank makes its announcement. Indeed, other things being equal, if the forward rate is larger than the current rate (i.e. the slope of the term structure, corrected for the liquidity premium, is upward sloping) then the market expects the central bank to increase its policy rate in the near future. Hence, financial market participants expect a higher value of *Index* to be announced, i.e. a hawkish declaration. Vice versa, if the short-end of the term structure is downward sloping, then the market expects the monetary authority to cut its policy rate in the near future. Thus, the market expects a dovish announcement. We want this second term to capture all available and relevant information that has hit the market since the last central bank press release. Obviously, our implicit maintained hypothesis is that financial markets are efficient.

Since the wording indicator variable, *Index*, takes only discrete values (i.e. integers from -1 to +1), ordered probit regression seems the most appropriate estimator. We construct market participants' expectations about the central bank announcement as follows:

$$E_{t-h}[Index_t^{NEW}] = \sum_{i=-1}^{1} \Pr(Index_t^{NEW} = i) \cdot i \qquad (4)$$

where E_{t-h} *[.]* stands for the expectation conditional on time *t-h* information set, and $\Pr(Index_t^{NEW})$ is computed analytically by the ordered probit model (see Ruud, 2000).

Table 2 reports the estimated regressor coefficients of Equation (3), together with its limit points δs, for the period January 1999 – June 2006 for the ECB and May 1999 – June 2006 for the Fed, excluding the monetary policy meeting held on September 17, 2001 (when both the ECB and the Fed made a joint policy rate reduction of 50 basis points in the aftermath of the September 11 terrorist attack) and December 1999 (the Millennium outlier, also known as year 2000 spike, affects especially the 1-month libor rate, and thus the measurement of the slope of the term structure).[4] The sample period for the Fed starts in May 1999 because since that date the FOMC has released a post-meeting policy statement explicitly announcing the expected future direction of policy as contained in the directive. Interestingly, in both cases the coefficients γ_1 and γ_2 have the expected positive sign and are highly statistically significant. Furthermore, the

[4] Financial markets have been affected by the perception of increased risks when lending short-term funds during the transition to the year 2000, in particular if such lending was undertaken without collateral. For instance, the interest rate implied in the three-month libor futures contract maturing in December 1999 had traded above the notional interest rate which would be obtained by linear interpolation between September 1999 and March 2000 contract. This increased risk - year 2000 compliance problem - stemmed primarily from the data field defining the year, which permeated files and databases. Some computer programs used to employ only a two-digit field. For this reason, the operating system could not have differentiated between the 1900s and the 2000s (see ECB Monthly Bulletin, October 1999, for further details).

independent variables explain fairly well the announced tone of the ECB and Fed's declaration (the goodness of fit measured by the pseudo-R^2 ranges between 0.54 and 0.58).

Table 2 here

The scope of the next Section is to re-estimate Equation (1) by adding as an additional regressor our measure of the unexpected tone of central bank announcement, the *news shock*, defined as follows:

$$NS_t = Index_t^{NEW} - E_{t-h}[Index_t^{NEW}] \quad (5)$$

Figure 1 plots the Fed (top) and ECB (bottom) policy decision and monetary policy shock (in the left diagram) and change in the wording indicator and the news shock (in the right diagram).[5] In the interest of brevity we comment the most interesting aspects only of the results concerning the Fed's monetary policy and news shocks. The two largest Fed's target surprises took place in January 3, 2001 and April, 18 2001, during unscheduled (inter-meeting) announcements: in both cases the magnitude of the monetary policy shock is almost identical to the actual policy move. The largest news shock occurred on January 28, 2004 FOMC announcement. In this occasion, market participants completely anticipated that the FOMC did not change the target fed funds rate, and as a consequence the target surprise was essentially zero. However, the FOMC dropped the phrase "considerable period" employed in its previous press statements, and this was not anticipated at all. Therefore, the size of the news shock is almost identical to the change of *Index*. Interestingly, on that date market participants revised up their expectations about the path of future policy rates: for instance the five-year market rate rose by 28 basis points and the ten-year rate by 21 basis points. Although this example is an exceptionally strong case, it serves to illustrate an important and more general point: central banks are able to move asset prices using words alone, without any need for deeds. Another interesting date is March, 19 2002 when the Fed revised its future policy intentions but that revision was completely expected by market participants, and thus the news shock was basically zero. In recent periods the average target surprise has become much smaller. The corresponding increase in the relative importance of the news shock is consistent with reports that market participants have paid close attention to central banks' accompanying statements in gauging the path of future monetary policy. For instance, since November 2005 the ECB has adopted the convention of employing the word "strong vigilance" in its President's press conferences to unambiguously signal its decision to raise its policy rate at its next Governing Council meeting. The use of this keyword has practically removed any uncertainty about its future short-term policy decisions. Finally, the correlation of the monetary policy and news shocks is not statistically different from zero. The orthogonality between these two shocks suggests that the news shock is

[5] Monetary policy and news shocks seem to be zero mean and randomly distributed. Formal tests, such as the Q-statistic (Ljung and Box, 1979), do not reject the null hypothesis that there is no serial autocorrelation for the first twelve lags. A more comprehensive set of basic rationality and efficiency tests is performed by Krueger and Kuttner (1996) on fed funds futures rates.

sometimes a “timing” surprise (when the target and news surprise have the opposite sign), and in other occasions is a “level” surprise about the expected monetary policy path (when the target and news surprise have the same sign).

Figure 1 here

We test the effectiveness of central bank words and deeds by estimating the following regression for both the ECB and the Fed:

$$r_{k,t+1} - r_{k,t} = \alpha + \beta_{MPS} \cdot MPS_{t+1} + \beta_{NS} \cdot NS_t + \varepsilon_{t+1} \quad (6)$$

The main difference compared to baseline Kuttner’s (2001) specification is that we introduce an additional regressor, *NS*, that is associated with central bank verbal communication and should capture news about the revision in the future path of monetary policy.

2.4 Descriptive analysis

Since we are interested in explaining only the innovations in market interest rates caused by central bank statements made on its Board meeting days, we restrict our econometric analysis to FOMC and Governing Council meetings. In other words, we apply a standard event-study approach.[6]

There are several differences between the ECB and the Fed decision-making process in both the frequency of their Board meetings, and number and magnitude of policy rate changes. Table 3 indicates that the ECB Governing Council has met much more often than the FOMC. However, the Fed has conducted a relatively more active monetary policy, by changing its policy rate more frequently than the ECB. The ECB rhetoric has been much more hawkish than what should have been implied by its actual interest rate setting behavior. Instead the tone of Fed’s statements has been broadly consistent with its monetary policy deeds.

Table 3 here

The Fed’s announcement contains on average only 224 words, while the ECB President’s introductory statement to the monthly press conference usually contains 1163 words that increases to 4533 if we include its Questions and Answers section. Despite the low number of words, we find very little ambiguity in classifying the tone of the Fed’s monetary policy stance. This finding suggests that clarity about future policy intentions may not be directly related to the length of the announcement and the details

[6] Both Mackinlay (1997) and Campbell et al. (1997, Chapter 4) provide detailed surveys of the event-study methodology.

provided therein. On the contrary, conciseness combined with a transparent assessment of the balance-of-risk statement appears to be much more important in enhancing the understanding of central bank declarations.

3 Asset price reactions to the news shock

3.1 American interest rate reactions to Fed decisions and announcements

Table 4 displays the reaction of American interest rates to the surprise component of (a) the monetary policy decision and (b) the press statement released by the FOMC during the sample period May 1999 to June 2006. We estimate Equation (6) by Ordinary Least Squares with White-t statistics (White, 1980) to account for heteroskedasticity in the residuals.

Table 4 here

The goodness of fit, measured by the adjusted R^2 statistic, of the regression decreases monotonically with interest rate maturity. Obviously, the longer the maturity and the wider the set of relevant variables for market expectations, the lower the explanatory power of the two sources of surprises considered in this paper. The regression coefficients of the monetary policy and news shock are always significantly different from zero for market interest rates of maturity ranging from 3 months to 5 years. For the longest maturities, however, only the regressor coefficient of the news surprise remains statistically significant at 5% level. The magnitude of the monetary policy surprise is inversely related to the interest rates maturities. Whereas the value of the news surprise parameters grows till the 3-year maturity and diminishes thereafter. Finally, the fact that the constant of Equation (6) is never statistically different from zero seems to indicate that there are no arbitrage opportunities in the dollar libor and IRS markets.

Since *Index* takes values between -1 and +1 and policy decisions take values between -50 and +50 basis points, the units of measurement of the monetary policy shock and the news shock are substantially different. Therefore, in order to compare the order of magnitude of the effect of the news shock and monetary policy shock on the whole spectrum of the term structure, we need to normalize them. In Table 5 we report the impact on the term structure of a news shock of one standard deviation versus a monetary policy shock of one standard deviation. An alternative normalization could be considered the shift of the term structure implied by the averages (of the absolute value) of the monetary policy and news shock. It turns out that the effect of the news shock is not only statistically different from zero and with the right sign, but also quantitatively important. For instance, a hypothetical negative monetary policy shock of one standard deviation is associated on average with about 3.8 basis points decrease in the 3-year market rates. A positive news shock of one standard deviation is associated with about 4.7 basis points increase in the same 3-year rate. We test whether these two effects are statistically different between each other. We find that for the short-end of the term structure up to one year maturity, the effect of the monetary policy shock is significantly larger than the effect of the news shock, but for the medium- and long-end the effects are statistically the same. It very much seems that words are an additional instrument in the hands of the central banker in conducting monetary policy (cf. Kohn and Sack, 2003).

