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Monetary policy communication under inflation targeting: Do words speak louder than actions?[1]

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Abstract

This paper assesses the effectiveness of monetary policy communication of the Central Bank of Turkey (CBT) by quantifying the information content of the policy statements released right after the monthly Monetary Policy Committee meetings. First, we quantify the signal regarding the next interest rate decision and ask whether CBT's words match its deeds, i.e., whether communication improves predictability using the Autoregressive Conditional Hazard model. Our findings suggest that the role of statements in predicting the next policy move have strengthened following the adoption of full-fledged inflation targeting (IT) regime. Second, we identify the surprise component of policy communication directly from market commentaries and assess its impact on the term structure of interest rates. We find that the response of the yield curve to policy statements have become highly significant for the unanticipated changes in the monetary policy communication and the relative importance of communication in driving market yields has increased through time.

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1. Introduction

Since the early 1990s, the conduct of monetary policy has shifted from secrecy towards more transparency. The main reason behind this global trend was the increasing understanding that transparency can improve the effectiveness of policy (see Woodford, 2003). This approach has highlighted the role of communication in monetary policy. Accordingly, the academic literature explored this topic extensively over the last fifteen years (see e.g. Blinder *et al*., 2008, Ehrmann and Fratzcher, 2007a-d, Reeves and Sawicki, 2007, Rozkurt *et al*., 2007, Fatum and Scholnick, 2008, Beine *et al*., 2009, Chulia *et al*., 2010, Sturm and de Haan, 2011, among others).

Central banks often use short-term interest rates as their main operational instrument. However, short-term rates hardly matter for the broader objectives of the central banks such as future inflation or prospective economic activity, as private consumption and investment decisions are mainly driven by longer term interest rates. Communication emerges as a natural bridge in this respect, which enables central banks to steer private sector expectations about their future actions and affect the longer end of the yield curve.

Monetary policy communication typically takes two main forms. The first one is communication through official documents such as inflation reports and policy announcements that accompany interest rate decisions. The second form of communication involves speeches, presentations or interviews by the policymakers during the inter-meeting period. In this paper, we focus on central bank communication through policy statements accompanying the interest rate decisions.

Two types of information are released in a policy statement. The first piece of information is the interest rate decision itself. In a seminal paper on this topic, Kuttner (2001) highlighted that following the interest rate announcements, market participants only respond to the unanticipated component of the interest rate decision. The second piece of information released with announcements, which is the main scope of this paper, is the forward looking message—the communication component. There have been numerous studies focusing on the monetary policy communication and its impact on financial markets. Just like the decision itself, policy communication should have an impact on financial markets only if it has some surprise content. Yet, the literature has not always been very careful in underlining the unanticipated component of policy communication due to the challenging nature of this task. The earlier studies that investigated the effects of policy statements attempted to use the information content of policy statements directly to assess the impact of communication on financial markets. However, these papers did not propose a systematic identification procedure to measure the surprise in policy communication, and thus, they were mostly silent on the methodology on the signal extraction process. For example, although Guthrie and Wright (2000) investigate the impact of communication surprises on financial indicators, the authors do not explain in detail how they actually compute the surprises. Kohn and Sack (2004) get around the difficulties of quantifying communication by focusing on the impact of policy statements on the volatility of financial assets, implicitly assuming that at least some part of the policy statement carries an unanticipated component to affect financial markets.

In order to measure the surprise content of the communication, more recent studies *estimate* the unanticipated component of communication using econometric techniques (see e.g. Gurkaynak *et al.*, 2005, Andersson *et al*., 2006, Rosa and Verga, 2007, Rosa and Verga, 2008, Rosa, 2011). Nevertheless, these techniques assume a particular law of motion for the formation of expectations and they provide an *indirect* measure of policy surprises.

