

On the Consistency and Effectiveness of Central Bank Communication: Evidence from the ECB*

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Abstract

In this paper we analyse the communication made by the ECB President in his introductory statement to the monthly press conference on Governing Council meeting days. Our contributions are as follows. First, we provide a glossary that translates the qualitative information of the press conferences into an ordered scale. Second, we find that the predictive ability of European monetary authority's statements is similar to that implied by market-based measures of monetary policy expectations. Third, ECB words provide complementary, rather than substitutable, information with respect to macroeconomic variables. Finally, we show that market expectations react to the unexpected component of the information released by the ECB, after controlling for the monetary policy shock.

Keywords: ECB communication, glossary, consistency, monetary policy forecast, news shocks.

JEL classification: E43, E52, E58, G14.

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“If you understood what I just said, you must not have heard me correctly”

Alan Greenspan, Testimony to a Congressional committee

“To me, that is the hallmark of credibility: matching deeds to words. (...) Credibility means that your pronouncements are believed – even though you are bound by no rule and may even have a short-run incentive to renege. In the real world, such credibility is not normally created by incentive compatible compensation schemes nor by rigid precommitment. Rather, it is painstakingly built up by a history of matching deeds to words. A central bank that consistently does what it says will acquire credibility by this definition almost regardless of the institutional structure.”

Alan Blinder, *Central Bank in Theory and Practice* (1998, page 64)

1 Introduction

What is European Central Bank (ECB) communication about? More generally, is the ECB transparent about its future monetary policy stance? What will the level of its policy rate be in three months from now? Do financial intermediaries understand the messages sent by the ECB about the future path of European monetary policy? Are these messages credible and, thus, promptly incorporated in market expectations? These are some of the questions this paper attempts to answer.

To put it differently, our goal is to analyse central bank communication, focusing in particular on ECB practices, its consistency (are words subsequently matched by actions?) and effectiveness (how effective are ECB’s words in moving financial markets?).

The recent past has witnessed a substantial change in the way central banks communicate with the public, and more specifically with financial markets. Only twenty years ago monetary policy was surrounded by secrecy (Goodfriend, 1986), while nowadays there is a strong emphasis on central bank transparency (Bernanke, 2004).

According to the ECB website¹, a central bank is transparent when “[it] provides the general public and the markets with all relevant information on its strategy, assessments and policy decisions as well as its procedures in an open, clear and timely manner”.

Central bankers motivate the need for transparency on the basis of two main reasons (see, for example, Issing, 2005)². First, since central banks are granted by legal status (at the very least instrument) independence, and their board is not democratically elected, good governance

¹ <http://www.ecb.int/ecb/orga/transparency/html/index.en.html> (lastly accessed on the 31st August 2005).

² Carpenter (2002) and Geraats (2002) provide an excellent overview of the theoretical and empirical literature on the transparency of monetary policy. Eijffinger and Geraats (2006) propose and construct an explicit transparency index for nine major central banks for the period 1998-2002. Geraats et al. (2006) use this index to investigate the effect of transparency on the level of both short and long nominal interest rates (i.e., to empirically analyse the flexibility and reputation effects of transparency).

practices call for them to be accountable. In order to fulfil the basic requirement of accountability, central banks should be transparent. Second, transparency is a necessary ingredient to enhance the efficiency of monetary policy. Central banks can directly control only the very short-run nominal interest rates, but aggregate-spending decisions are closely related to interest rates of all maturities. Therefore, the management of financial market expectations has become a crucial instrument in monetary authority's hands to affect the overall course of the economy. Sound credibility and good communication skills (to direct market expectations) are essential tools for the effective working of a modern central bank.

We have recently seen a paradigm change in central bank practices. In fact, as Woodford (2003, page 3) notes: “The adoption of ‘inflation targeting’ (...) is characterized not only by public commitment to an explicit target, but also by a commitment to explain the central bank's policy actions in terms of a systematic decision-making framework that is aimed at achieving this target”. In other words, transparency has become an integral element in the definition of monetary policy.

Blinder et al. (2001, page 9) first ask: “Does [central bank] communication really matter?” They then answer: “To date there is no research to report on, so we can only call upon casual experience to back our claim that it does, and quite a lot”. This paper tries to support their claim econometrically³. In particular, this paper contributes to the empirical literature on central bank transparency in three important ways. First, from a methodological point of view, we analyse the semantic content of ECB communication in an explicit way: we provide a glossary to rank the information contained in the ECB President's monthly press conference into an ordered scale about the danger to European price stability and sustained economic growth. Second, we test the ECB's consistency between words and deeds. Third, we verify empirically whether, and to what extent, the public not only understand but also believe the signals sent by the European monetary authority.

Our main findings can be summarized as follows. First, by looking at the semantic content of the ECB President's introductory statement to the monthly press conference, we can predict the ECB near future monetary policy moves. Therefore, ECB words are usually followed by facts (i.e., a monetary policy move consistent with what the ECB has previously announced). For instance, when the introductory statement states that “the overall prospects remain in line [or “are appropriate”] with price stability over the medium term”, the Governing Council will not normally change the official rate at its next meeting.

Second, the informational content of ECB rhetoric is substantial. On the one hand, the forecasting ability of European monetary authority words is similar to the one implied by market-based measures of monetary policy expectations. On the other, we find that words and data on macroeconomic variables are essentially complementary, rather than substitutable, pieces of information to correctly predict the future Repo rate (which is the key ECB policy rate).

³ It is important to notice that since 2001 the empirical literature on central bank communication has been rapidly expanding (cf. Section 2 and 6 and references provided thereafter).

Third, we show that innovations (due to ECB's announcements) in market expectations about future monetary policy can be explained by the unexpected component of the information released by the ECB, after controlling for the monetary policy shock. Hence, we infer that even if the ECB is a relatively young multinational financial institution, it has already acquired a reputation for telling the truth.

Finally, a by-product of our empirical analysis is that non-standard econometric techniques, such as fuzzy regression, do not perform better than standard OLS and ordinal regressions.

The rest of the paper is organized as follows. In the next section, we explicitly measure ECB communication. In other words, we construct a glossary that translates the qualitative information of the ECB President's speeches during press conferences into an ordered scale. In section 3, we investigate the consistency of ECB communication (i.e., between its words and deeds). In section 4, we further analyse the informational content of the wording of the ECB. First, we compare the forecasting ability between ECB words and Euribor rates (i.e., interest rates in force in the interbank market). Second, we determine whether words are complements or substitutes to macroeconomic variables in empirical reaction functions. Then in section 5, we investigate the significance of news surprises after controlling for monetary policy shocks. In section 6, we suggest some important issues left for future research and conclude. Appendix A provides both the description and the sources of the time series used in the estimations. Appendix B describes the methodology and discusses the results of applying fuzzy non-linear regression procedure.

2. A glossary to interpret the ECB President's monthly press conferences

Since the very beginning of its life, the ECB has paid a lot of attention to its announcement policy, and especially to its choice of medium, form and content. For example, in order to properly communicate with the public and address the informational needs of the various target groups, such as politicians, academics, the press, financial markets, etc., the ECB uses many different instruments. Among others, the Monthly Bulletin, the President monthly press conference (and its Questions and Answers session), the Testimony to the Committee on Monetary Affairs of the European Parliament (twice a year)⁴ and frequent speeches by either its President or the members of its Governing Council.

In its Monthly Bulletin of November 2002 (page 64), the ECB said that "The monthly press conferences held by the President and the Vice-President and the Monthly Bulletin are two of the most important communication channels adopted by the ECB. (...) The press conference is thus an effective means of presenting and explaining discussion in the Governing Council and therefore the monetary policy decision-making process."

⁴ Before March 2001, it was called either Hearing before the Committee on Economic and Monetary Affairs of the European Parliament or Speech at the Parliamentary Assembly of the Council of Europe. Note that from 2002 it takes place four times a year.

More precisely, the press conference is a timely tool to communicate concisely to the public the ECB Governing Council's view of recent economic developments. Instead, the Monthly Bulletin is used by the ECB not only to convey its detailed and quantitative view of the economy (thus integrating the information released by its President press conference), but also to describe its analytical framework - models, methods and indicators - that represents the basis of its decision-making process.

In this paper we restrict our econometric analysis only to the wording of the press conferences. The underlying motivations are as follows. We consider this research work as a first step in a broader research agenda that aims to investigate the consistency and effectiveness of all ECB communication channels. It seems to us that the introductory statement to the monthly press conference represents a natural candidate to begin with, since it is simple, short and systematic in terms of its frequency, structure and use of keywords. Moreover, there is a more subtle reason that convinced us to use the monthly press conference as a starting point. Usually both the Editorial section of the Monthly Bulletin and the introductory statement to the press conference report the same information concerning the ECB monetary policy stance. However, the Editorial is made available to the public after a time lag compared to the introductory statement. Since in section 5 we investigate how ECB real time statements affect financial markets, the use of the wording contained in the Monthly Bulletin turned out to be quite intractable.⁵

The structure of the introductory statement has remained the same since January 1999, and it has been reproduced in Table 1.

After some greetings, there is a synthetic assessment of the ECB perceived risk to price stability. Then it follows a detailed analysis of real sector and price developments in the Euro area. Given the ECB characteristic two pillars monetary policy strategy (cf. Monthly Bulletin, November 2000), it is not surprising to observe its close monitoring of monetary aggregates. Usually, but not always, the initial synthetic assessment is repeated (and introduced by the string "To sum up"). Finally, the ECB President has often concluded the introductory statement by drawing the attention of national governments on the need for implementing rigorous fiscal policy and structural reforms, such as labour market and pension reforms. The "Questions and Answers" session provides an important opportunity for the ECB both to reiterate its point of view about the economic outlook and to clarify its messages. In particular, in more than one occasion, the ECB President has further explained the meaning of some words. For instance, at the press conference on the 6th March 2003 President Duisenberg said: "Well, if we use the word 'appropriate' we expect it to remain valid for a considerable period of time".

In order to make the European monetary authority's statements suitable for statistical computation, we assign a number to each ECB monthly announcement. This number should capture the intensity of the risk to price stability (or to growth) at the time of the meetings that the ECB wants to communicate to the market. This is important because the higher those risks

⁵ Nonetheless, we acknowledge that someone could argue that the contents of the Monthly Bulletin are more complete and thus more representative of the whole governing Council's view of future ECB monetary policy (at the very least simply because a larger amount of time has been devoted to prepare it). It is a testable hypothesis and we leave the answer to it to future research.

are, the higher is the probability of some future monetary policy intervention (in other words, a change in the Repo rate). The reason for this is obvious: the higher the risk is now, the higher the probability that in the course of time the risk will reach the level that triggers a monetary policy intervention.

Since words are not precise quantitative data, ranking them according to their inclination (either tightening, neutral or easing) about ECB future interest rate setting behaviour cannot but be influenced by our personal judgements. Therefore, we cannot rule out possible misclassifications in individual cases. Nonetheless, we tried to reduce the probability of a wrong classification by doing our coding independently from one another. When we came up with a different coding for the same press conference, we have double-checked it together and agreed on a common value for the wording indicator.

In his press conferences, the President⁶ employs a very standardized form of language, and its main conclusions consist of a very limited number of key words or strings. Hence, we could represent explicitly our mapping between words and numbers (therefore, an ordered scale) in a systematic way through the construction of a glossary.