Table 5 here

Table 5 also illustrates that for the long-end of the yield curve the explanatory power of adding the news shock to Equation (1) is substantial. Given that the informational content of the FOMC press releases is related to the Fed's future monetary policy actions, it is naturally more important for the medium and long-term expectations. For instance, for a 5-year interest rate, the fit improves by around 350%.

3.2 European interest rate reactions to ECB decisions and announcements: a comparison

The impact of the ECB's monetary policy decisions and announcements on European interest rate movements is reported in Table 6. The regressor coefficient of the monetary policy shock has the expected positive sign and is statistically different from zero up to the five-year maturity, while the coefficient of the news shock remains significant also for the seven-year horizon. As in the Fed's case, the explanatory power of the regressions monotonically decreases over time, and the constant is never significantly different from zero, indicating that there are no arbitrage opportunities.

Table 6 here

Table 7 shows the reaction of market rates to a normalized monetary policy and news shock. The monetary policy surprise turns out to be the main cause of changes in the short- and medium-term interest rates. On the other hand, market rates of longer maturities, say five to ten years, are mostly driven by the surprise component of the ECB President's speech.

Table 7 here

The bottom part of Table 7 compares the explanatory power of the baseline Kuttner's (2001) model against the specification of Equation (6) that includes the news shock as additional regressor. As in the Fed case, the inclusion of the surprise component of central bank communication is especially helpful to predict changes in market rates of medium- and long-term maturity. For instance, for a 5-year interest rate, the fit improves by around 200%.

There remain important differences between the market reaction to the ECB and the Fed's decisions and announcements. Figure 2 provides a graphical comparison of the estimation results contained in Tables 4 and 6 concerning the effects of central bank words and deeds on interest rates. Note that since the constant term in Equation (6) is always insignificant, the normalized total effect is simply equal to:

$$Total\ Effect = \beta_{MPS} \cdot \sigma_{MPS} + \beta_{NS} \cdot \sigma_{NS} \qquad (7)$$

Figure 2 here

Overall, we find that the Fed seems more effective than the ECB in steering market rates. This is particularly stark for maturities below one year. We further investigate this different market reaction by disentangling and comparing all the components that form the total effect: the magnitude of the normalized monetary policy and news shock (i.e. σ_{MPS} and σ_{NS}), and their regressor coefficients (i.e. β_{MPS} and β_{NS}) for both the ECB and the Fed.

In the sample period under consideration the standard deviation of the U.S. monetary policy shock has been significantly much higher, more than double, than the corresponding euro-area monetary policy shock. On the other hand, the volatility of the news shock has been statistically (and numerically almost) the same for both the ECB and the Fed. A possible explanation of this finding can be that the Fed has conducted a relatively more active monetary policy, by changing its policy rate more frequently than the ECB. Indeed, as shown in Table 3, in the period January 1999 – June 2006, the ECB Governing Council changed the policy rate in 14.4% of its meetings (18 times on 125 meetings), while in the period May 1999 – June 2006 the FOMC has changed the policy rate in 58% of its meetings (35 times on 60 meetings). Monetary policy surprises have on average larger absolute magnitudes when the central bank decides to change rates compared to meetings that resulted in no change (cf. among others Andersson, 2007).

The coefficients of the monetary policy shocks are very similar, and not statistically different, in the European and American case. Whereas, for a given size of the shock, the financial market response to the surprise component of ECB's statements is generally lower than the corresponding reaction due to FOMC press releases, especially for medium- and long-term interest rates. Moreover, the difference between the coefficients of the news shock in Europe and in the U.S. for interest rates of maturity above one year is jointly statistically significant. This latter empirical evidence about the discrepancy of the effects of the news shocks can be rationalized by two complementary hypotheses.[7] One possibility is that the Federal Reserve's long-term inflation objective is not well-known, so long-term inflation expectations and hence interest rates in the U.S. are more sensitive to Fed statements than are those in the euro area.[8] In other words, Fed's press

[7] We do not think that this pattern is a consequence of the U.S. Fed being more credible than the ECB. Credibility would have shifted in a parallel way the coefficients of the news shock for all maturities, not just for maturities greater than one year.

[8] The mandate of the Fed is spelled out in the Federal Reserve Act, established by the Humphrey-Hawkins law (Federal Reserve, 1978), which specifies that the FOMC "shall maintain long run growth of the monetary and credit aggregates (…) to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates." Therefore, the Fed has to pursue the objective of stabilizing both prices and economic activity, and its inflation target is not specified quantitatively. On the other hand, the mandate of the ECB, set out by the Maastricht Treaty, provides a clear hierarchy of objectives by assigning overriding importance to price stability. Moreover, the ECB Governing

statements may contain information not only about its future policy intentions but also about its time-varying inflation target and the weight attached to output stabilization (cf. Faust and Svensson, 2001 and 2002). An alternative explanation might be that the Fed's statements are more transparent or communicate more to the markets than the ECB's statements, and as a result the Fed's statements move interest rates of all maturities more than the ECB's statements do. We try to discriminate between these two possibilities in a more rigorous econometric analysis as follows. On the one hand, to test the long-run inflation expectations hypothesis, we look at the reaction of far-ahead forward interest rates both in the U.S. and in Europe. On the other hand, to test the transparency hypothesis, we compare the ability of central bank statements to forecast future monetary policy actions. More formally:

$$f_{t+1+\tau,t+1+\tau+k,t+1} - f_{t+\tau,t+\tau+k,t} = \alpha + \beta_{MPS} \cdot MPS_{t+1} + \beta_{NS} \cdot NS_t + \varepsilon_{t+1} \quad (8)$$

$$R_{t+m} - R_t = \alpha + \beta\, Index_t + \varepsilon_{t+m} \quad (9)$$

where $f_{t+\tau,t+\tau+k,t}$ stands for the τ-month-ahead k-month-forward interest rate quoted on day t, and R_{t+m} is the policy rate force within m months from today t.

We find that neither the Fed nor the ECB's monetary policy and news shock can move 5-year-ahead 2-year forward and 7-year-ahead 3-year forward interest rates (results not reported in the interest of space). Thus, the data do not support the long-run inflation expectations hypothesis, and the different institutional mandate of the two central banks does not explain the different reaction of market interest rates to the surprise component of central bank announcements.

Table 8 reports the estimation results of Equation (9) for both the Fed and the ECB. Across the same forecasting horizon, the explanatory power for the Fed regression is much larger than for the ECB. This evidence seems to indicate that Fed's statements are more transparent about its future intentions and thus more reliable to forecast its future actions compared to ECB announcements. For both central banks, the coefficient of the wording indicator variable is positive, suggesting that a hawkish announcement is followed by a policy rate hike, and highly significant. However, the magnitude of the coefficient is much higher for the Fed. This result seems to be intimately related to the conduct of the U.S. monetary policy. More specifically, in the sample period under consideration, the Fed increases its Fed funds target to 6.5%, then decreases it to 1% and finally increases it back to 5.5%. On the other hand, the ECB conduct of monetary policy has been much more gradual, and its policy rate has fallen in the range of 4.75% and 2%.

Table 8 here

Council defines precisely price stability as "a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below but close to 2% to be maintained over the medium term" (ECB, 1999 and ECB, 2003).

3.3 Cross-reactions: American and European interest rate reactions to ECB and Fed decisions and announcements

Tables 9 and 10 report the cross-reaction effects, namely the impact of the Fed's words and deeds on European market rates and the response of American rates to ECB decisions and announcements. More formally, we estimate the following regressions:

$$r^{E}_{k,t+1} - r^{E}_{k,t} = \alpha + \beta_{MPS} \cdot MPS^{US}_{t+1} + \beta_{NS} \cdot NS^{US}_{t} + \varepsilon_{t+1} \quad (10)$$

$$r^{US}_{k,t+1} - r^{US}_{k,t} = \alpha + \beta_{MPS} \cdot MPS^{E}_{t+1} + \beta_{NS} \cdot NS^{E}_{t} + \varepsilon_{t+1} \quad (11)$$

where the superscript *US* stands for United States and *E* for Europe.

The difference between the two sets of estimated parameters of Equations 10 and 11 is self-evident. Indeed, a strong link seems to exist between the surprise components of what the Fed does and says and the European interest rate movements (Table 9), whereas there is no discernable statistical relationship between the shocks stemming from ECB's words and deeds and American asset price returns (Table 10).