Hermeneutic theory and textual analysis (a set of techniques to analyse the content of a message, cf. Holsti (1969)) warn us that the message itself is not an objective entity, nor is it defined objectively by the words the sender uses. Instead, the content of the message depends as much on the receiver's understanding of it as on the context in which it is sent. For example, the same sentence "today is cold" has a different meaning according to circumstances (i.e., is it summer or winter? Are we in Florida or in Alaska?). For this reason, the glossary we provide is a very helpful device to interpret ECB statements, but it should not be applied in a purely mechanical way.

In general, we focus our attention to codify the "main statement" and "second main statement" of Table 1, which are the summary of the introductory statement to the monthly press conference. These brief assessments in the President's speech usually convey information only on the risk to price stability.

However, in light of the Maastricht Treaty, we have explicitly considered the ECB opinions expressed in the real sector section of the press conference in situations that contemporaneously feature both downward economic danger (indicated by strings such as "We continue to monitor downside risks" or "There remain downside risks to the outlook for economic activity"), and no risk to price stability⁷. In fact, in accordance with the Maastricht Treaty, which established the European Union and, as a by-product, the European System of Central Banks, the ECB has both a nominal (i.e., inflation) and real (i.e., output growth) objective⁸. Nonetheless, the latter ECB goal is subordinated to the achievement of the former:

⁶ There is no difference between the tone of Duisenberg's and Trichet's speeches: the President, in fact, simply reads a communiqué prepared by the whole Governing Council.

⁷ It should be noted that since we have always done our coding by checking the whole monthly press conference (including its questions and answers section), the ECB comments on the economic outlook have always been considered (although many times implicitly) to better understand the central bank overall assessment.

⁸ Article 105 states: "The primary objective of the ESCB shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the

more formally, ECB preferences can be represented by an almost lexicographic utility function with price stability (defined as inflation of somewhat less than 2% in the medium term) and economic growth being respectively its first and second argument⁹. Therefore, the words about real activity should become relevant only when there are no inflation risks. Note that in our sample period there are no contradictory cases when both upside risks for price stability and downside risks for economic growth have been announced (also Gerlach, 2004, pages 36-37 in independent work reaches a similar conclusion).

All expressions contained in the glossary (either words or strings) have been ordered along with their everyday meaning. Thus, synonyms have been put together.

The wording indicator variable can take five values: -2 (very dovish), -1, 0, +1, +2 (very hawkish). Our assigned value of risk, *Index*, to each ECB monetary policy announcement is reported in Table A1 of Appendix A, where we also provide a few examples of introductory statements along with our coding.

The value of zero suggests that the current level of the Repo rate is appropriate to maintain price stability over the medium term.

The value -1 characterizes an easing period: it is possible that the Repo rate will be cut in the near future.

The value -2 indicates that the Governing Council is increasingly inclined to cut interest rates.

The values +1 (+2) characterizes a (strong) likelihood of future monetary policy tightening.

Clearly, as we mentioned above, any statement should be placed in the right context before being interpreted. This is especially important when the ECB makes relative statements, for example by comparing the present economic environment with the recent past. For this reason, in order to emphasize the relative nature of these announcements, in the bottom of Table 2, we provide a specific glossary for comparisons. In this case, the wording indicator (*Index*) takes three values: -1 (dovish), 0, +1 (hawkish), and it should be added to the value of the previous month press conference. To be fully precise, two points are worth mentioning. On the one side, prior to November 2001 two press conferences were sometimes held in a given month. In this case the relative nature of the statement is always referred to the most recent available information (i.e., the second press conference of the previous month). On the other, it never happened to observe the appearance of a relative statement after a press conference which we were not able to classify (cf. Section 3 and Table A1).

When more than one word or string from Table 2 (our mapping between words and numbers) features in a given press conference, our coding corresponds to the mean of the

Community with a view to contributing to the achievement of the objectives of the Community as laid down in Article 2” [i.e., “the objectives of the Union are a high level of employment and sustainable and non-inflationary growth”].

⁹ According to the ECB website (<http://www.ecb.int/mopo/intro/html/objective.en.html>, lastly accessed on the 15th March 2006): “The Treaty establishes a clear hierarchy of objectives for the Eurosystem. It assigns overriding importance to price stability. The Treaty makes clear that ensuring price stability is the most important contribution that monetary policy can make to achieve a favourable economic environment and a high level of employment.”

indices of each single expression used by the ECB rounded to its nearest integer. Note that the coding attributed to the relative statement (bottom panel of Table 2) constitutes one of the components of the calculated mean of indices.

There are two kind of statements that are not classified in Table 2, but, given their frequent presence in the monthly press conference, need to be mentioned.

First, there are statements (such as “Any factor which might alter this assessment in either direction will be carefully examined” or “We remain vigilant with regards to the further evolution of the key factors determining the outlook for prices”) that do not really imply any balance of risks (it is not mentioned that the risk to price stability is either upward or downward), although they may signal an higher degree of uncertainty in the economic environment.

Second, as hermeneutic theory emphasizes, the language is a dynamic entity, and words can change meaning according to circumstances. Moreover, from time to time, new words (neologisms) are introduced. For instance, the ECB has recently used a new string: “interest rates are very low by historical standards”, in order to underline its unwillingness to cut interest rates.

Finally, it is interesting to note that on the one hand there are many applied econometric papers that attempt to predict future monetary policy moves and to find empirical reaction functions. Nonetheless, studies that analyse the news originating from central bank communication are somewhat less ubiquitous and, in a sense, may date back to the seminal paper of Romer and Romer (1989), where they examined the records of Federal Reserve policy deliberations (narrative approach) in order to identify exogenous (according to their claim) monetary policy shocks. Fortunately, given its clear policy relevance, this literature is rapidly expanding.

In order to assess to what extent ECB’s words provide an indication of its future policy deeds, also Gerlach (2004) and Heinemann and Ullrich (2005), in independent and contemporaneous work, construct a wording indicator of ECB monetary policy stance. However, Gerlach (2004) does not provide an explicit mapping between words (contained in the Editorial section of the Monthly Bulletin) and numbers. While Heinemann and Ullrich (2005) construct a “statistically robust” wording indicator based on a simple counting rule. Unfortunately, they completely disregard the rules of hermeneutic theory. And in fact it turns out that their index has a small predicting power of future ECB monetary policy moves.

3. The consistency of ECB communication

In this section, we want to test the consistency between ECB words and its subsequent deeds.

There are two main hypotheses underlying our empirical exercise.

First, the monetary authority should not face a severe time-inconsistency problem (cf. Barro and Gordon, 1983). In other words, when the incongruence of preferences between the

central bank and the private sector is not too large, there is no incentive for the central bank to misrepresent its private information.

Second, the public should understand the language used by the monetary authority.

We can synthetically rephrase the two assumptions above by stating that if the central bank releases *true* and *clear* information (cf. Winkler, 2000), then the public should be able to infer its future actions. Note that if at least one of these assumptions is not satisfied, our empirical exercise will be meaningless.

As we explained in the previous section, the glossary reported in Table 2 is employed to rank the words used in speeches into an ordered scale of numbers representing the degree of risk to price stability. Recall that this *Index* is a summary statistics of the ECB Governing Council view about its future monetary policy stance. More specifically, it is strongly biased towards inflation risk assessment, with a real activity appraisal only in cases when no price stability threat is present.

In order to investigate whether ECB statements on its future monetary policy stance are matched by actions, we estimate the following equation for the period January 1999 - December 2004:

$$R_{t+m} - R_t = \alpha + \beta Index_t + \varepsilon_t \quad (1)$$

where R_{t+m} stands for the monthly Repo rate in force within m months from today (t). α is a constant and ε stands for a zero-mean noise term uncorrelated with *Index*.

We consider the full operational life of the ECB (January 1999 – December 2004¹⁰). In this six-year period, the Repo rate changed on fifteen occasions: it was cut eight times and raised seven times. Moreover, we restrict attention only to the days of the ECB Governing Council meetings.

Although the ECB Governing Council meets twice a month, since November 2001 the Repo rate could be changed only at its first meeting. Both to be consistent over time and to have (more or less) monthly data (and thus monthly-frequency forecasts), for the period January 1999 – October 2001 we have only considered the first meeting of every month. Overall we are left with 62 available observations (cf. Table A1), since in August there is no ECB Governing Council meeting (and thus no press conference).

Note that by construction the econometrician's information set contains only one element, which is a summary of the information released in the most recent ECB President press conference.

In order to have a straightforward interpretation of our empirical results we have firstly used Ordinary Least Squares (OLS) estimation with White-t statistics.

Table 3 reports the estimated OLS coefficients of equation (1) for $m = 1, \dots, 6$.

First, our regression results are quite robust with respect to the choice of the wording indicator: CR, GV, Index in Table A1 or $(CR+GV) / 2$ (regression results not reported).

¹⁰ Since we make a six-month projection of future Repo rates, the last forecast is for June 2005.

Second, β is always positive and statistically significant. Thus, future monetary policy interventions (namely, changes in the Repo rate) are an increasing function of the absolute value of *Index*. For example, if today the ECB President says that “it is imperative to contain upward pressure to price stability”, then the Repo rate on average will increase by about 50 basis points within the next four months.

Third, α turns out to be always negative and in most cases significant at the 1% level: this seems to indicate that our indicator variable is downward distorted. In other words, to have an unbiased *Index*, we need to scale down slightly the degree of risk reported in Table 2, but at the same time still preserving its relative ranking. Hence, for instance, the word “appropriate” should be associated to a negative number. This can be easily rationalized by recalling the ECB objectives postulated by the Maastricht Treaty: when there are no risks to price stability, the European monetary authority should achieve sustainable economic growth, and, thus, should be inclined to an expansionary monetary policy. However, note that the distortion of *Index* is small. In fact, by estimating a constrained version of (1) with $\alpha = 0$, the R^2 drops (because now the estimation becomes a constrained minimization problem), but not substantially.

The only relevant information contained in our $Index_t$ is the kind of words used by the ECB President. Ideally using a dummy variable to indicate the presence / absence of a given word, rather than a scale, seems to be the most appropriate way to address the ordinality (instead of cardinality) nature of the problem. For this reason, we also estimate the following equation, again for the period January 1999 - December 2004:

$$R_{t+m} - R_t = \beta_1 D_{-2,t} + \beta_2 D_{-1,t} + \beta_3 D_{0,t} + \beta_4 D_{1,t} + \beta_5 D_{2,t} + \varepsilon_t \quad (2)$$

where R_{t+m} , R_t and ε_t are defined as before. Instead, $D_{i,t}$ stands for a dummy variable that takes value 1 when $Index_t = i$, and 0 otherwise.

Table 4 reports the estimated β s of equation (2) for $m = 1, \dots, 6$. First, the null hypothesis that all β s are equal to each other¹¹ is always rejected at much below the 1% level (see Table 4).

Second, most of the regression coefficients for most maturities are statistically significant, and with the expected sign. Unfortunately, our limited sample size prevented us from obtaining always significant results.

In order to check the suitability of the cardinality restriction we have implicitly imposed on *Index* (e.g., is it true that a value of *Index* of +2 is twice as strong as a value of the wording indicator of +1?), we test the linear restriction on the β s of equation (2). In particular, our null hypothesis takes the following form:

$$\begin{aligned} H_0: \beta_1 - \beta_2 &= \beta_2 - \beta_3 \\ \beta_2 - \beta_3 &= \beta_3 - \beta_4 \\ \beta_3 - \beta_4 &= \beta_4 - \beta_5 \end{aligned} \quad (3)$$

¹¹ Technically it is an F test, where the only explanatory variable is a constant.