Tables 9 and 10 here

All adjusted R^2 statistics reported in Table 10 are always negative, suggesting that the explanatory power of the ECB's monetary policy on American interest rates is particularly poor. The F-test of the regressions confirms this conclusion: the null hypothesis that all slope coefficients, excluding the intercept, in Equation 10 (the Fed's case) are zero is strongly rejected by the data, while this null hypothesis cannot be rejected for Equation 11 (the ECB's case). Overall, this evidence underlines the key role exerted by the U.S. Fed in the world financial market, and is broadly in line with the findings of previous studies, such as Wongswan (2006). This strong discrepancy between the pronounced European interest rate reactions to the Fed's monetary policy compared with the more muted response of American asset prices to the ECB's words and deeds needs to be further investigated. In particular, what are the factors that drive this different pattern? We analyse econometrically this issue in the next subsection.

3.4 Is the ECB following the Fed or is it arbitrage?

During the first years of the European Monetary Union (EMU), the ECB's conduct of monetary policy was not well known, and financial market participants used to employ information coming from the Fed to forecast the future ECB behaviour under the assumption that the monetary policy of the ECB would have been influenced by the Fed. Moreover, Euro-denominated money and bond markets were much smaller than corresponding U.S. dollar fixed income assets: it is not surprising, therefore, that the causal effect comes from America to Europe, and not vice versa. At this point a question seems natural: is the effect of the

Fed's behaviour on European interest rates a simple consequence of arbitrage driven by uncovered interest rate parity, or do financial intermediaries thinks that the ECB is really following the Fed?

In order to evaluate the significance of these two competing hypotheses, we posit that in the case of arbitrage European interest rate movements should be explained by corresponding changes in the level of American interest rates, rather than by U.S. monetary policy and news shocks. In other words, in estimating the following regression:

$$r^{E}_{k,t+1} - r^{E}_{k,t} = \alpha + \beta_{MPS} \cdot MPS^{US}_{t+1} + \beta_{NS} \cdot NS^{US}_{t} + \gamma\,(r^{US}_{k,t+1} - r^{US}_{k,t}) + \varepsilon_{t+1} \qquad (12)$$

we should find a statistically significant γ coefficient, and βs insignificantly different from zero. On the contrary, if financial markets think that the ECB mimics the Fed, the ECB should react to the new information, and as a consequence European rates respond only to the surprise components of the Fed's words and deeds. In this latter case, we should find that both β_{MPS} and β_{NS} remain significantly different from zero, while γ is small and insignificant.

The estimated parameters of Equation 12 are reported in Table 11. The regressor coefficients of the change in American interest rates, $r^{US}_{k,t+1} - r^{US}_{k,t}$, are always significantly different from zero, while the coefficient of the monetary policy and news shocks are in all but two cases statistically insignificant. For the three- and six-month euro libor rate, the coefficient of the monetary policy shock is significant at the 5% probability level but has the negative, rather than positive, sign.

Table 11 here

These findings support the hypothesis that the ability of the Fed to influence European rates stems from the global dimension, especially at the starting of the ECB life, of the American financial market compared to the European one.

The coefficients reported in Table 11 may be inconsistently estimated because of the simultaneity issue that European and American rates are jointly determined. In order to verify the severity of the endogeneity problem, we apply the weak exogeneity test originally proposed by Hausman (1978) and Wu (1973). This specification test is based on two steps. First, we estimate the marginal equation by regressing the explanatory variable, $r^{US}_{k,t+1} - r^{US}_{k,t}$, on a set of exogenous and predetermined variables, such as its lagged value, the Fed's monetary policy and news shocks, the change in the Federal fund rate, and two lags of the daily one-month dollar libor. Second, we include its residual, $z^{US}_{k,t+1}$, as a further explanatory variable in the right-hand side of Equation 12. If the coefficient of the computed residuals is not significantly different from zero, the variable $r^{US}_{k,t+1} - r^{US}_{k,t}$ is defined weakly exogenous with respect to $r^{E}_{k,t+1} - r^{E}_{k,t}$. The implication is that its regressor coefficient can be estimated consistently even in a univariate framework.

In the weak exogeneity test (see separate Appendix), we find that the residuals are never significant, excluding the case of the one year maturity where they are significant only at the 10% level. This suggests that our results are not biased by the presence of a contemporaneous effect of the European to the American interest rates. The power of the weak exogeneity test depends on the R^2 of the marginal regression. In particular, a low R^2 indicates that the conclusions of the test are not particularly reliable. In our case, the goodness-of-fit of the marginal equation substantially decreases with the interest rate maturity. Hence, for maturities longer than one year, the estimates reported in Table 11 could potentially be biased. However, the high probability of $z^{US}_{k,t+1}$ being insignificant is evidence against the existence of such a bias.

4 Robustness checks

4.1 Generated regressor issue

In the previous Section, the econometric estimations have been carried out in two steps. First, we determine market expectations about the ECB's and Fed's announcements to pin down the surprise component of central bank communication. Then, we use both monetary policy and news shock to explain the changes in market interest rates. In other words, in the second step we employ a generated regressor (cf. Oxley and McAleer, 1993). This fact may give rise to underestimated standard errors and hence to spurious significant regressor coefficients. In order to solve this issue and to check the statistical validity of our conclusions, we re-estimate the same regressions of the previous subsections all in one step. More formally, we estimate the following regressions:

$$r^{US}_{k,t+1} - r^{US}_{k,t} = \alpha^{US} + \beta^{US}_{MPS,k} \cdot MPS^{US}_{t+1} + \beta^{US}_{NS,k} \cdot (Index_t^{US,NEW} + \gamma^{US}_1\, Index_t^{US,OLD} + \gamma^{US}_2\, Slope_{t-h}^{US}) + \varepsilon^{US}_{t+1} \quad (13)$$

$$r^{E}_{k,t+1} - r^{E}_{k,t} = \alpha^{E} + \beta^{E}_{MPS,k} \cdot MPS^{E}_{t+1} + \beta^{E}_{NS,k} \cdot (Index_t^{E,NEW} + \gamma^{E}_1\, Index_t^{E,OLD} + \gamma^{E}_2\, Slope^{E}_{t-h}) + \varepsilon^{E}_{t+1} \quad (14)$$

where the notation is the same as before.

This direct estimation method presents both advantages and drawbacks with respect to the two-step procedure we employed before. On the one hand, the correction of the estimator is especially important for short maturities since in this case the corresponding residuals are leptokurtic (i.e. peaked relative to the normal distribution), while for maturities of one-year onwards the distribution is fairly near to a Gaussian. On the other hand, the two-step exercise is informative in two respects. First, it determines the explanatory power of adding the news shock in an otherwise standard regression (Equation 6). Second, since the *Index* variables assume only three integer values {-1, 0, 1}, the news shock should be estimated more precisely by using ordered probit econometric method. Importantly, if the econometric results of these two estimation methods are similar to each other, this evidence will provide support for the conclusions reached previously.

In order to avoid inconsistencies among different maturities for the estimated coefficients γ_1 and γ_2, we impose the constraint that they should have the same values for all the equations. In other words, the surprise component of central bank announcements must be the same for all interest rate maturities. This theoretical constraint is not rejected by the data, even at 10% significance level. Therefore, we estimate a system of eight equations by Non-Linear Least Squares, one for every maturity, where the parameters α,

$\beta_{MPS,k}$ and $\beta_{NS,k}$ can change from one equation to another (so the effect of the monetary policy and news shocks may be different among different maturities), while the coefficients γs are maintained fixed. All the econometric results continue to hold both qualitatively and quantitatively. The significance of the estimated coefficients, reported in Table 12, are very similar to those obtained in the previous section, and reported in Tables 4 and 6, where White's robust standard errors are used. This fact confirms that both the ECB and the Fed are indeed able to move asset prices in the desired direction by using either words or deeds. Moreover, the two surprises of central bank communication, $Index_t^{US,NEW} + \gamma^{US}_1\ Index_t^{US,OLD} + \gamma^{US}_2\ Slope_{t-h}^{US}$ and $Index_t^{E,NEW} + \gamma^{E}_1\ Index_t^{E,OLD} + \gamma^{E}_2\ Slope^{E}_{t-h}$, obtained from the corresponding estimated values of γ's (Table 12), are strongly correlated to NS^{US}_{t+h} and NS^{E}_{t+h} derived from the auxiliary regressions of Table 2: 0.96 for the Fed and 0.954 for the ECB surprises. Therefore, when compared to this alternative estimation procedure our previous econometric results seem robust.

Table 12 here

In order to account for the generated regressor problem when computing coefficient estimates' standard errors, we also check the robustness of our conclusions by using two types of bootstrap approach to statistical inference (see for example Efron and Tibshirani, 1993). More specifically, we apply either a sampling-with-replacement raw residuals bootstrap scheme with 1,000 repetitions, or a wild bootstrap scheme.[9] The empirical results are qualitatively very similar to those obtained in the previous section when White's robust standard errors are used, and are reported in a separate Appendix. Indeed, the coefficient of the news shock remains highly statistically significant (by using empirical confidence levels) for long-term maturities. This fact confirms that both the ECB and the Fed are indeed able to move asset prices in the desired direction by simply making announcements.

4.2 Stability over time

In this Section we carry out a detailed stability analysis of the reaction of European and American market interest rates to the ECB's and the Fed's announcements. In particular, in order to get some information about the stability of the results reported in Tables 4, 6, 9 and 10, we compute the Cusum test (Brown, Durbin, and Evans, 1975), the Chow breakpoint test statistics for January 2004, Recursive Least Squares (RLS), and the N-step ahead forecast.[10,11]

[9] This is the same as resampling residuals but with the additional step that each resampled residual is randomly multiplied by 1 or -1. This method assumes that the 'true' residual distribution is symmetric and can offer advantages over simple residual sampling for smaller sample sizes.

[10] The stability of the regression coefficients is an important diagnostic criterion for two main reasons. First, during the estimation phase, it allows us to exclude the possibility that the omission of important explanatory variables creates instability in the parameters. Second, any forecasting model should be stable over time to be useful for future applications.

[11] The econometric results obtained by RLS and N-step-ahead forecasts are available from the author in a separate Appendix.

The Cusum test is based on a recursive estimation, and it is especially apt when there is uncertainty whether and when a structural change has taken place (cf. Johnston and DiNardo, page 117, 1996). Table 13 summarizes the results: in general the regressions seem fairly stable with the only exception of some short-term maturities, when the cumulative sum of the recursive residuals does cross the 5% critical lines, and thus indicates the presence of parameter instability. However, in these few cases, different tests provide conflicting conclusions. For Table 6, when the Cusum test rejects the null hypothesis of parameter stability, the Chow breakpoint test cannot reject it. For Table 9, when the Chow breakpoint test rejects stability, the Cusum cannot reject it. Overall, despite a couple of (not very decisive) exceptions, we conclude that our econometric results seem sufficiently reliable and stable.

Table 13 here

5 Discussion of the related literature

Central bank communication and its effects on financial markets have recently received increasing attention in monetary economics literature both theoretically (Woodford, 2005, and Rudebusch and Williams, 2005) and empirically (see among others Ehrmann and Fratzscher, 2007a, 2007b, Jansen and deHaan, 2007, 2006, 2005, and Kohn and Sack, 2003). Nowadays, it is clear that central banks accentuate verbal communication with the markets in an attempt to inform them of the likely direction of future monetary policy. This is very much the case with the ECB, which holds all-important news conferences at its Governing Council meetings, and it is also increasingly the case for the U.S. Federal Reserve.

The workhorse model so far used in the literature (Kuttner, 2001) to describe the effects of central bank interest rate setting behaviour has been based only on monetary policy shocks, i.e. a single factor, whereas Bomfim (2003) and Gurkaynak, Sack and Swanson (2005) suggest that at least two factors are required in order to capture adequately the effects of U.S. monetary policy on asset prices. They interpret the first one as the current federal funds target rate and the second one as the future path of policy, which is associated with FOMC announcements. We solve a related empirical exercise. However, there remain important differences. First, the methodology is different. First, we identify the surprise component of the central bank's statement. Then, we use it to explain the change in market interest rates. On the other hand, Gurkaynak, Sack and Swanson (2005) assume that the second factor of a principal component analysis on the futures price changes with maturity of less than a year corresponds to central bank announcements. Then, they use both factors to explain other asset price movements. By doing so, they implicitly assume that the two factors are at least weakly exogenous with respect to bond and stock prices, while we do not make any exogeneity assumption. Put differently, *before* we explicitly measure the news shock and *then* explain its effects, while Gurkaynak et al. (2005) do not interpret central bank statements simply because the surprise is posited equal to the second factor, rather than derived from first principles (and noteworthy the second factor is related only marginally, i.e. 18%, to FOMC statements). Second, we analyse both the ECB and the U.S. Fed while they focus exclusively on the U.S. Fed.

Very interestingly, our methodology allows to explicitly testing the identification restriction proposed by Gurkaynak, Sack and Swanson (2005), and later used by Brand, Buncic and Turunen (2006) and Wongswan (2005), that monetary policy and news shocks are orthogonal to each other. Indeed, both for the ECB and the Fed this assumption is not rejected by the data: the surprise component of the monetary policy decision has been so far uncorrelated to the surprise component of the announcement (for the Fed the correlation coefficient is -0.39 and for the ECB the correlation coefficient is 0.194, and in both cases it is not statistically different from zero).

Like Rosa and Verga (2007, 2006), in this paper we examine the effect of central bank communication on the price discovery process for European money market rates. However, we also analyse the impact of Fed's announcements on American interest rates, we perform a comparative study between the effectiveness of ECB and Fed communication policy, and we also study the cross-effects of monetary policy words and deeds. Moreover, we investigate the whole term structure of interest rates, rather than only the short-end of forward rates, as well as taking into account the generated regressor issue of the news shock by estimating a system of equations where we impose the constraint that the surprise component of central bank announcements must be the same for all the interest rate maturities. Finally, this study performs a detailed stability analysis. This is important because any forecasting model should be stable over time to be useful for future applications.

The seminal contribution of Romer and Romer (2004) also develops a measure of *unanticipated* policy deliberations. They regress their previous (1989) measure of Federal Reserve intentions for the Federal funds rate around FOMC meetings on the Federal Reserve internal forecasts. However, they use only one dimension to describe monetary policy conduct, rather than two as we do in this work.

Ehrmann and Fratzscher (2007a) analyse the communication policies employed by the Fed, the ECB and the Bank of England in the context of their underlying decision-making processes, individualistic versus collegial approach. However, there remain important differences between their paper and this one. First, we look at a different set of events: they consider all statements related to monetary policy by individual committee members in the inter-meeting period, we focus on statements made on monetary policy decision days. We think that these latter announcements are very important because they represent the view of the whole monetary policy committee and not simply of one of its individual members. Second, we investigate the impact of *unexpected* central bank announcements, the difference between what the central bank announces and what financial market participants expect the central bank to announce, while they use ternary communication dummies that capture only the tone of the announcement. We think that, after all, a hawkish announcement about the future monetary policy path should not cause an interest rate hike if the market has already priced it in, i.e. it is completely expected. Third, we analyse the content of the official central bank declaration that is published or broadcast in real time on the respective central bank website: they employ Reuters newswire service to select reports about forward-looking policy statements. Note that it is not uncommon that to preserve space the newswire company only displays some selected excerpts of a given speech or interview, rather than its full content.

Finally, Andersson (2007) examines bond and stock market reactions in the euro area and the U.S. following their respective economies' monetary policy decisions over the uniform sample period of April 1999 to May 2006. We conduct a similar empirical exercise by focusing on the ECB and the U.S. Fed. Nevertheless, we study the impact not only of monetary policy decisions *but also* central bank announcements. Clearly, higher volatility of financial asset returns surrounding the release of monetary policy decisions can gauge the extent to which these events contain new information for market participants. Andersson (2007) studies only the reaction of second moments that are however silent about the direction and the quantitative influence exerted by monetary policy on financial market expectations. In this work, we explain the change in the level of asset prices, rather than simply the change in intraday volatility at the release of the monetary policy decision announcement.

6 Summary and conclusions

The ultimate objectives of monetary policy are usually expressed in terms of output and inflation. However, decisions on current policy rates have a negligible impact on the inter-temporal decisions of firms and households, and thus the influence of monetary policy instruments on macroeconomic variables is at best indirect. The most direct and immediate effects of monetary policy actions, such as changes in the policy rate, are on financial markets. By affecting asset prices, central bankers can guide economic behaviour in ways that enhance the achievement of their ultimate goals. Hence, understanding the relationship between monetary policy and the term structure of interest rates turns out to be very important for understanding the monetary policy transmission mechanism. Furthermore, since monetary policy is one of the most important drivers of global financial markets, understanding the international transmission of monetary shocks is important for gauging the financial integration across the American and European capital markets.

This paper examines the different communication policies of the ECB and the Fed, and the implied financial markets' response. In particular, we compare the impact of monetary policy decisions and central bank announcements on the full spectrum of the American and European yield curve over the sample period May 1999 – June 2006 and January 1999 – June 2006. We find that the Fed's announcements about the future path of its policy rate are on average more straightforward to interpret than corresponding ECB declarations. Moreover, they are much shorter and made less frequently. Hence, clarity seems not to be a question of the number of words used. On the contrary, conciseness together with a transparent balance-of-risk statement appears to be important tools in enhancing the understanding of central bank declarations.

On monetary policy committee meeting days both the ECB and the Fed can systematically and significantly move market rates by using either the monetary policy or the news shock, i.e. the difference between what the central bank does (or announces) with respect to what the market expects the central bank to do (or announce). For example, the Fed's surprises about its monetary policy decisions and statements can explain at least 80% of American money market interest rate dynamics, and around 10% of long-term interest rate changes. Moreover, the U.S. Fed is able to move the long-end of the term structure more effectively than the ECB. This evidence is intimately related to the higher transparency of U.S. Fed statements compared to ECB announcements rather than to the different institutional mandate of the two central banks.

We find that the surprise components of Fed's words and deeds drive European interest rates of all maturities, whereas we do not find any effect of ECB's actions and announcements on American interest rates. The ability of the Fed seems to reside on the larger size of the American financial market compared to the European market rather than in the ECB's attempt to mimic the Fed's monetary policy, as argued by some commentators (see initial quotations).