Table 4 reports the Wald test statistics for $m = 1, \dots, 6$. It turns out that for most maturities the linear restriction cannot be rejected at the 5% level. More precisely, except for the case of $m = 1$ and $m = 3$, the constraint imposed by the cardinality nature of *Index* is not statistically binding. Therefore, in order to capture the ECB monetary policy stance, throughout the paper we use the one-dimensional variable *Index* rather than relying each time on five different explanatory dummy variables (that will reduce the degrees of freedom of the regression).

Note that OLS is not the most appropriate econometric technique to estimate expected policy rate changes. On the one hand, in most of its meetings (57 out of 72), the Governing Council has not changed the Repo rate. On the other, when it has changed its policy rate, it has always varied it by discrete amounts of either 25 or 50 basis points. Hence, to check the robustness of our regression results, we also estimate ordered probit models (Vanderhart, 2000) that distinguish among months in which interest rates were raised, left unchanged, or reduced. In other words, the dependent variable is the expected sign of future Repo rate changes¹².

In Table 5 we report the contingency tables for $m = 1, \dots, 6$. The columns represent the sign of the actual future change in the Repo rate, while the rows represent its predicted sign. Clearly, when a table takes the form of a diagonal matrix the fit of the model is perfect. Instead, when a table features many off-diagonal elements, the explanatory power of the model is quite poor.

It turns out that most entries are located on the diagonal (i.e., right classification). Moreover, only in three cases and for a long forecasting horizon ($m = 5$ or 6) our estimates make a large forecasting error, that is suggest a future increase in the Repo rate when the actual movement was downward. After all, central bankers are not omniscient and the role of uncertainty about the future overweighs their knowledge.

Therefore, we conclude that ECB words are on average matched by consistent deeds, and this result is quite robust to the choice of the econometric tool used (either OLS or ordered probit). This seems quite intuitive. In fact, the right-hand-side variable remains the same as in equation (1) (i.e., *Index*), and the left-hand-side is just a monotonic transformation of the actual policy rate change (more precisely, its sign).

Since the content of the ECB President's speeches, as of any other qualitative document, is of a fuzzy nature, in Appendix B we further check whether fuzzy methods of estimation could improve upon standard regression techniques, such as either OLS or ordered probit.

4. The informational content of the wording of the ECB is substantial

In this section, we further analyse the importance of the wording of the ECB. First, we compare the forecasting ability between ECB words and market-based measures of European monetary policy expectations. Second, we determine whether ECB wording are still helpful in

¹² The function $sign(\Delta Repo)$ takes respectively value 1 when $\Delta Repo > 0$, 0 when $\Delta Repo = 0$ and -1 when $\Delta Repo < 0$.

predicting its future behaviour once we control for either Taylor-type macroeconomic variables or financial markets' information set.

4.1. A comparison between the forecasting ability of ECB words and Euribor rates

In this subsection, we show that the forecasting ability of European monetary authority words is similar to the one implied by market-based measures of monetary policy expectations. We proceed in three steps. First, we review the empirical framework underlying the derivation of the forecasting equation when the Euribor term structure is used as explanatory variable. Then, on the one hand, we estimate the OLS coefficients of the interest rate forecasting regressions. On the other, we compute the contingency tables of the sign of future Repo changes by using an ordered probit regression as econometric tool. Finally, we compare the predicting ability of ECB words with respect to financial market interest rates about the future course of ECB monetary policy over different short-term time horizons.

Most short-run interest rates are closely related to short-run expectations about future monetary policy moves: this relationship arises because financial intermediaries can potentially choose between different short-term financial strategies.

In particular, financial market expectations can be proxied by the Euribor term structure, and forward and futures contracts on the Euribor. In what follows, we use the Euribor term structure because the other two measures are characterized by relatively smaller trading volumes, at least at the beginning of our sample. Nonetheless, our main results are quite robust to the choice of data. In fact, Euribor rates of return on futures contracts are highly positively correlated to the underlying Euribor implicit rates of return.

Clearly if banks are good forecasters of the future ECB monetary policy, then the Euribor rate should anticipate the Repo movements. This hypothesis is confirmed by Figure 1, which plots the Repo rate together with the one-month and six-month Euribor rates. Indeed, in the sample period January 1999 – June 2005 Euribor rates have been quite close to the corresponding moving average of the spot daily Repo rates.

More specifically, Figure 1 shows, unsurprisingly, that the ability of the term structure to predict spot Repo rates decreases with the length of the forecast horizon (compare the left box with the right one). Moreover, this figure suggests that financial markets react sluggishly to changes in the Repo rate. When the Repo rate follows an upward trend, the rate implied by the term structure is usually below the realized Repo rate. When the Repo rate follows a downward trend, the rate implied by the term structure is usually above the realized Repo rate. Finally, it is eye-catching the Millenium outlier (especially, and obviously, for the 1-month Euribor rate).

Both the absence of arbitrage opportunities and the ability of borrowers to resort to different lenders imply that the financial cost $r_{t,m}$ to borrow money on the interbank market for m months starting at day t is equivalent to the expected cost of borrowing from the central bank again from day t to day $t+m$ months, up to a risk premium γ (returns in excess of the risk-free rate). Hence,

$$r_{t,m} = E_t \left[\prod_{j=0}^{m-1} (1 + R_{t+j}) - 1 \right] + \gamma \quad (4)$$

where R_{t+j} (as before) stands for the monthly Repo rate in force within j months from today t . Equation (4) can be theoretically motivated by relying on standard asset pricing formulas, and specifically to the stochastic pricing kernel (see, for example, Campbell et al. (1997), chapter 8 and 10)¹³.

In the empirical literature is often assumed that γ is time-invariant and this assumption is also known as the expectation hypothesis. We have deferred the discussion about the implications of allowing predictable time-varying risk premia in the conclusion.

In order to derive the specification of the interest rate forecasting regression, we can rearrange (4) as:

$$\bar{R}_{t,m} = \alpha + \beta r_{t,m} + \varepsilon_t \quad (5)$$

where $\bar{R}_{t,m}$ is defined as $\left[\prod_{j=0}^{m-1} (1 + R_{t+j}) - 1 \right]$ and ε_t stands for a stochastic zero-mean forecast error, $\bar{R}_{t,m} - E_t [\bar{R}_{t,m}]$, which is uncorrelated with all available information at time t .

Obviously, under the maintained hypotheses of both no arbitrage opportunities and constant risk premia, we should find that β equals 1 and α equals $-\gamma$.

Phillips-Perron unit root tests (not reported here for reasons of space, but available from the authors upon request) reject the unit root hypothesis for the first differences of Euribor interest rates, but not for their levels. Moreover, the cointegration Johansen estimations cannot reject that every couple of interest rates is cointegrated with a slope equal to 1. However, note that the non-stationarity of the data may disappear as more observations for the Euro area become available, since interest rates are likely to be stationary in large samples.

If we estimate directly (5), then we are going to find the cointegrating vector (a long-run relationship), rather than the coefficients of the short-run interest rate forecasting regression. To avoid this econometric problem, we stochastically detrend (it is a common practice) both sides of (5):

$$\bar{R}_{t,m} - R_t = \alpha + \beta (r_{t,m} - R_t) + \varepsilon_t \quad (6)$$

The parameters α and β have the same interpretation as before, but the R^2 statistics now measures the fraction of changes in the Repo rate explained by the Euribor rate curve.

If we are interested in predicting the Repo rate over some interval beginning at some point in the future, we can easily extend (6) as follows:

¹³ Note that in the ECB case γ contains also an econometrically indistinguishable transaction cost component. Borrowing from the central bank is more costly than borrowing from the interbank market since in the first situation the loan is backed by the deposit of a security collateral whose rate of return is lower than the one granted by the market.

$$\bar{R}_{t+m,t+m+n} - R_t = \alpha + \beta(r_{t,t+m,n} - R_t) + \varepsilon_t \quad (7)$$

where $r_{t,t+m,n}$ stands for the (implicit) Euribor rate quoted on day t for an interbank loan for n months starting at day $t+m$ months, and $\bar{R}_{t+m,t+m+n}$ is defined as $\left[\prod_{j=0}^{n-1} (1 + R_{t+m+j}) - 1 \right]$. Note that $\bar{R}_{t+m,t+m+1}$ is equal to R_{t+m} .

Again the coefficients α and β have the same interpretation as before but the R^2 statistic now measures the ability of the Euribor rate to forecast changes in the Repo rate from its current level to its average level over some interval in the future.

Table 6 reports our estimations of (7) for the period January 1999 - December 2004 when $n = 1$ and $m = 1, \dots, 6$. In all regressions, the Wald test of the expectation hypothesis (i.e., $\beta = 1$) cannot be rejected. Therefore, we decided also to estimate (7) with the constraint $\beta = 1$, that is:

$$\bar{R}_{t+m,t+m+n} - r_{t,t+m,n} = \alpha + \varepsilon_t \quad (8)$$

Note that in this formulation $-\alpha$ represents the risk premium: it is both positive (always statistically different from zero) and increasing over time.

The R^2 of the constrained estimation is just slightly lower than before, confirming that the above restriction is almost slack.

As a robustness check (cf. section 3 above) of our conclusion that Euribor rates predict quite well future Repo changes, Table 7 reports the contingency tables for $m = 1, \dots, 6$ of the sign of future Repo changes by using an ordered probit regression as econometric tool.

Again, as in section 3, it turns out that our results are unaffected by the choice of the econometric tool (either OLS or ordered probit).

It is also interesting to note that the findings of both Table 6 and Table 7 are broadly consistent with older studies on market predictability of ECB policy decisions, such as Bernoth et al. (2004), Perez-Quiros et al. (2002) and Ross (2002): financial markets forecast quite well future ECB monetary policy moves.

After having evaluated econometrically the ability of short-term financial market interest rates to predict the future course of ECB monetary policy, we can assess quantitatively the informational content of ECB rhetoric. In particular, we compare the forecasting ability of European monetary authority words with the one implied by the standard benchmark of market-based measures (Euribor rates) of monetary policy expectations.

Table 8 reports the percentage of corrected classification of the ordered probit: for each m , the sum of the diagonal entries of Table 5 and 7 is divided by the total number of observations (in our case, 62).

Diebold and Kilian (2001) have shown that the R^2 of the OLS regression provides a good measure of the forecasting ability of future interest rate changes. Note that our qualitative conclusions about the predicting ability of ECB words would not substantially change if we use the goodness of fit reported in Table 3 and 6, rather than the corrected classification of the ordered probit estimation about the predicted sign of the Repo rate change.

As expected, market-based measures of future monetary policy moves, proxied by the implicit Euribor rate, represent an upper bound on the ability of statistical models to forecast future changes in the Repo rate. This finding supports the classical view that prices incorporate all available information. And as Rudebusch (1998), among others, once underlined, this is due to the flexibility of market forecasts in processing and then incorporating new information. Moreover, it is important to notice that the above result is in part driven by the fact that Euribor rates are a continuous variable, while the informational content of ECB words is summarized by a discrete variable. Hence, by construction the latter provides less information.