We carry out a detailed sensitivity analysis of the above results. We find that the regression estimations are robust with respect to the choice of the econometric method used (generated regressor issue), and fairly stable over time.

The results of this paper pose a number of challenges to monetary theorists. In most DSGE monetary models, verbal communication plays no role. In light of the strong response of market interest rates both in the U.S. and in Europe to central bank announcements this seems like a shortcoming in the present state of affairs. Second, it is not completely clear what is the nature of the new information the markets are picking up from the central bank's words: are they learning about the true state of the economy (which implies that the central bank knows more about the state of the economy than the markets); or are they learning about the central bank's reaction function? Finally, there is a key issue that this paper brings to the fore: the Fed moves market rates more than the ECB, and is particularly effective in affecting the long-end of the term structure through its statements. The question presents itself: if this monetary policy strategy optimal? In other words, should central bank announcements have a large effect? Unfortunately, in the absence of a fully-microfounded model it is impossible to provide a definitive answer.

Of course, several important issues are not considered in this paper and deserve further study. In this work as a first step in a broader research agenda we analyse only the effect of the ECB press conference and the release of the Fed statement on market interest rates. However, both central banks use many different communication channels. Among them, it would also be interesting to analyse the impact of the release of the Fed minutes that, similar to the Bank of England communication strategy, are substantially more comprehensive than its monetary policy statement. However, they are usually published with a three week delay: are these releases affecting asset prices too?

The methodological approach employed in this work could be easily applied to study the effectiveness of other central banks' communication policy, such as the Bank of Japan or the Bank of England. Moreover, it is possible to investigate the impact of central bank announcements on other asset prices, such as global equity indexes and exchange rates. We can also examine whether the reaction of asset prices depend on certain characteristics of the announcement. For instance, we can explore four kinds of asymmetries: positive versus negative shocks, policy action versus policy inaction, scheduled versus unscheduled meeting days, and policy reversal situations by interacting the monetary policy and news shocks with dummy variables (Bernanke and Kuttner, 2005). Finally, it would be interesting to analyse the impact of the quantitative announcements of the Reserve Bank of New Zealand[12] on the future level of its future policy rate: are numbers more effective than words?

[12] The case of the Central Bank of Colombia, Banco de la Republica, is even more interesting. It made the policy experiment of publishing quantitative interest rate forecasts in four inflation reports from December 2003 to September 2004, before dropping this communication strategy.

REFERENCES

Andersson, M., 2007. Using intraday data to gauge financial market responses to Fed and ECB monetary policy decisions. ECB Working Paper 726.

Bernanke, B., Kuttner, K., 2005. What explains the stock market's reaction to Federal Reserve policy? Journal of Finance, LX(3), 1221-1257.

Bomfim, A., 2003. Monetary policy and the yield curve. Federal Reserve Board Finance and Economics Discussion Series 2003-15.

Brand, C., Buncic, D., Turunen, J., 2006. The impact of ECB monetary policy decisions and communication on the yield curve. ECB WP 657.

Brown, R.L., Durbin, J., Evans, J.M., 1975. Techniques for testing the constancy of regression relationships over time. Journal of the Royal Statistical Society, Series B, 37, 149-192.

Campbell, J., Lo, A., Mackinlay, C., 1997. The econometrics of financial markets. Princeton University Press, Princeton.

ECB, 2003. Press seminar on the evaluation of the ECB's monetary policy strategy. Available at http://www.ecb.int/press/pressconf/2003/html/is030508_1.en.html

ECB, 1999. http://www.ecb.int/mopo/intro/html/benefits.en.html

Efron, B., Tibshirani, R.J., 1993. An introduction to the bootstrap, Chapman & Hall.

Ehrmann, M., Fratzscher, M., 2007a. Communication and decision-making by central bank committees: different strategies, same effectiveness? Journal of Money, Credit and Banking, 39(2–3), 509-41.

Ehrmann, M., Fratzscher, M., 2007b. The timing of central bank communication. European Journal of Political Economy, 23(1), 124-145.

Evans, C., Marshall, D., 1998. Monetary policy and the term structure of nominal interest rates: evidence and theory. Carnegie-Rochester Series in Public Policy, 49, 53-111.

Faust, J., Svensson, L.E.O., 2001. Transparency and Credibility: Monetary Policy with Unobservable Goals. International Economic Review, 42(2), 369-397.

Faust, J., Svensson, L.E.O., 2002. The equilibrium degree of transparency and control in monetary policy. Journal of Money, Credit and Banking, 34(2), 520-39, May.

Federal Reserve, 1978. http://www.federalreserve.gov/generalinfo/fract/sect02a.htm

Gerlach, S., 2007. Interest rate setting by the ECB: Words and deeds. International Journal of Central Banking, 3, 1-45.

Gurkaynak, R., Sack, B., Swanson, E., 2007. Market-based measures of monetary policy expectations. Journal of Business and Economic Statistics, 25(2), 201-212.

Gurkaynak, R., Sack, B., Wright, J., 2007. The U.S. treasury yield curve: 1961 to the present. Journal of Monetary Economics, 24(8), 2291-2304.

Gurkaynak, R., Sack, B., Swanson, E., 2005. Do actions speak louder than words? The response of asset prices to monetary policy actions and statements. International Journal of Central Banking, May, 55-93.

Guthrie, G., Wright, J., 2000. Open Mouth Operations. Journal of Monetary Economics, 46, 489-516.

Hausman, J.A., 1978. Specification tests in econometrics. Econometrica, 46, 1251-1271.

Jansen, D.-J., De Haan, J., 2007. Were verbal efforts to support the euro effective? A high-frequency analysis of ECB statements. European Journal of Political Economy, 23(1), 245-259.

Jansen, D., De Haan, J., 2006. Look who's talking: ECB communication during the first years of EMU. International Journal of Finance and Economics, 11(3), 219-228.

Jansen, D., De Haan, J., 2005. Talking heads: the effects of ECB statements on the euro-dollar exchange rate. Journal of International Money and Finance 24, 343-361.

Johnston, J., DiNardo, J., 1996. Econometric methods. McGraw-Hill, Irvine.

Kohn, D., Sack, B., 2003. Central bank talk: does it matter and why? Federal Reserve Board Finance and Economics Discussion Series 2003-55.

Krippendorf, K., 2004. Content analysis: an introduction to its methodology. 2nd edition, Thousand Oaks, CA: Sage.

Krueger, J.T., Kuttner, K., 1996. The Fed funds futures rate as a predictor of Federal Reserve Policy. Journal of Futures Markets, 16, 865-879.

Kuttner, K., 2001. Monetary policy surprises and interest rates: evidence from the Fed Funds futures markets. Journal of Monetary Economics, 47, 523–44.

Ljung, G., Box, G., 1979. On a measure of lack of fit in time series models. Biometrika, 66, 265-270.

MacKinlay, A.C., 1997. Event studies in economics and finance. Journal of Economic Literature, 35(1), 13-39.

Oxley, L., McAleer, M., 1993. Econometric issues in macroeconomic models with generated regressors. Journal of Economic Surveys, 7(1), 1-40.

Piazzesi, M., Swanson, E., 2004. Future prices as risk-adjusted forecasts of monetary policy. NBER Working Paper 10547.

Romer, C., Romer, D., 2004. A new measure of monetary shocks: Derivation and implications. American Economic Review, 94(4), 1055–1084.

Romer, C., Romer, D., 1989. Does monetary policy matter? A new test in the spirit of Friedman and Schwartz. NBER Macroeconomics Annual, 121-170.

Rosa, C., 2006. Central bank communication: the case of the European Central Bank. Ph.D. thesis, London School of Economics.

Rosa, C., Verga, G., 2007. On the consistency and effectiveness of central bank communication: evidence from the ECB. European Journal of Political Economy, 23, 146-175.

Rosa, C., Verga, G., 2006. The impact of central bank announcements on asset prices in real time: testing the efficiency of the Euribor futures market. CEP Discussion Paper 764.

Rudebusch, G.D., Williams, J.C., 2006. Revealing the secrets of the temple: the value of publishing central bank interest rate projections. NBER Working Paper 12638

Ruud, P.A., 2000. Introduction to classical econometric theory. Oxford University Press.

Weber, R.P., 2004. Basic content analysis. 2nd ed., Newbury Park, CA: Sage.

White, H., 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica, 48(4), 817-838.

Woodford, M., 2005. Central-bank communication and policy effectiveness. NBER Working Paper 11898.

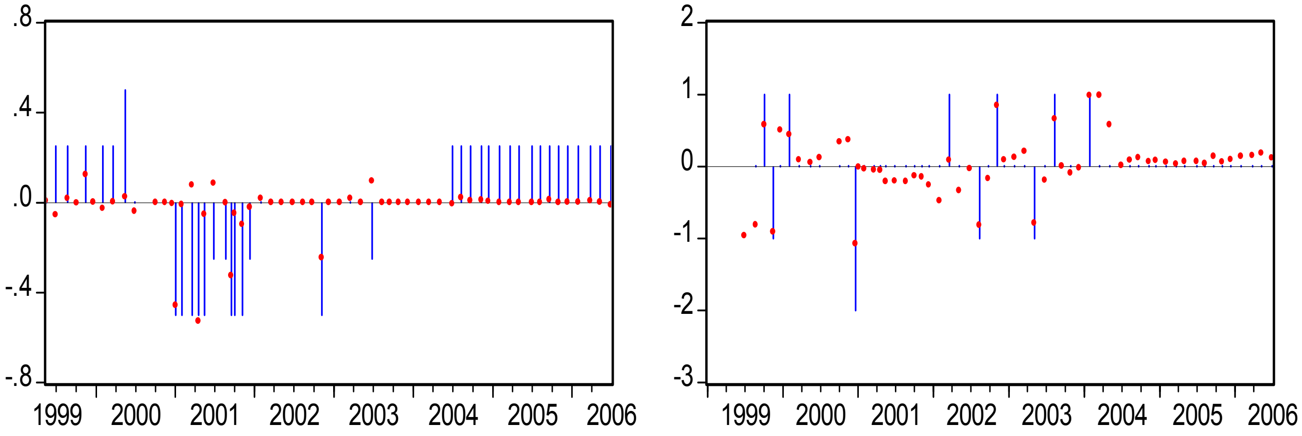
Wongswan, J., 2006. Transmission of information across international equity markets. Review of Financial Studies, 19, 1157-1189.

Wongswan, J., 2005. The response of global equity indexes to U.S. monetary policy announcements. Federal Reserve Board Discussion Paper 844.

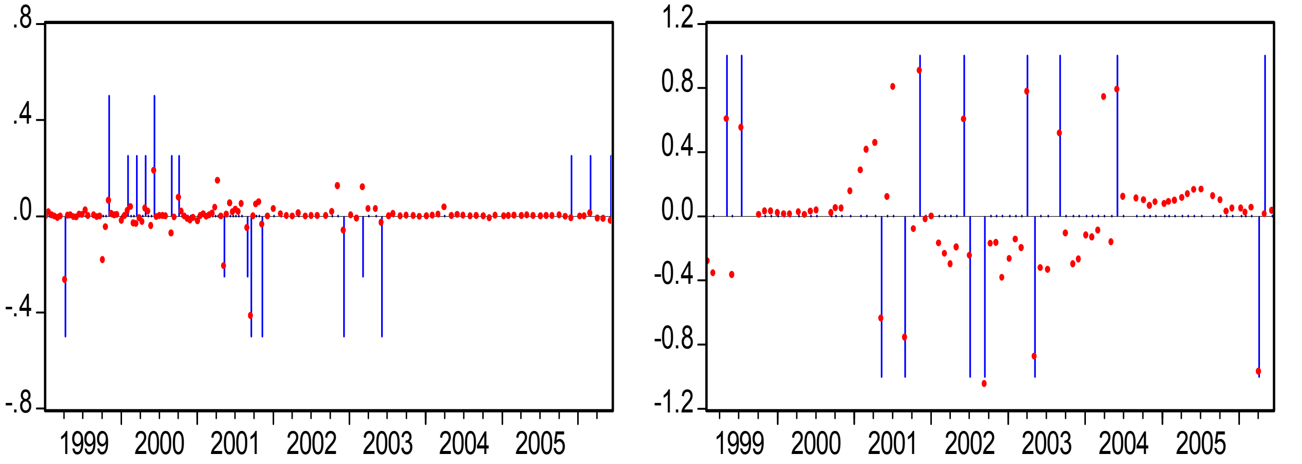
Wu, D., 1973. Alternative tests of independence between stochastic regressors and disturbances. Econometrica, 41, 733-750.

***Figure 1.** – Fed and ECB monetary policy and news shock*

a) Fed

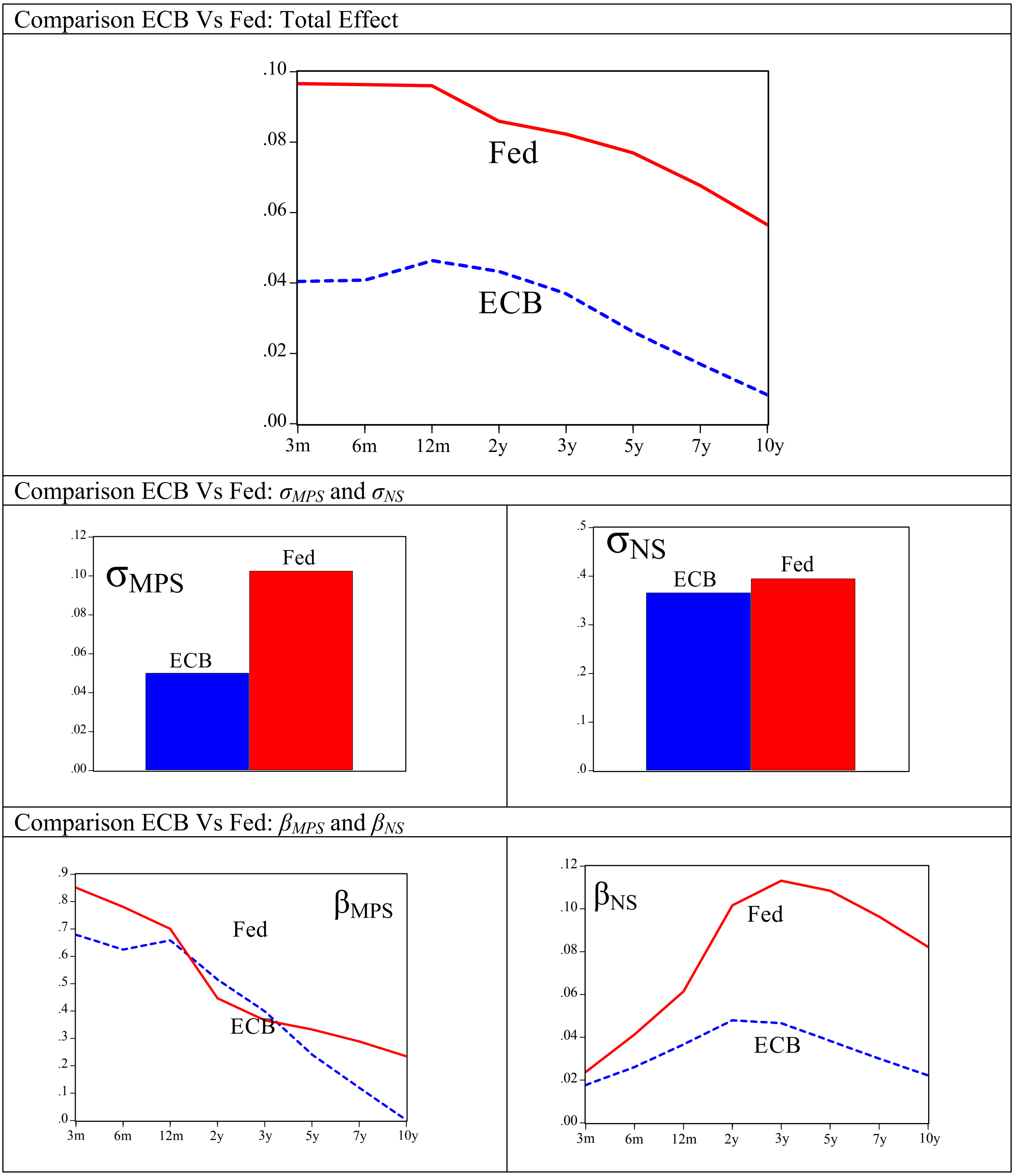


b) ECB



NOTE: The top chart plots the US Fed's policy action and monetary policy shock (left panel) and wording indicator and news shock (right panel). The shock is represented by a red bullet, and the action or the in the tone of the announcement by a vertical line. The sample period includes all FOMC meeting days from May 1999 through June 2006, excluding the September 17, 2001and December 21, 1999 FOMC announcements. The bottom chart plots the ECB's policy action and monetary policy shock (left panel) and wording indicator and news shock (right panel). The sample period includes all Governing Council meeting days from January 1999 through June 2006, excluding the September 17, 2001 ECB announcement.

Figure 2. *- The effects of central banks' decisions and announcements on interest rates: A graphical analysis (1999-2006)*



NOTE: This figure is based on Tables 4 and 6. The top panel plots the total effect of the surprise components of central bank words and deeds on interest rates for the period 1999-2006. The X axis is maturity of interest rates (from 3 months to 10 years). The Y axis is interest rates in basis points. The middle panel plots the average magnitude of monetary policy (left diagram) and news (right diagram) shocks in the period 1999-2006. The bottom panel plots the magnitude of the regressor coefficients of both the monetary policy (left diagram) and news (right diagram) shocks. The X axis is maturity of interest rates (from 3 months to 10 years).