It is interesting to note that even if the R^2 of the OLS regression and the corrected classification of the ordered probit provide very similar information, there is no one-to-one mapping between them. In particular, the corrected classification criterion is by construction very much non linear. In fact, it over penalizes (with respect to the R^2 statistics) a misclassification of the predicted sign when there is a tiny difference between the maximum probability of an event and the second maximum one. Vice versa, the corrected classification criterion over rewards (w.r.t. the R^2 criterion) a corrected classification of the predicted sign when again there is a tiny difference between the maximum probability of an event and the second maximum one. In our econometric analysis the former case happens for $m = 2$ when we use the *Index* regressor.

4.2. Macroeconomic variables and Index: substitutes or complements?

In this subsection we investigate whether textual analysis is still helpful to predict the future ECB Repo rate once we control for the hard information contained in either macroeconomic data or financial markets' information set.

Since several papers (among others, Gerlach-Kristen (2003) and Ullrich (2003)) have recently provided evidence that the Taylor rule explains quite well ECB's past and current interest rate setting behaviour, we decide to add the following explanatory variables to the right-hand side of equation (1):

1. The short-term effective real interest rate, defined as the difference between the policy rate and the core inflation (the rate of growth of industrial prices net of energy and unprocessed food prices), $R_t - INFL_t$. We expect it to be a mean-reverting process.
2. The real annual growth rate of the Euro compared with the US Dollar (measured in US\$ needed to buy 1 €), gE_t . We postulate that the ECB considers the effects of the exchange rate channel on the monetary transmission mechanism in terms of both net external demand and import prices (cf. Ball, 1999). For instance, an appreciation of the Euro reduces the risk of inflation and thus a decrease of the ECB official interest rate is more likely. Note that since in the period 1999-2004 the difference between European and American inflation has been approximately constant, we could have used the nominal (rather than the real) appreciation / depreciation of the Euro against the US Dollar.
3. We approximate the real economic activity (i.e., expected GDP growth for the Euro area) by three different measures: economic Sentiment indicator, Eurogrowth and Eurocoin. We

use principal component analysis to summarize their information content: the first factor (*Factor*) captures around 87% of the overall variance of (and it is positive correlated with) these indices. Of course, we expect that an increase in the Repo rate is more likely when the European economy is growing fast. Note that our qualitative results reported in Table 6 will not change if we approximate the real economic activity by the output gap, defined as the difference between the level of GDP and its long-run trend (Hodrick-Prescott filter with smoothing parameter equal to 1600). Indeed, when we include *Index* as explanatory variable, also in this second case the R^2 of the regression increases substantially.

The motivation behind the choice of these macroeconomic variables, rather than relying to a more standard specification of the Taylor rule, is provided in a working paper (Rosa and Verga, 2005a)

Note that for each variable at t , the analysis has considered only the values that were really available (Orphanides, 2001). In other words, we estimate real-time empirical reaction functions: we have used the (preliminary and incomplete) data that are contained in the financial market information set at t , rather than final and revised macroeconomic data.

In Table 9 we report the estimation results for the following specification:

$$R_{t+m} - R_t = \alpha + \beta_1(R_t - INFL_t) + \beta_2 Factor_t + \beta_3 gE_t + \beta_4 Index_t + \varepsilon_t \quad (9)$$

where the rest of the notation is the same as before.

First, we find that the coefficient of *Index* is always positive and significantly different from zero.

Second, Table 9 shows that the coefficients of some economic variables, such as either the Repo rate or the core inflation, remain significant and with the right sign.

Therefore, words seem to be complements to (rather than a substitute for) numbers. And the press conference turns out to be crucially important to enhance ECB transparency.

Third, note that we have included no lags of the explanatory variables in the right-hand side of equation (9). In other words, we have implicitly assumed that a Markovian process governs their evolution. It is clearly a simplification, which nonetheless has not been rejected by the data. In fact, the regressor coefficients of many lags turned out to be not significantly different from zero once we include them in (9) (regression results not reported). More generally, we acknowledge that it is possible to criticize the selection of our macroeconomic variables in equation (9). In particular, there is always a positive probability of not only regression mis-specification (due to inappropriate forward- or backward-lookingness), but also of omitted variables. For this reason, words may not be complementary to data: policy-makers' interpretation of the data is simply superfluous. Rather, in a data-rich environment, our wording indicator simply summarizes neatly the informational content of a large number of other (not included) macroeconomic data.

Clearly, if markets are efficient, all relevant and available information should be incorporated in asset prices. Therefore, in order to test whether the left-hand-side of equation (9) omits some variables that are correlated with *Index*, we include Euribor rates quoted

immediately before the ECB President monthly announcement (for the precise timing convention, see next section) as an explanatory variable and estimate the following equation:

$$R_{t+m} - R_t = \alpha + \beta_1(r_{t,t+m,1} - R_t) + \beta_2 Index_t + \varepsilon_t \quad (10)$$

where the notation is the same as before.

Table 7 reports estimations of the regression coefficients for the period January 1999 - December 2004 for $m = 1, \dots, 6$.

We find that both β_1 and β_2 are always positive and significantly different from zero.

Hence, we conclude that words not only provide complementary information with respect to macroeconomic variables, but also on average provide new and important information even if we control for a very large (i.e., the financial market) information set. This finding corroborates the empirical results of, among others, Peek et al. (1999) and Romer and Romer (2000): the central bank's information set does not overlap with the information set of financial markets.

This observation begs a natural question: when the central bank talks, does the market react to what it did not know? More precisely, do financial intermediaries both understand and believe the announcements made by the ECB about the future path of its monetary policy?

The answer to this question is provided in the next section.

5. Monetary policy and news shocks

There has recently been some empirical work on the effect of news on market expectations and asset prices.¹⁴ The news variable usually consists of macroeconomic data releases (see, for example, Kliesen and Schmidt, 2004).

Moreover, Gurkaynak et al. (2005) find 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 closely associated with FOMC announcements. We are going to solve a related empirical exercise. However, by using a very intuitive and simple approach, our results are much easier to interpret.

Stein (1989, page 32) observes: "Casual empiricism suggests that bond and exchange market traders pay careful attention to such pronouncements [of the central bank], even while bemoaning the uncertainties associated with trying to interpret them."

In this section, we test whether this casual empiricism is also confirmed by the data.

On Governing Council meeting days, two news systematically hit financial markets. On the one hand, at around 1:45 p.m., through an ECB press release, the new level of the Repo rate in force for the following month becomes public information. On the other, at 2:30 p.m., the ECB President's press conference takes place. Euribor data (that approximate financial market expectations) are quoted at 11 a.m. for each workday.

¹⁴ Tivegna (2002) in footnotes 21 and 22 provide some references of works that test the sensitivity and volatility of exchange rates, stock and bond prices, and future financial instruments to the release of news.

Our testable hypothesis is that from the day of the Governing Council meeting (t) to the day after ($t' \equiv t+1$) the market takes into account the content of the new ECB President's press conference in order to set its expectations about the future path of the ECB's monetary policy.

Our maintained hypotheses are both that the market forms expectations rationally using all available information, and that the only new information about the future Repo rate that systematically reaches the market between day t and t' are (1) the new Repo level and (2) the content of the President's press conference.

Note that we are interested in investigating only the innovations in expectations caused by the ECB President's press conference, so we restrict our econometric analysis only to Governing Council meeting days. In other words, we apply a standard event-study approach.

In order to check whether financial markets react to ECB communication, it is important to realize that the news is not represented by the ECB announcement but rather by its unexpected component (cf. Rosa and Verga, 2005b). Therefore, to verify empirically the effectiveness of ECB words, we need to proceed in two steps. First, we have to pin down what the market expects the ECB to declare. Second, we can investigate the sensitivity of asset prices to the news shock.

We posit that the market tries to predict the ECB announcement through the following regression:

$$E_t [Index_{t'}] = \alpha + \gamma_1 Index_t + \gamma_2 (r_{t,t+k,1} - r_{t,t,1}) \quad (11)$$

where $E_t [.]$ stands for the expectation conditional on time t information set. α is a constant and γ s are regression coefficients. The rest of the notation is the same as before.

In words, we assume that *Index* follows an AR (1) process: the economic environment cannot change too much in the course of one month.

Moreover, other things being equal, if the k -month forward one-month-ahead implicit Euribor rate is higher than one-month rate, then the market expects the ECB to increase its policy rate in the near future. Hence, it expects a greater value of *Index* to be announced. That is, if the very short-end of the term structure is upward sloping, then it is likely a hawkish declaration. Vice versa, if the short-end of the term structure is downward sloping, then the market expects the ECB to cut its policy rate in the near future. Hence, it expects a dovish announcement. We want this second term to capture all available and relevant information that hit the market in the previous thirty days, that is since the last ECB press conference.¹⁵ There is clearly a frequency issue (Ehrmann and Fratzscher, 2004) because Euribor data are continuous (real-time), while ECB's news is released monthly. The third explanatory variable in equation (8) should take care of this problem.

It is clearly possible to use additional instruments to predict future ECB announcements. In particular, we also estimate (results not reported) equation (11) by adding in its right-hand side the macroeconomic variables discussed in section 4.2. Nonetheless, all the econometric

¹⁵ Of course, our implicit maintained hypothesis is that financial markets are efficient.

results presented in this section are neither qualitatively nor significantly affected by this different specification of (11).

In order to select the most appropriate value of k in $r_{t,t+k,1}$, we use a general to specific approach, including all values of k from 1 to 6. Subsequently, we gradually eliminate those regressors that turned out to be insignificant.

We report in Table 11 the OLS estimates of equation (11) for $k = 5$ (best fit).

Interestingly, γ_1 belongs to $(0,1)$ implying a stable AR process, γ_2 is positive, and both are significantly different from zero. Furthermore, α is very close to zero, indicating that there is no bias in the ECB assessment of the balance of risks. Finally, note that the regression fit is quite high.

We can now test the effectiveness of ECB communication by estimating the following regression:

$$r_{t',t'+k,1} - r_{t,t+k,1} = \alpha + \beta_1 MPS_{t'} + \beta_2 NS_{t'} + \varepsilon_{t'} \quad (12)$$

where $MPS_{t'}$ and $NS_{t'}$ stand respectively for monetary policy and news surprises just after ECB announcements. The left-hand side approximates the change in expectations for the implicit k -month forward one-month-ahead Euribor rate (i.e., the change in expectations from date t to date t' about the level of the Repo rate in k months from now).

As standard in the literature (see, for example, Kuttner, 2001), we measure the unexpected component of monetary policy decisions by the change on the committee days in the one-month ahead Euribor money market rate. More formally,

$$MPS_{t'} \equiv r_{t',t',1} - r_{t,t,1} \quad (13)$$

By doing that, we are implicitly assuming that the risk-premium stays constant during Governing Council meeting days.¹⁶

While the news surprise ($NS_{t'}$) is approximated by the difference between $Index_{t'}$ and $E_t[Index_{t'}]$, as given by equation (11).

The fact that the news is measured by the difference between what the central bank officials declare and what financial intermediaries expect them to declare represents a new methodological contribution of this paper. In fact, in an independent work, also Ehrmann and Fratzscher (2005) check the effectiveness of ECB communication in moving financial markets. However, in their paper, the news is approximated by the face value of the content of the statement.

¹⁶ This assumption is at least loosely consistent with the findings 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. Alternatively, the monetary policy surprise can be approximated, up to a constant, by $R_{t'} - r_{t,t,1}$. In this latter case, we are making the stronger assumption that the risk premium has been constant throughout our sample period (cf. Section 6). Note that estimations of (12) are robust to the choice of proxy for monetary policy shocks.

We report the estimation results of (12) in Table 12 for the period January 1999 to December 2004 for $k = 1, \dots, 6$.

Our first conclusion is that there are no arbitrage opportunities in the Euribor market. In fact, the constant is never significantly different from zero at the 5% level (and most of the times well beyond the 10%).

Second, Table 12 suggests that the ECB can influence to some extent the money market interest rates using just words, rather than deeds such as a change in the Repo. Therefore, it appears that the European monetary authority communication is quite effective. For example, consider the five-month-ahead one-month forward rate (namely, $r_{t,t+5,1}$). When the ECB President declares: “It is imperative to contain upward pressure to price stability” while the market expects a value of *Index* of zero, then $r_{t,t+5,1}$ on average (and *ceteris paribus*) jumps up of about 7 basis points.

Third, the news shock is not important in explaining the innovation in expectations for the implicit one-month forward one-month-ahead Euribor rate. This is not fully surprising once we notice that the wording indicator usually does not refer to a very short horizon but rather to a three- or four-month horizon (cf. Table 3).

Since *Index* takes values between -2 and +2 while the policy decisions between -50 and +50 (in basis points), the units of measure of the monetary policy shock and the news shock are substantially different. Therefore, in order to compute the order of magnitude of the effect on the short-end of the term structure of the news shock and monetary policy shock, we need to normalize them. In Table 13 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 have been to consider 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, consider the two-month-ahead one-month forward rate (namely, $r_{t,t+2,1}$). In this case, a news shock of one standard deviation produces the same shift in the term structure as a monetary policy shock of one standard deviation. It very much seems that words are an additional instrument in the hands of the central banker to conduct monetary policy (cf. Khon and Sack, 2004).

We are very aware that the estimation of (12) can be invalidated by the presence of contemporaneous correlation between $NS_{t'}$ and $\varepsilon_{t'}$. In the current context, it is likely to be caused by either endogeneity or a regression mis-specification (specifically for the presence of a latent common cause such as an unexpected oil shock).

If we assume that the ECB is well managed, then we can rule out the endogeneity problem.¹⁷ As vividly pointed out in Blinder’s book (1998, page 61), “financial markets ... have ludicrously short time horizons, whereas maintaining a long time horizon is the essence of proper central banking”. For this reason, it is not optimal that the central bank delivers “the

¹⁷ This is a standard assumption in the “event-study” literature, but it can be relaxed. In fact, Rigobon and Sack (2004) solve the simultaneity problem through a heteroskedasticity-based method of identification. They exploit the fact that on days of FOMC meetings the variance of policy shocks increase.

interest rate path that the markets have embedded in asset prices” (ibid. page 60). Rather, a central bank should be independent from financial markets.

The regression mis-specification problem can be much mitigated by using an intraday (tick-by-tick) data set. In fact, by reducing the interval between the points in time in which we measure financial market expectations, we decrease the probability that other news hit financial markets. Obviously, the time window cannot become too short, otherwise, our observations will be too noisy: asset prices should, but actually do not, properly incorporate news instantaneously. We conclude this section by qualifying Gurkaynak et al. (2005) claim that words speak at least as loud as actions: it is important not only that the ECB speaks, but also what unexpectedly says!

6. Conclusions

In this paper, we show that in recent times central bankers are not boring at all (cf. Lambert, 2004): since the ECB has so far been consistent between its words and future deeds, its communication conveys useful information about the short-run dynamics of the Repo rate. In fact, by looking at the verbatim content of the ECB President’s monthly press conferences, it is possible to predict fairly well the European monetary authority’s interest rate setting behaviour. Furthermore, we show that the informational content of the wording of the ECB is substantial. On the one hand, the forecasting ability of ECB words is similar to the one implied by the Euribor term structure. On the other, the information of ECB rhetoric does not disappear once we control for Taylor-type macroeconomic variables. Finally, we verify empirically that financial markets not only understand but also believe the signals sent by the European monetary authority. Therefore, we conclude that the ECB is effective in its job of communication to the public, and is able to influence market expectations on the short-term interest rate path using just words. To put it another way, not only can the ECB reinforce the effects of a policy action by adding a statement in the same direction (Kohn and Sack, 2003), but it can also affect the short-end of the money market term structure just by the words contained in the President’s press conference.

Of course, some important issues are not considered in this paper and deserve further study.

In subsection 4.1 we have made the implicit assumption that the risk premium on Euribor contracts (proxied by $-\alpha$) is constant over time. Piazzesi and Swanson (2004) show that for the period 1988-2003 (sixteen years) excess returns on U.S. federal funds futures have been time-varying and, more specifically, strongly countercyclical. Moreover, they found that excess returns could be well predicted by macroeconomic indicators. Therefore, they conclude that futures-based measures of the future monetary policy path should be adjusted to account for these variable excess returns (see in particular Figure 6 in their paper). Is this also true for the European case? We have tentatively tried to replicate their exercise by regressing (OLS with White standard errors) the risk premium for various maturities (defined as $\bar{R}_{t+k,t+k+1} - r_{t+k,t}$ in our notation) on a constant and a vector of variables known to financial markets at time t

(regression results not reported). The constant turns out to be always positive and significantly different from zero, while the regressor coefficients on employment growth and financial business cycle indicators such as corporate bond spreads were systematically insignificantly different from zero. Perhaps, our sample of six years was too short to investigate this issue or we have not identified the right set of explanatory variables.

The validity of the horse race proposed at the end of subsection 4.1 crucially depends on the correct measurement of ECB opinions. We have already noted that the interpretation of verbal documents cannot but be imprecise and subjective, in spite of all our efforts, and these ambiguities will never be fully cancelled out. The solution suggested in this paper about turning verbal expressions into an ordinal variable is just one possibility. Others may include either the use of textual analysis software based on the relative frequency of words or running an experiment.

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Table 1. – An example of the ECB President’s introductory statement

<p>Introductory statement with Q&A</p> <p>Jean-Claude Trichet, President of the ECB, Lucas Papademos, Vice President of the ECB, Frankfurt am Main</p> <p>Title</p>	<p>Turning to price developments, annual HICP inflation was 2.1% in June, according to Eurostat's flash estimate, compared with 1.9% in May. Over the next few months annual HICP inflation rates are expected to fluctuate around current levels and may not fall below 2% for the remainder of 2005. This outlook mainly reflects recent developments in oil prices, which were seen as an upside risk in the context of the June 2005 Eurosystem staff inflation projections. However, wage increases have remained contained over recent quarters and, in the context of moderate economic growth and weak labour markets, this trend should continue for the time being. Overall, we continue to see no significant evidence of underlying domestic inflationary pressures building up in the euro area.</p> <p>At the same time, upside risks to this scenario for inflation warrant close monitoring. These risks relate mainly to oil price developments and their potential to lead to second-round effects stemming from wage and price-setting behaviour. It is important that the social partners continue to play their part in containing inflationary pressures. We will continue to take into account when assessing current inflationary risks.</p> <p>Prices</p>	<p>Transcript of the questions asked and the answers given by Jean-Claude Trichet, President of the ECB, and Lucas Papademos, Vice-President of the ECB</p> <p>Question: Mr Trichet, three questions. First of all, after the September 11 attacks in the United States you did make some efforts to ensure the stability of the financial system, notably by making liquidity available wherever it was needed on whatever side of the Atlantic. I wanted to ask if you saw any similar necessity this time around or any other measures which might be necessary under the current circumstances. My second question is: what was your message to Mervyn King when you spoke to him today? And my third question is: did you discuss a rate cut today?</p> <p>Trichet: On the first question, I have been in touch with Mervyn King on the functioning of the markets. Our joint observation was that markets were functioning on both sides of the Channel. Of course, both the US and the UK have taken into account the payment system, and we are being in touch and, at this point, we would call for action. If this were the case, you can be sure that we would act immediately. Again, we are in permanent contact. On this occasion, I expressed our very deep sympathy to Mervyn. I expressed the emotion of the Governing Council. As I said, we had a moment of silence to express condolences to the British people and the families concerned</p> <p>(...)</p> <p>Q & A</p>
<p>Ladies and gentlemen, welcome to our press conference. The Governing Council of the ECB expresses its deep sympathy and its total solidarity with the British people and the Bank of England in these dreadful circumstances. We have observed a minute of silence in memory of the victims of these terrorist attacks and we convey our sincere condolences to the British people and the Bank of England.</p> <p>The Vice-President and I will be present at the Governing Council of the ECB in Almunia.</p> <p>Greetings</p>	<p>Looking at inflation prospects over medium to longer horizons, our assessment is also based on the results of our monetary analysis. In line with developments since mid-2004, monetary and credit growth in the euro area have remained low. In the context of the low level of interest rates, monetary developments, as reflected in the private sector. Liquidity conditions are favourable. Overall, monetary developments suggest risks to price stability over medium to longer horizons.</p> <p>Monetary variables</p>	
<p>On the basis of our regular economic and monetary analyses, we have concluded that the monetary policy stance is appropriate, given the current outlook for price stability over the medium term. A rate cut is not warranted at this time. ECB interest rates unchanged. A rate cut is not warranted at this time. ECB interest rates unchanged. A rate cut is not warranted at this time.</p> <p>Main Statement</p>	<p>To sum up, the economic analysis confirms that domestic inflationary pressures over the medium term remain contained in the euro area, while oil price developments in particular imply some upside risks. The monetary analysis also confirms that the euro area remains vigilant in order to maintain price stability, monetary policy will remain unchanged.</p> <p>Second Main Statement</p>	
<p>In the context of our economic analysis, recent indicators of economic activity in the euro area have, on balance, confirmed that growth has remained subdued. High and rising oil prices in particular appear to have weighed on demand and confidence. On the basis of current information, the growth rate in the second quarter of this year is expected to be lower than the first quarter growth rate of 0.5%, quarter on quarter. Available data are still mixed, with some of the most recent indicators showing a slight improvement, but there are no signs as yet that a more sustained recovery in economic activity has already started. At the same time, looking beyond the short term, there continues to be reason to expect a gradual improvement in economic activity in the euro area. On the domestic side, investment should benefit from the very favourable financing conditions, the robust growth of corporate earnings currently observed and ongoing improvements in corporate efficiency. Consumption growth should evolve broadly in line with expected developments in disposable income. On the external side, ongoing growth in global demand and improvements in euro area price competitiveness should support euro area exports. This assessment is in line with available forecasts and projections.</p> <p>This baseline scenario for growth uncertainty. On balance, risks to the euro area are not materially different from those prevailing in the euro area and global economy.</p> <p>Real Sector</p>	<p>Prudent fiscal policies could provide considerable support for confidence in the euro area. The discussions on revising the Stability and Growth Pact regulations have been concluded and rigorous implementation is now key to ensuring an effective framework for fiscal policy coordination and discipline. This is all the more true as current and projected fiscal deficits in several euro area countries still need to be addressed with rigour. In a number of cases these deficits not only imply a rising debt ratio, but also leave no safety margin for short-term budgetary relief in the event of adverse developments. In this context, as significant revisions of past deficit and debt figures have been reported for a few countries, let me also reiterate previous calls by the Governing Council for the reliable compilation and timely reporting of government finance statistics.</p> <p>Finally, let me conclude with a few words on structural reform. As we have stressed repeatedly, a decisive and comprehensive adjustment process within the euro area is urgently needed. The primary objective is to ensure greater resilience to the challenges from globalisation, rapid technological change and demographic developments, to ensure greater resilience to the challenges from globalisation, rapid technological change and demographic developments, to ensure greater resilience to the challenges from globalisation, rapid technological change and demographic developments.</p> <p>Other topics</p>	

NOTE: Introductory statement to the press conference, 7th July 2005.