Table 1. *– Glossary of the Fed's official statements and their ranking*

Fed's main statements: the most important keywords	*Index*
Risks are weighted mainly toward conditions that may generate heightened inflation – Directive was biased toward a possible firming of policy going forward – A directive that is tilted toward the possibility of a firming in the stance of monetary policy – Some further policy firming is likely to be needed – Further policy firming may be needed – Some inflation risks remain – Policy accommodation can be removed at a pace that is likely to be measured – The Committee believes that it can be patient in removing its policy accommodation	+1
Risks are balanced with respect to prospects for both goals – A directive that includes no predilection about near-term policy action – Symmetrical with regard to the outlook for policy over the near term – The Committee does not believe it can usefully characterize the current balance of risks – Policy accommodation can be maintained for a considerable period	0
Risks are weighted mainly toward conditions that may generate economic weakness – The balance of risks to achieving its goals is weighted toward weakness over the foreseeable future	–1

NOTE: Since the standardization of the language used is far from perfect and the meaning of some keywords may change over time, we have done the coding of each statement by reading the full press statement, and the glossary only serve to provide a parsimonious and transparent background of the coding. Following the suggestion of the discussant, Brian Madigan, we code the statement "The Committee believes that it can be patient in removing its policy accommodation" as hawkish because the FOMC dropped the phrase "for a considerable period" used in previous press statements. The econometric results presented in the paper are very similar if we code this sentence as neutral.

***Table 2.** – Auxiliary regressions*

a) Measuring the expected Fed announcement

$Index_t$	1.505***
	(0.314)
$Slope_t$	2.348***
	(0.702)
δ_1	-0.615**
	(0.303)
δ_2	1.327***
	(0.390)
Log Likelihood	-27.550
Pseudo-R^2	0.542
Observations	57

NOTE: Observations on days of FOMC meetings, May 1999 – June 2006, excluding September 2001 and December 2001. The econometric method is ML – Ordered Probit (Quadratic hill climbing). ***, **, * indicate significance at 99%, 95% and 90% levels.

b) Measuring the expected ECB announcement

$Index_t$	2.015***
	(0.334)
$Slope_t$	1.799***
	(0.660)
δ_1	-1.570***
	(0.336)
δ_2	1.127***
	(0.314)
Log Likelihood	-37.723
Pseudo-R^2	0.577
Observations	79

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – June 2006, excluding September 2001. The econometric method is ML – Ordered Probit (Quadratic hill climbing). ***, **, * indicate significance at 99%, 95% and 90% levels.

Table 3. – Descriptive analysis of Fed and ECB monetary policy decisions and announcements

	ECB		**Fed**
Total number of events (Governing Council or FOMC meetings)	125		60
The monetary policy stance was changed	18		35
Of which:			
Increase of 50 basis points (bp)	2		1
Increase of 25 bp	8		22
Cut of 25 bp	3		4
Cut of 50 bp	5		7
Number of classified announcements	80		60
Of which:			
Hawkish (+1)	41		28
Neutral (0)	24		15
Dovish (–1)	15		17
Number of words	(c)	(d)	
Average:	1163	4533	224

NOTE: The wording indicator for the ECB is provided by Rosa and Verga (2006). (c) does not include the Q&A section, while (d) includes it. Although the ECB Governing Council meets twice a month, since November 2001 the policy rate could be changed only at its first meeting. Both to be consistent over time and to have monthly observations, for the period January 1999 through October 2001 only the press conference of the first meeting of every month is coded. For both central banks we do not analyze econometrically two press statements (December 1999 and September 2001, see main text for details).

Table 4. *– Effect of US Fed decisions and announcements on American interest rates*

	Dollar Libor			**Dollar Irs**				
	3 month	6 month	12 month	2 year	3 year	5 year	7 year	10 year
Constant	-0.002 (0.003)	-0.001 (0.005)	-0.001 (0.007)	-0.002 (0.012)	-0.004 (0.012)	-0.007 (0.012)	-0.007 (0.012)	-0.007 (0.011)
MPS_{t+1}	0.851*** (0.044)	0.781*** (0.030)	0.700*** (0.089)	0.447*** (0.111)	0.367*** (0.123)	0.333** (0.159)	0.289* (0.173)	0.235 (0.181)
NS_t	0.024*** (0.007)	0.041*** (0.008)	0.061*** (0.013)	0.102*** (0.028)	0.113*** (0.033)	0.108*** (0.038)	0.096** (0.038)	0.082** (0.038)
Adj. R^2	0.942	0.835	0.685	0.310	0.258	0.215	0.178	0.131
Obs.	57	57	57	57	57	57	57	57

NOTE: Observations on days of FOMC meetings, May 1999 – June 2006, excluding September 2001. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at 99%, 95% and 90% levels.

Table 5. *– Importance of news shock: Fed on American rates*

a) Order of magnitude of news shock and monetary policy shock

	Dollar Libor			Dollar IRS				
	3 month	6 month	12 month	2 year	3 year	5 year	7 year	10 year
$\beta_{MPS} \cdot \sigma_{MPS}$	8.7	8.0	7.2	4.6	3.8	3.4	3.0	2.4
$\beta_{NS} \cdot \sigma_{NS}$	0.9	1.6	2.4	4.0	4.7	4.3	3.8	3.2
H_0: $\beta_{MPS} \cdot \sigma_{MPS} = \beta_{NS} \cdot \sigma_{NS}$	0.000***	0.000***	0.000***	0.714	0.687	0.699	0.726	0.741

b) Explanatory power (Adj. R^2)

	Dollar Libor			Dollar IRS				
	3 month	6 month	12 month	2 year	3 year	5 year	7 year	10 year
W/O NS	0.932	0.803	0.614	0.157	0.082	0.060	0.046	0.028
WITH NS	0.942	0.835	0.685	0.310	0.258	0.215	0.178	0.131

NOTE: Observations on days of FOMC meetings, May 1999 – June 2006, excluding September 2001.

Table 6. *– Effect of ECB decisions and announcements on European interest rates*

	Euro Libor			**EurIRS**				
	3 month	6 months	12 month	2 year	3 year	5 year	7 year	10 year
Constant	0.001 (0.002)	0.004 (0.003)	0.007 (0.005)	0.007 (0.007)	0.006 (0.007)	0.004 (0.006)	0.002 (0.006)	0.000 (0.005)
MPS_{t+1}	0.679*** (0.099)	0.625*** (0.113)	0.659*** (0.144)	0.515*** (0.167)	0.399** (0.157)	0.241* (0.136)	0.120 (0.111)	0.001 (0.095)
NS_t	0.018*** (0.007)	0.026** (0.010)	0.037** (0.014)	0.048** (0.021)	0.047** (0.021)	0.038* (0.020)	0.030* (0.018)	0.022 (0.016)
Adj. R^2	0.799	0.583	0.414	0.212	0.153	0.084	0.039	0.004
Observations	79	79	79	78	78	78	78	78

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – June 2006, excluding September 2001. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at 99%, 95% and 90% levels. On March, 4 1999 (ECB Governing Council meeting day) we have the quote for the euro libor rate, but not for the EurIRS rate.

Table 7. *– Importance of news shock: ECB on European rates*

a) Order of magnitude of news shock and monetary policy shock

	Euro Libor			EurIRS				
	3 month	6 month	12 month	2 year	3 year	5 year	7 year	10 year
$\beta_{MPS} \cdot \sigma_{MPS}$	3.4	3.1	3.3	2.6	2.0	1.2	0.6	0.0
$\beta_{NS} \cdot \sigma_{NS}$	0.6	1.0	1.3	1.8	1.7	1.4	1.1	0.8
H_0: $\beta_{MPS} \cdot \sigma_{MPS} = \beta_{NS} \cdot \sigma_{NS}$	0.000***	0.003***	0.054*	0.528	0.820	0.865	0.610	0.337

b) Explanatory power (Adj. R^2)

	Euro Libor			EurIRS				
	3 month	6 month	12 month	2 year	3 year	5 year	7 year	10 year
W/O NS	0.776	0.544	0.369	0.162	0.104	0.046	0.010	-0.012
WITH NS	0.799	0.583	0.414	0.212	0.153	0.084	0.039	0.004

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – June 2006.

Table 8. *– Prediction of future policy changes using central bank words*

a) Fed

	m = 3	m = 6	m = 12	m = 18	m = 24
Constant	-0.227** (0.097)	-0.294* (0.150)	-0.372 (0.230)	-0.381 (0.316)	-0.340 (0.431)
$Index_t$	0.736*** (0.123)	0.991*** (0.189)	1.136*** (0.295)	1.158*** (0.414)	1.044* (0.541)
Adj. R^2	0.454	0.372	0.208	0.124	0.058
Observations	57	57	57	53	49

b) ECB

	m = 3	m = 6	m = 12	m = 18	m = 24
Constant	-0.122*** (0.046)	-0.128* (0.066)	-0.166 (0.105)	-0.261* (0.146)	-0.418** (0.161)
$Index_t$	0.416*** (0.054)	0.513*** (0.086)	0.525*** (0.137)	0.419** (0.183)	0.153 (0.749)
Adj. R^2	0.362	0.261	0.133	0.056	-0.008
Observations	79	79	74	69	63

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – June 2006, or FOMC meetings, May 1999 – June 2006, excluding September 2001. The econometric method is Ordinary Least Squares.. The independent variable is the wording indicator, *Index*. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at the 99%, 95% and 90% levels.