Table 2. – Glossary of ECB’s official statements and their ranking

ECB’s main statements: the most important keywords	<i>Index</i>
Imperative that upward pressure to be contained – Risks [to price stability] are upward (upside) – The risks to price stability are confirmed (or: remain) – Vigilant (vigilance) [with regard to upside risks to price stability]– Close monitored (or: continuous close attention) [upside risks] – Several [upward] factors need to be monitored carefully	+2
Both confident and vigilant (or: Good however vigilant) [upside risks] – Upward pressure remains contained – A number of (or: Some) upside risks need to be carefully monitored – Alert to emerging of upward risks – Vigilance with regard to the materialisation of upside risks	+1
Appropriate – Favorable – Compatible – Consistent – In line – Balanced – Absence of significant (or: No strong) pressures either upwards or downwards – The downside risks have disappeared –	0
Favorable, but there are some [downside] risks – Appropriate but remain downside risks – Downside risks are not vanished – Some of the downward risks had materialised	-1
Consistent, but carefully monitor all [downside] risks to economic growth – Balanced but monitor closely all [downside] factors – Monitor carefully all [downside] factors relevant to economic growth – Downside risks are still relevant – Economic slowdown is still cause for concern – [Strong] downside risks for economic activity – Monitor closely the downside risks to economic growth.	-2

ECB’s main statements: Comparisons	<i>Index</i>
Somewhat less favorable – [Price perspectives are] less satisfactory but further evidence is needed – move towards the upside	+1
Confirmed – not altered – not changed (or: no fundamental changes)	0
More balanced – Inflationary pressures have further diminished (or: are lower, are easing)	-1

Table 3. – Prediction of the Repo change using ECB words

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
<i>Constant</i>	-0.036* (0.021)	-0.068** (0.028)	-0.106*** (0.030)	-0.118*** (0.038)	-0.135*** (0.049)	-0.161*** (0.056)
<i>Index_t</i>	0.091*** (0.022)	0.143*** (0.026)	0.203*** (0.026)	0.255*** (0.031)	0.291*** (0.039)	0.326*** (0.046)
R ²	0.367	0.411	0.537	0.527	0.461	0.431
Adj. R ²	0.356	0.401	0.530	0.519	0.452	0.422
Observations	62	62	62	62	62	62

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
<i>Index_t</i>	0.086*** (0.021)	0.133*** (0.025)	0.187*** (0.026)	0.237*** (0.031)	0.270*** (0.039)	0.300*** (0.048)
R ² = Adj. R ²	0.329	0.350	0.446	0.456	0.398	0.366
Observations	62	62	62	62	62	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The econometric method is Ordinary Least Squares.. The independent variable is *Index* reported in Table A1. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at the 99%, 95% and 90% levels.

Table4. – Prediction of the Repo change using dummy variables for ECB words

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
<i>D_{-2,t}</i>	-0.250*** (0.091)	-0.321*** (-0.087)	-0.429*** (0.045)	-0.536*** (0.063)	-0.536*** (0.063)	-0.643*** (0.049)
<i>D_{-1,t}</i>	-0.125 (0.080)	-0.281** (0.126)	-0.406*** (0.112)	-0.406*** (0.112)	-0.500*** (0.122)	-0.500*** (0.122)
<i>D_{0,t}</i>	0.000 (0.000)	-0.032 (0.024)	-0.065 (0.040)	-0.120* (0.066)	-0.163* (0.089)	-0.193* (0.102)
<i>D_{1,t}</i>	-0.021 (0.021)	0.000 (0.053)	-0.068* (0.035)	-0.023 (0.062)	-0.023 (0.092)	-0.083 (0.132)
<i>D_{2,t}</i>	0.167*** (0.056)	0.250*** (0.069)	0.384*** (0.083)	0.500*** (0.102)	0.596*** (0.132)	0.692*** (0.161)
R ²	0.420	0.445	0.614	0.569	0.514	0.495
Adj. R ²	0.379	0.406	0.586	0.539	0.480	0.459
Observations	62	62	62	62	62	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at the 99%, 95% and 90% levels.

Wald F test

1) All β s are equal to each other

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
F statistics	4.947	8.040	23.739	21.813	18.309	20.081
Probability	0.002	0.000	0.000	0.000	0.000	0.000
Observations	62	62	62	62	62	62

2) Restrictions are linear in coefficients

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
F statistics	5.104	1.257	5.612	2.418	2.695	2.400
Probability	0.003	0.298	0.002	0.076	0.054	0.077
Observations	62	62	62	62	62	62

Table 5. – Contingency table of the sign of future Repo changes using ECB words

Index

m = 1		actual			total
		-	0	+	
fitted	-	4	3	0	7
	0	3	46	6	55
	+	0	0	0	0
	total	7	49	6	62

m = 2		actual			total
		-	0	+	
fitted	-	5	2	0	7
	0	8	38	9	55
	+	0	0	0	0
	total	13	40	9	62

m = 3		actual			total
		-	0	+	
fitted	-	13	2	0	15
	0	6	28	0	34
	+	0	3	10	13
	total	19	33	10	62

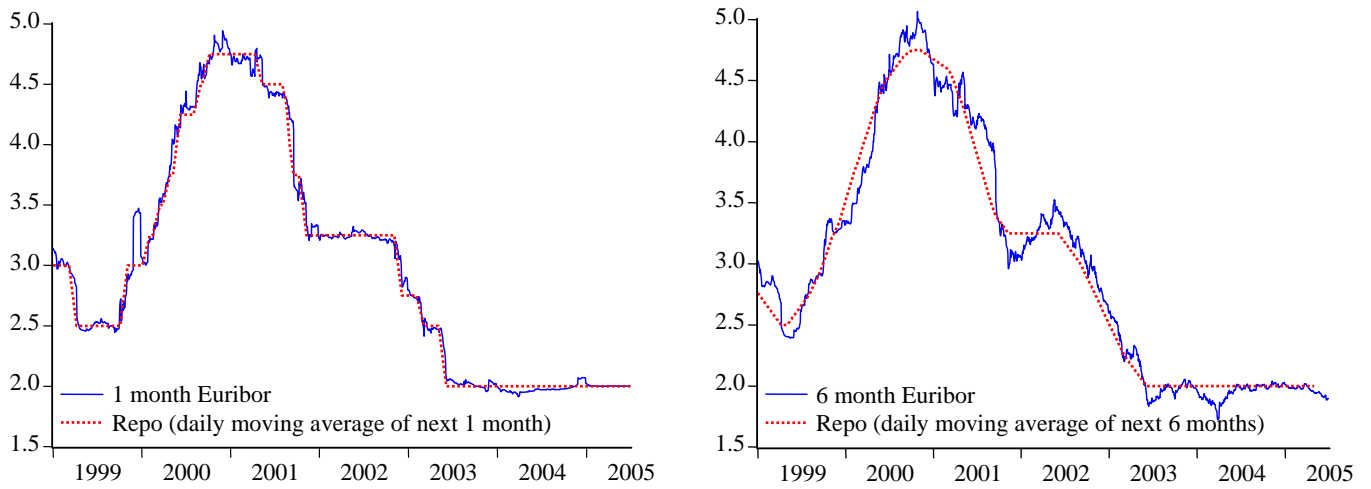
m = 4		actual			total
		-	0	+	
fitted	-	13	2	0	15
	0	7	26	1	34
	+	0	3	10	13
	total	20	31	11	62

m = 5		actual			total
		-	0	+	
fitted	-	13	2	0	15
	0	8	24	2	34
	+	1	2	10	13
	total	22	28	12	62

m = 6		actual			total
		-	0	+	
fitted	-	13	2	0	15
	0	9	22	3	34
	+	2	1	10	13
	total	24	25	13	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The dependent variable is the sign of the change in the Repo rate. The econometric method is ML – Ordered Probit (Quadratic hill climbing). The predicted sign is the event with maximum probability.

Figure 1. - Repo and Euribor rates



NOTE: The sample is January 1999 – December 2004, daily data. In order to have a sensible plot, the median value of the risk premium together with the implicit cost of borrowing from the central bank, defined as $\bar{R}_{t+k,t+k+1} - r_{t+k,1}$ with $k = 0$ and 5 (the notation is the same as before), is subtracted from the Euribor implicit rate.

Table 6. – Prediction of the Repo change using the Euribor rate

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
<i>Constant</i>	-0.134 ^{***} (0.031)	-0.195 ^{***} (0.038)	-0.231 ^{***} (0.034)	-0.266 ^{***} (0.040)	-0.303 ^{***} (0.047)	-0.370 ^{***} (0.056)
$r_{t,t+m.1} - R_t$	0.862 ^{***} (0.171)	0.984 ^{***} (0.147)	0.993 ^{***} (0.126)	1.124 ^{***} (0.101)	1.136 ^{***} (0.115)	1.165 ^{***} (0.137)
R ²	0.450	0.516	0.628	0.712	0.672	0.615
Adj. R ²	0.441	0.507	0.621	0.708	0.666	0.609
Observations	62	62	62	62	62	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ^{***}, ^{**}, ^{*} indicate significance at the 99%, 95% and 90% levels.

Wald F test of $\beta = 1$ (Expectation hypothesis)

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
F statistics	0.654	0.012	0.002	1.496	1.391	1.451
Probability	0.421	0.913	0.960	0.226	0.243	0.233
Observations	62	62	62	62	62	62

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
<i>Constant</i>	-0.153 ^{***} (0.018)	-0.197 ^{***} (0.024)	-0.232 ^{***} (0.027)	-0.243 ^{***} (0.030)	-0.275 ^{***} (0.039)	-0.329 ^{***} (0.050)
R ² = Adj. R ²	0.439	0.515	0.628	0.703	0.662	0.603
Observations	62	62	62	62	62	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ^{***}, ^{**}, ^{*} indicate significance at the 99%, 95% and 90% levels.

Table 7. – Contingency table of the sign of future Repo changes using Euribor rates

Euribor

m = 1		actual			total
		-	0	+	
fitted	-	3	1	0	4
	0	4	46	2	52
	+	0	2	4	6
	total	7	49	6	62

m = 2		actual			total
		-	0	+	
fitted	-	9	3	0	12
	0	4	35	2	41
	+	0	2	7	9
	total	13	40	9	62

m = 3		actual			total
		-	0	+	
fitted	-	14	4	0	18
	0	5	29	1	35
	+	0	0	9	9
	total	19	33	10	62

m = 4		actual			total
		-	0	+	
fitted	-	16	3	0	19
	0	4	28	1	33
	+	0	0	10	10
	total	20	31	11	62

m = 5		actual			total
		-	0	+	
fitted	-	17	5	0	22
	0	5	22	3	30
	+	0	1	9	10
	total	22	28	12	62

m = 6		actual			total
		-	0	+	
fitted	-	17	6	0	23
	0	6	18	2	26
	+	1	1	11	13
	total	24	25	13	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The dependent variable is the sign of the change in the Repo rate. The econometric method is ML – Ordered Probit (Quadratic hill climbing). The predicted sign is the event with maximum probability.

Table 8. – Corrected classification of the Ordered Probit forecast in %

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
<i>Euribor</i>	85.5	82.3	83.9	87.1	77.4	74.2 (1)
<i>Index</i>	80.6	69.4	82.3	79	75.8 (1)	72.6 (2)

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. Percentage of corrected classification using Ordered Probit (Quadratic hill climbing) as econometric method. In brackets large mistakes.

Table 9. – Prediction of the Repo change using both ECB words and real-time economic variables

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
<i>Constant</i>	0.124 ^{**} (0.063)	0.220 ^{***} (0.083)	0.263 ^{***} (0.078)	0.400 ^{***} (0.086)	0.612 ^{***} (0.105)	0.830 ^{***} (0.123)
<i>Repo_t - INFL_t</i>	-0.072 ^{***} (0.026)	-0.126 ^{***} (0.037)	-0.160 ^{***} (0.035)	-0.225 ^{***} (0.036)	-0.319 ^{***} (0.046)	-0.419 ^{***} (0.057)
<i>gE_t</i>	-0.002 (0.002)	-0.004 (0.003)	0.003 (0.003)	-0.004 (0.004)	-0.009 (0.005)	-0.014 [*] (0.005)
<i>Factor_t</i>	0.017 (0.020)	0.059 [*] (0.028)	0.087 [*] (0.034)	0.126 [*] (0.042)	0.181 ^{**} (0.051)	0.224 ^{**} (0.057)
<i>Index_t</i>	0.081 ^{***} (0.035)	0.099 ^{**} (0.039)	0.144 ^{***} (0.030)	0.167 ^{***} (0.036)	0.142 ^{***} (0.046)	0.134 ^{**} (0.057)
<i>R²</i>	0.437	0.559	0.681	0.705	0.705	0.714
<i>Adj. R²</i>	0.398	0.528	0.658	0.684	0.684	0.694
<i>Observations</i>	62	62	62	62	62	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ^{***}, ^{**}, ^{*} indicate significance at the 99%, 95% and 90% levels.

Table 10. – Prediction of the Repo change using both ECB words and financial market's information set

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
<i>Constant</i>	-0.107 ^{***} (0.022)	-0.133 ^{***} (0.026)	-0.185 ^{***} (0.030)	-0.225 ^{***} (0.040)	-0.262 ^{***} (0.049)	-0.324 ^{***} (0.059)
<i>r_{t,t+m,l} - R_t</i>	0.630 ^{***} (0.145)	0.475 ^{**} (0.190)	0.625 ^{***} (0.120)	0.800 ^{***} (0.127)	0.849 ^{***} (0.144)	0.890 ^{***} (0.172)
<i>Index_t</i>	0.040 ^{**} (0.019)	0.091 ^{**} (0.035)	0.109 ^{***} (0.022)	0.113 ^{***} (0.027)	0.116 ^{***} (0.034)	0.133 ^{***} (0.043)
<i>R²</i>	0.573	0.485	0.688	0.733	0.676	0.635
<i>Adj. R²</i>	0.559	0.467	0.677	0.724	0.664	0.622
<i>Observations</i>	62	62	62	62	62	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ^{***}, ^{**}, ^{*} indicate significance at the 99%, 95% and 90% levels.

Table 11. – Auxiliary regression to measure the expected ECB announcement

<i>Constant</i>	0.040 (0.097)
$r_{t,t+5,1} - r_{t,t,1}$	0.899 ^{***} (0.252)
<i>Index_t</i>	0.690 ^{***} (0.078)
R ²	0.744
Adj. R ²	0.736
Observations	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ^{***}, ^{**}, ^{*} indicate significance at the 99%, 95% and 90% levels.

Table 12. – Explanation of innovation in expectations

	k = 1	k = 2	k = 3	k = 4	k = 5	k = 6
<i>Constant</i>	0.000 (0.003)	0.007 (0.005)	0.010 [*] (0.005)	0.009 [*] (0.005)	0.010 (0.007)	0.011 (0.008)
<i>MPS_t</i>	0.665 ^{***} (0.116)	0.325 (0.260)	0.465 ^{**} (0.187)	0.437 ^{**} (0.165)	0.607 ^{***} (0.176)	0.537 ^{**} (0.226)
<i>NS_t</i>	0.006 [*] (0.003)	0.024 ^{***} (0.008)	0.020 [*] (0.012)	0.026 ^{***} (0.009)	0.033 ^{***} (0.010)	0.030 [*] (0.013)
R ²	0.680	0.291	0.299	0.319	0.350	0.251
Adj. R ²	0.669	0.267	0.275	0.296	0.328	0.226
Observations	62	62	62	62	62	62

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004. The econometric method is Ordinary Least Squares. Heteroskedasticity - Consistent standard errors in brackets. ^{***}, ^{**}, ^{*} indicate significance at the 99%, 95% and 90% levels.

Table 13. – Order of magnitude of news shock and monetary policy shock

	k = 1	k = 2	k = 3	k = 4	k = 5	k = 6
$\beta_1 \cdot \sigma_{MPS}$	4.1	2	2.9	2.7	3.8	3.3
$\beta_2 \cdot \sigma_{NS}$	0.4	1.5	1.3	1.6	2.1	1.9

NOTE: Monthly observations on days of ECB Governing Council meetings, January 1999 – December 2004.

Appendix A – Data

For details on Euribor, see http://www.euribor.org/html/content/euribor_tech.html. Daily data on Euribor interest rates ($r_{t,k,n}$ for $k = 1, \dots, 6$) are downloadable from the www.euribor.org/html/content/euribor_data.html.

Data on $REPO_t$, $INFL_t$, gE_t , $Unemployment_t$, GDP_t , $Industrial Production_t$ can be found in the “Euro area statistics” section of the Monthly Bulletin available at <http://www.ecb.int/pub/mb/html/index.en.html>

gE_t can be downloaded from the ECB website <http://www.ecb.int/stats/exchange/eurofxref/html/index.en.html>

$SENT_t$ and its associated $gSENT_t$ can be downloaded at http://europa.eu.int/comm/economy_finance/indicators/business_consumer_surveys/bcsseries_en.htm. The economic sentiment indicator is composed of the industrial, services, consumer, construction and retail trade confidence indicators; the industrial confidence indicator has a weight of 40%, the services confidence indicator a weight of 30%, the consumer confidence indicator a weight of 20% and the two other indicators a weight of 5% each. For more information about this index, see http://europa.eu.int/comm/economy_finance/indicators/business_consumer_surveys/userguide_en.pdf.

The *Eurogrowth* time series can be downloaded at <http://www.euroframe.org/index.php?id=9/index.php>.

EuroCOIN data are available at <http://www.cepr.org/data/EuroCOIN>.

MSCI Index – Euro Credit Corporate Spread is our proxy for the corporate bond spread used in section 7.

All websites were last accessed on January 31st 2006.

The data set is available from the authors upon request.

Table A1. – ECB President announcements about future monetary policy moves

Date	Index	CR	GV
07/01/1999	-1	-1	0
04/02/1999	-2	-2	-2
04/03/1999	-2	-2	-2
08/04/1999			
06/05/1999	0	0	0
02/06/1999	0	0	0
01/07/1999	1	1	1
NA			
09/09/1999	1	1	1
07/10/1999	2	2	2
04/11/1999	2	2	2
02/12/1999			
05/01/2000	2	1	2
03/02/2000	2	1	2
02/03/2000	2	2	2
13/04/2000	2	2	2
11/05/2000	2	2	2
08/06/2000			
06/07/2000	2	2	2
NA			
14/09/2000	2	2	2
05/10/2000	2	2	2
02/11/2000	2	2	2
14/12/2000	2	2	2
04/01/2001			
01/02/2001	1	1	1
01/03/2001	1	1	1
11/04/2001	1	1	0
10/05/2001	0	0	0
07/06/2001	0	0	0
05/07/2001	0	0	0
NA			
30/08/2001	-1	-1	-1
11/10/2001	-2	-2	-2
08/11/2001	0	0	-1
06/12/2001	0	0	0

Date	Index	CR	GV
03/01/2002	0	0	0
07/02/2002	0	0	0
07/03/2002	0	0	0
04/04/2002	0	0	0
02/05/2002	0	0	0
06/06/2002	1	1	1
04/07/2002	0	0	0
NA			
12/09/2002	-2	-2	-2
10/10/2002	-1	-1	-1
07/11/2002	-2	-2	-2
05/12/2002	-2	-2	-2
09/01/2003	-1	-1	-2
06/02/2003	-2	-2	-2
06/03/2003	-1	-1	-1
03/04/2003	0	0	0
08/05/2003	-1	-2	-1
05/06/2003	-1	-1	-1
10/07/2003	-1	-1	-1
NA			
04/09/2003	0	0	-1
02/10/2003	0	0	0
06/11/2003	0	0	0
04/12/2003	0	0	0
08/01/2004	0	0	0
05/02/2004	0	0	0
04/03/2004	0	0	0
01/04/2004	0	0	0
06/05/2004	0	0	0
03/06/2004	1	1	0
01/07/2004	1	1	0
NA			
02/09/2004	1	1	0
07/10/2004	1	1	0
04/11/2004	1	1	0
02/12/2004	1	1	0

NOTE: January 1999 - December 2004. We report the degree of risk to price stability (Index, CR and GV) of each ECB President press conference: its construction is based on Table 1. CR and GV stand respectively for Carlo Rosa and Giovanni Verga's coding. Note that we have considered only the first press conference of each month.

We have highlighted in grey all the observations we have not used in the forecasting regressions. In particular:

- we were not able to codify the press conference of 08/04/1999, 08/06/2000 and 04/01/2001 because the wording of the ECB President referred to the past and thus was not forward-looking.
- NA when the press conference did not take place.
- the Millenium effect 02/12/1999 (cf. Figure 1). In order to have the same sample size when using different set of explanatory variables, we decided not to use this observation (since it represents an outlier when Euribor rates are used).

In order to estimate equation (11) we have also codified the press conference on December 22nd 1998 with a value of Index of 0.

Examples of Introductory statements and their coding

Date: 7 June 2001

“The Governing Council conducted its regular examination of monetary and economic developments and analysed their implications for the maintenance of price stability in the euro area. On the basis of the information available at today's meeting, the Governing Council concluded that the current level of interest rates remains **appropriate** to ensure that the euro area economy will be able to maintain price stability in the medium term, and thus decided to keep the key ECB interest rates unchanged.”

CR coding: 0

GV coding: 0

Date: 7 February 2002

“Let me now turn to our regular examination of recent monetary, financial and economic developments. The Governing Council concluded today that there was no reason to change its previous assessment. Accordingly, the key ECB interest rates were kept unchanged at a level which remains **appropriate** for the maintenance of price stability over the medium term.”

CR coding: 0

GV coding: 0

Date: 7 November 2002

“In view of the high uncertainty on future growth, and its implication for medium-term inflationary developments, the Governing Council has discussed extensively the arguments for and against a cut in the key ECB interest rates. The view has prevailed to keep interest rates unchanged. However, the Governing Council **will monitor closely the downside risks to economic growth** in the euro area.”