Table 9. *– Effect of US Fed decisions and announcements on European interest rates*

	Euro Libor			EurIRS				
	3 month	6 month	12 month	2 year	3 year	5 year	7 year	10 year
Constant	-0.002 (0.003)	-0.000 (0.003)	0.000 (0.004)	0.003 (0.005)	0.003 (0.006)	0.001 (0.006)	0.002 (0.005)	0.001 (0.005)
MPS_{t+1}	0.171*** (0.026)	0.208*** (0.017)	0.234*** (0.022)	0.229*** (0.073)	0.195** (0.083)	0.134* (0.077)	0.130* (0.068)	0.106* (0.058)
NS_t	0.013** (0.005)	0.018*** (0.005)	0.028*** (0.007)	0.039*** (0.013)	0.042*** (0.014)	0.049*** (0.013)	0.035*** (0.012)	0.029** (0.012)
Adj. R^2	0.395	0.423	0.405	0.295	0.236	0.200	0.143	0.102
Prob(F-stat)	0.000***	0.000***	0.000***	0.000***	0.000***	0.001***	0.006***	0.022**
Obs.	57	57	57	56	56	55	56	56

NOTE: Observations on days of FOMC meetings, May 1999 – June 2006, excluding September 2001. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at 99%, 95% and 90% levels. On March, 20 2001 dollar IRS rates are not available and on November, 16 1999 five-year Eurirs rate is not available.

Table 10. *– Effect of ECB decisions and announcements on American interest rates*

	Dollar Libor			**Dollar IRS**				
	3 month	6 months	12 month	2 year	3 year	5 year	7 year	10 year
Constant	0.001 (0.002)	0.004 (0.003)	0.010** (0.005)	0.011 (0.007)	0.011 (0.007)	0.009 (0.008)	0.008 (0.008)	0.008 (0.008)
MPS_{t+1}	0.017 (0.023)	0.021 (0.053)	0.026 (0.089)	-0.004 (0.172)	0.008 (0.177)	-0.031 (0.200)	-0.032 (0.201)	-0.020 (0.204)
NS_t	0.002 (0.004)	-0.000 (0.006)	-0.002 (0.014)	0.002 (0.019)	0.007 (0.021)	0.008 (0.023)	0.007 (0.023)	0.002 (0.022)
Adj. R^2	-0.019	-0.025	-0.025	-0.026	-0.025	-0.025	-0.025	-0.026
Prob(F-stat)	0.760	0.936	0.960	0.992	0.938	0.935	0.944	0.989
Observations	79	79	79	79	79	79	79	79

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – June 2006, excluding September 2001. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at 99%, 95% and 90% levels.

***Table 11.** – Effect of Fed decisions and announcements on European interest rates, controlling for American rates*

	Euro Libor			**EurIRS**				
	3 month	6 month	12 month	2 year	3 year	5 year	7 year	10 year
Constant	-0.001 (0.003)	0.000 (0.003)	0.001 (0.003)	0.002 (0.004)	0.003 (0.004)	0.003 (0.005)	0.003 (0.004)	0.002 (0.004)
MPS^{US}_{t+1}	-0.277^{**} (0.127)	-0.154^{**} (0.066)	-0.042 (0.045)	0.083 (0.076)	0.073 (0.071)	0.042 (0.043)	0.039^{*} (0.022)	0.036^{*} (0.021)
NS^{US}_{t}	0.001 (0.005)	-0.001 (0.006)	0.003 (0.007)	0.008 (0.012)	0.006 (0.013)	0.013 (0.013)	0.006 (0.009)	0.006 (0.008)
$r^{US}_{k,t+1} - r^{US}_{k,t}$	0.527^{***} (0.165)	0.463^{***} (0.095)	0.394^{***} (0.060)	0.308^{***} (0.060)	0.311^{***} (0.055)	0.286^{***} (0.054)	0.295^{***} (0.044)	0.279^{***} (0.041)
Adj. R^2	0.557	0.670	0.652	0.557	0.547	0.494	0.503	0.447
Obs.	57	57	57	56	56	55	56	56
Wald test: $\beta_{MPS} = \beta_{NS} = 0$								
F-statistic	3.155^{*}	3.957^{**}	1.047	0.608	0.524	0.722	1.518	1.519
Prob.	0.051	0.025	0.358	0.548	0.595	0.491	0.229	0.228

NOTE: Observations on days of FOMC meetings, May 1999 – June 2006, excluding September 2001. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at 99%, 95% and 90% levels. We exclude from the estimation sample the 17 September 2001 observation, when both the ECB and the Fed made a joint policy rate reduction of 50 basis points in the aftermath of the September 11 terrorist attack.

***Table 12.** – Generated regressor issue*

(a) Effect of Fed decisions and announcements on American interest rates

	Dollar Libor			**Dollar IRS**				
	3 month	6 months	1 year	2 year	3 year	5 year	7 year	10 year
Constant	-0.001 (0.010)	0.001 (0.010)	0.002 (0.010)	0.002 (0.011)	0.001 (0.011)	-0.002 (0.011)	-0.003 (0.011)	-0.003 (0.010)
MPS_{t+1}	0.848*** (0.097)	0.776*** (0.097)	0.692*** (0.098)	0.431*** (0.099)	0.349*** (0.100)	0.316*** (0.099)	0.274*** (0.099)	0.222** (0.098)
NS_t	0.024 (0.023)	0.040* (0.023)	0.058** (0.023)	0.090*** (0.023)	0.098*** (0.023)	0.093*** (0.023)	0.083*** (0.023)	0.071*** (0.023)
γ_1	-0.636*** (0.071)							
γ_2	-0.502*** (0.180)							
Adj. R^2	0.942	0.833	0.679	0.271	0.209	0.224	0.130	0.085
Observations	57	57	57	57	57	57	57	57

(b) Effect of ECB decisions and announcements on European interest rates

	Euro Libor			**EurIRS**				
	3 month	6 months	1 year	2 year	3 year	5 year	7 year	10 year
Constant	-0.001 (0.006)	0.001 (0.006)	0.003 (0.006)	0.002 (0.006)	0.001 (0.006)	-0.000 (0.006)	-0.001 (0.006)	-0.002 (0.006)
MPS_{t+1}	0.687*** (0.112)	0.635*** (0.112)	0.672*** (0.113)	0.531*** (0.113)	0.413*** (0.113)	0.251** (0.113)	0.127 (0.113)	0.007 (0.112)
NS_t	0.015 (0.014)	0.023(*) (0.014)	0.034** (0.015)	0.045*** (0.015)	0.046*** (0.015)	0.040*** (0.015)	0.031** (0.015)	0.023 (0.015)
γ_1	-0.711*** (0.090)							
γ_2	-0.124 (0.208)							
Adj. R^2	0.790	0.569	0.397	0.293	0.137	0.071	0.023	0.037
Observations	79	79	79	78	78	78	78	78

NOTE: Monthly observations on either days of FOMC meetings, May 1999 – June 2006 (panel a) or days of ECB Governing Council meetings, January 1999 – June 2006 (panel b), in both cases excluding September 2001. The econometric method is Iterative Least Squares. ***, **, * indicate significance at 99%, 95% and 90% levels.

***Table 13.** – Stability tests*

			Dollar Libor or Euro Libor			Dollar IRS or EurIRS				
Equation table	Test:		3 month	6 month	1 year	2 year	3 year	5 year	7 year	10 year
Table 4 (Fed on USA)	Cusum test		yes	yes	yes	yes	yes	yes	yes	yes
	Chow Breakpoint: 2004 Jan	P(F-stat)	0.203	0.329	0.153	0.286	0.333	0.508	0.656	0.814
		P(logL)	0.165	0.283	0.120	0.242	0.288	0.462	0.618	0.789
Table 6 (ECB on Euro)	Cusum test		yes	yes	yes	yes	yes	yes	yes	yes
	Chow Breakpoint: 2004 Jan	P(F-stat)	0.053	0.064	0.261	0.384	0.411	0.455	0.461	0.491
		P(logL)	0.041	0.050	0.231	0.350	0.377	0.421	0.427	0.458
Table 9 (Fed on Euro)	Cusum test		no	no	yes	yes	yes	yes	yes	yes
	Chow Breakpoint: 2004 Jan	P(F-stat)	0.684	0.531	0.647	0.223	0.169	0.590	0.480	0.472
		P(logL)	0.684	0.531	0.647	0.223	0.169	0.590	0.480	0.472
Table 10 (ECB on USA)	Cusum test		yes	yes	yes	yes	yes	yes	yes	yes
	Chow Breakpoint: 2004 Jan	P(F-stat)	0.905	0.981	0.999	0.469	0.415	0.441	0.394	0.392
		P(logL)	0.895	0.978	0.998	0.436	0.382	0.407	0.361	0.359

NOTE: This Table reports a summary of two stability tests, Cusum and Chow breakpoint test, for Equations (8), (9), and (10), considering all interest rate maturities from 3 months to 10 years. For the Cusum test, "Yes" or "No" indicates whether the cumulative sum of squares crosses the 5% confidence bands. For the Chow breakpoint test, we report the probability both of the F-statistic and the Log likelihood ratio.

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