CR coding: -2

GV coding: -2

Date: 3 June 2004

“In summary, we noted that **the economic recovery has strengthened** over recent months. At the same time, we have also witnessed **stronger inflationary** pressures over the short term. **Nevertheless, we are**

still of the view that the medium-term outlook remains in line with price stability. Accordingly, we left the key ECB interest rates unchanged. The low level of interest rates continues to support the economic recovery. **We will remain vigilant with regard to all developments** which could affect the risks to price stability over the medium term.

...

To sum up, the economic analysis indicates that the main scenario for the outlook for price developments over the medium term remains **in line** with price stability. However, short-term pressures on inflation have increased recently and some upside risks need to be taken into account. Cross-checking with the monetary analysis also supports the **case for vigilance with regard to the materialisation of risks to price stability.**”

CR coding: 1

GV coding: 0

Date: 2 September 2004 (quite ambiguous)

“We noted that the information which has become available in recent months indicates that the economic recovery in the euro area has maintained its momentum and should remain firm in the coming quarters. We have also witnessed **somewhat higher inflation rates**, mainly due to developments in oil prices. At present, our judgement is that **although some upside risks to price stability exist, the overall prospects remain in line** with price stability over the medium term. Accordingly, we have retained our monetary policy stance and left the key ECB interest rates unchanged. The level of interest rates is very low by historical standards, both in nominal and in real terms, lending support to economic activity. **We will remain vigilant with regard to all developments which could imply risks to price stability over the medium term.**

...

To sum up, while the economic analysis indicates that prospects are **consistent** with price stability being maintained over the medium term, **a number of upside risks need to be carefully monitored.** Cross-checking with the monetary analysis also supports the case for **strong vigilance with regard to the materialisation of risks to price stability.**”

CR coding: 1

GV coding: 0

Appendix B – Fuzzy regression

In this Appendix we use non-linear fuzzy logic (Zadeh, 1965) to empirically investigate the relationship between the independent variable *Index* introduced in section 3 and the future changes of the Repo rate.

Fuzzy logic is a generalization of conventional (Boolean) logic: it allows the elements of a fuzzy set to have different grades of membership in $[0,1]$, rather than in $\{0,1\}$.

Given the approximate (fuzzy) mode of reasoning, the theory of fuzzy logic is well suited to model human decision-making, and in particular lexical uncertainty (i.e., linguistic imprecision).

On the one hand, the ranking of Table 2 is strongly affected by Rosa and Verga's personal judgment. For example, another researcher could have interpreted the string "upward pressure remain contained" as +2 or 0 and not necessarily as +1. On the other, its scale is ordinal: the only meaningful information conveyed by it consists of the relative order among different words, and not by their distance.

Given the nature of the problem, does the fuzzy regression procedure improve the model's fit with respect to OLS estimations? Moreover, could we get some additional information about the underlying relationship between *Index* and future Repo changes?

Before answering these questions, we briefly review the fuzzy estimation technique.

First, we generate the membership values u_{it} for each $Index_t$ with respect to cluster i by using the Fuzzy C-Means (FCM) Clustering algorithm (cf. Giles et al., 2000, page 8 and 9)¹⁸. In particular, in our case, since the sample size is small, we imposed three partitions: downward risk (D), no risk (N) and upward risk (U) to price stability, initially centred at -1, 0, and +1 respectively. Then we apply the FCM algorithm¹⁹:

- a) We generated a new partition of the data by assigning each observation to its closest cluster centre.
- b) We calculate new cluster centres as the centroids of the clusters.
- c) We iterated a) and b) until the cluster partitions get stable.

Our resulting u_{it} have been reported in Table B1. Of course, when $Index_t$ is equal to $Index_{t+s}$, then $u_{it} = u_{it+s}$. Moreover, by construction, when *Index* is equal to -1, 0, +1, then the corresponding u_{it} is equal to the canonical basis of \mathfrak{R}^3 (respectively given by (1,0,0), (0,1,0) or (0,0,1)). The FCM algorithm requires a large support, but $Index_t$ does not vary much. For this reason we have restricted its boundary values to belong only to the extreme partitions.

Second, we constructed three different sets by looking at the highest membership degree of each $Index_t$. Then, we estimated by OLS the following equation:

$$R_{t+m} - R_t = \alpha_i + \beta_i Index_{it} + \varepsilon_{it} \quad \text{for } i \in \{U, N, D\} \text{ and } m = 1, \dots, 6 \quad (\text{B1})$$

¹⁸ Alternatively, the membership values can be generated by linear interpolation (Lindstrom, 1998).

¹⁹ The program written by the authors is available upon request.

Finally, by combining the first two steps, we have:

$$E_t[R_{t+m}] - R_t = \sum_{i \in \{U, N, D\}} u_{it} (\alpha_i + \beta_i \text{Index}_{it}) \quad \text{for } m = 1, \dots, 6 \quad (\text{B2})$$

Table B2 reports the fuzzy estimation coefficients. Since by construction the shape of the relationship is allowed to change from set to set, overall the estimation becomes non-linear.

Figure B1 plots the expected future Repo changes implied by (either unconstrained or constrained) OLS and fuzzy regression.

Except for $m = 1$, the shape of the fuzzy relationship between Index and expected Repo changes is quite similar and almost linear. Nevertheless, note that the magnitude of the expected reaction of future Repos to a given ECB word is increasing in m , especially when the absolute value of *Index* is large. Thus, it seems that the ECB follows the Brainard's (1967) principle: because of uncertainty, it prefers to make small and gradual policy changes rather than a single large one.

When the absolute value of *Index* is small, the fuzzy estimation results are more ambiguous to interpret than the corresponding OLS estimates. Perhaps, the fuzzy regression results want to capture that when the value of *Index* is near zero, the expected future ECB policy moves are flat, but with a lot of variance.

Overall, fuzzy regressions do not perform substantially better than standard OLS. In fact, the R^2 reported in Table B2 is quite close to the corresponding R^2 computed by using standard OLS estimation (cf. Table 3).

Table B1. – Degree of membership u_{it}

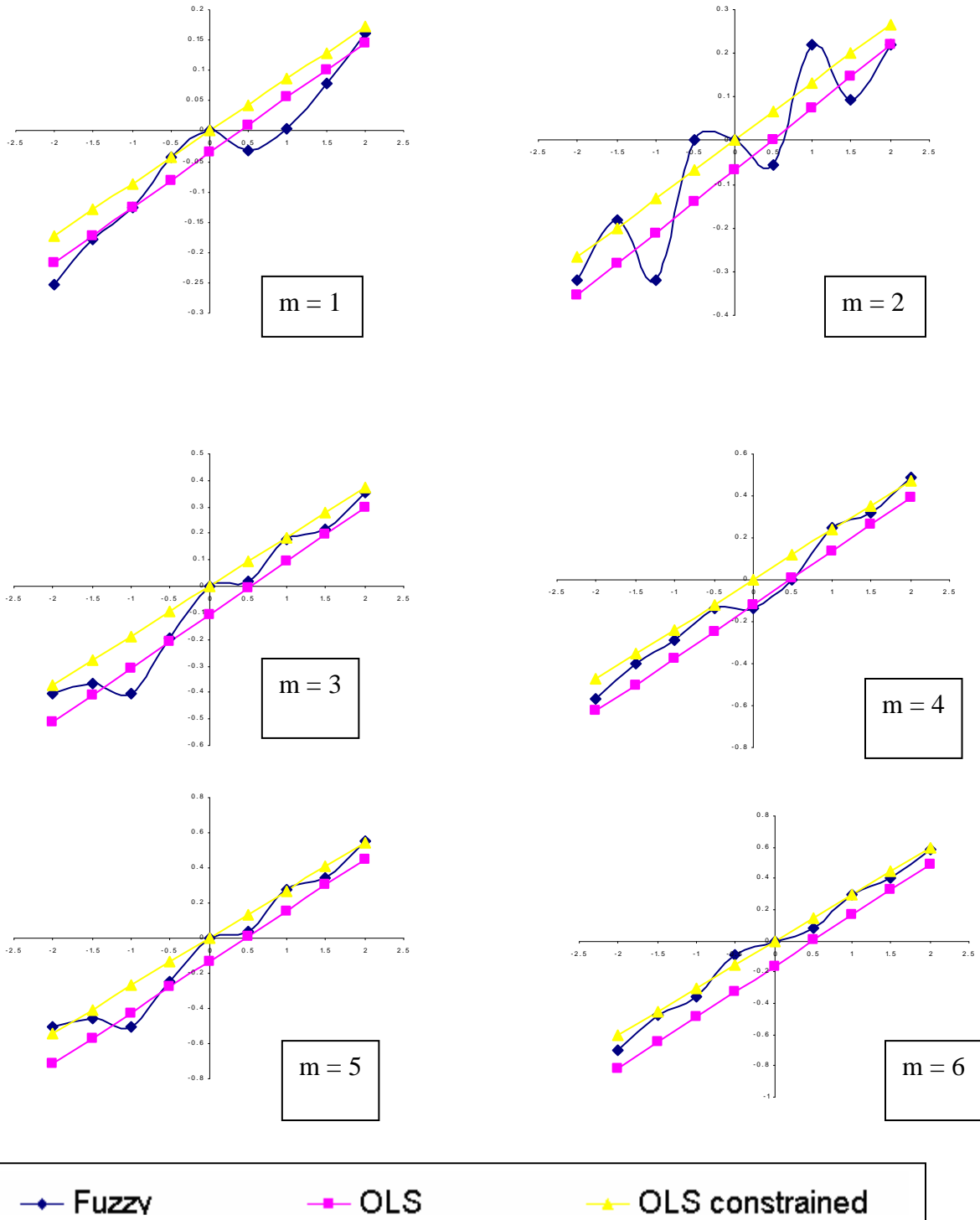
	Downward	No Risk	Upward
2	0	0	1
1.5	0.035	0.097	0.869
1	0	0	1
0.5	0.053	0.474	0.474
0	0	1	0
-0.5	0.474	0.474	0.053
-1	1	0	0
-1.5	0.869	0.097	0.035
-2	1	0	0

Table B2. – Fuzzy estimation using ECB words

	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
α_D	-	-0.320***	-0.407***	-	-0.508***	-
	-	0.076	0.064	-	0.073	-
β_D	0.126***	-	-	0.284***	-	0.352***
	0.038	-	-	0.034	-	0.033
α_N	-	-	-	-0.138**	-	-
	-	-	-	0.064	-	-
β_N	-	- 0.602***	-	-	-	-
	-	0.137	-	-	-	-
α_U	-0.151**	0.221***	-	-	-	-
	0.073	0.062	-	-	-	-
β_U	0.156***	-	0.178***	0.245***	0.277***	0.295***
	0.057	-	0.043	0.053	0.067	0.086
Fuzzy OLS R ²	0.419	0.457	0.519	0.532	0.429	0.377
Observations	62	62	62	62	62	62

NOTE: January 1999 – December 2004, monthly observations. – stands for a regression coefficient constrained to be zero, since in the unconstrained estimation turned out to be not statistically significant at least at the 5% level. The estimator is OLS. The independent variable is $(CR+GV) / 2$ reported in Table A1. Heteroskedasticity - Consistent standard errors in brackets. ***, **, * indicate significance at the 99%, 95% and 90% levels.

Figure B1. – Estimation of expected future Repo changes using Index
(Fuzzy Vs OLS)



NOTE: The sample is January 1999 - December 2004, monthly data. The lines represent expected future Repo changes, $E_t[R_{t+m}] - R_t$, using Index as independent variable.