One possible explanation for the scarcity of papers that study the impact of the unanticipated component of policy statements is the inherent challenge in measuring the surprise due to lack of expectations surveys on the "wording" of the statements. Indeed, Ehrmann and Fratzscher (2007) state that "*Ideally one would want to study the response of financial markets to the surprise component contained in a given communication. However construction of a proxy of market expectations is not straightforward, for instance no survey data like in the case of macroeconomic announcements or monetary policy decisions are available.*"

There are no surveys but there are market commentaries. This paper contributes to the ever growing literature on central bank communication by using a novel and simple methodology to measure the unanticipated component of policy statements: we identify the statement surprises directly from market commentaries published before and after the release of monthly Monetary Policy Committee (MPC) statements of the Central Bank of Turkey (CBT).[3] In most cases market players not only explicitly mention whether the

[3] Clearly, monthly statements are not the only communication tools. There are other forms of communication tools available such as speeches/interviews by the governor or the members of the monetary policy committee. However, in the case of CBT, inflation reports and monthly policy statements are by far the most actively used communication tools of monetary policy (see the CBT's main policy

statement was expected but also implicitly indicate in which direction they were surprised. Therefore, comparing the comments written by central bank watchers before and after the meeting allows us to pin down the surprise component of the communication.

Using the surprise components derived from market commentaries, we measure the impact of central bank communication over the yield curve. We assess whether monetary policy communication affects expectations of future interest rates in the desired direction via its reflections on the yield curve. We find that policy statements play a significant role in affecting the yield curve, independent of the current interest rate decision. In particular, the yield curve on average shifts by an additional 20 basis points over the medium term following a surprise change in the policy stance.

The second contribution of the paper is an evaluation of the potential effectiveness of the systematic component of monetary policy communication in Turkey. We quantify the CBT's implied signal regarding the next interest rate decision and assess whether central bank communication has actually improved the predictability of the interest rate decisions after the adoption of a more clear and transparent policy framework with the inflation targeting regime. For each document, we track the changes

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strategy document at http://www.tcmb.gov.tr/yeni/announce/2010/Mon_Exc_Pol_2011.php). In this paper, we restrict our attention only to the monthly policy statements rather than the Inflation Report because of the lack of sufficient data for market commentaries regarding the inflation report. In the early years of the inflation targeting period, market participants hardly commented on the inflation reports before and after the release. Because our identification of communication surprises depends on these commentaries, we excluded inflation reports from our analysis, even though these reports are one of the main communication tools of CBT together with monthly monetary policy committee statements.

in the wording on future policy rate so as to capture the signal regarding the next interest rate decision. Utilizing these signals via a forecasting model developed for irregularly spaced events, we estimate whether the CBT's words match its deeds. The results suggest that central bank communication provided very accurate signals regarding the next interest rate decision in Turkey. Especially after the implementation of the inflation-targeting regime, the information content of policy statements improved the predictability of the CBT substantially, suggesting that the systematic component of central bank communication has also become potentially more effective.

The remainder of this paper is organized as follows: The next section provides a brief evaluation of the history of central bank communication in Turkey. Section three discusses our identification strategy while section four presents our empirical results. The fifth section concludes.

2. A Brief History of Monetary Policy Communication in Turkey

Monetary policy of the Central Bank of Turkey became increasingly more transparent since 2001 with many important structural changes transforming the policy-making environment. In this section, we provide a brief history of the key developments affecting the policy-making process of the CBT and the relevant communication strategy during this period.[4]

[4] We restrict our attention to the period 2002-2010, when the CBT had a single objective of price stability and used short term interest rate as the unique policy instrument. Therefore, we exclude the recent period (starting with the last quarter of 2010) when the CBT adopted financial stability as a supplementary objective and began to utilize additional policy instruments such as reserve requirement ratios. Assessing the communication issues related to this episode is beyond the scope of this paper.

In order to highlight the milestones affecting the communication strategy of monetary policy, we divide our sample into three parts: (i) 2001-2004: implicit inflation targeting with unknown decision dates, (ii) 2005: implicit inflation targeting with fixed decision dates but no explicit signal regarding future policy path, (iii) 2006-to-date: full-fledged inflation targeting: explicit information regarding future policy path through policy announcements and inflation reports.

2.1. 2001-2004: Implicit Inflation Targeting with Unknown Decision Dates[5]

Turkey adopted inflation targeting and free float exchange rate regime in February 2001. The new Central Bank Law was enacted in May 2001, which defined the main goal of the CBT as "achieving price stability". Along with the legislation of the new law, CBT was granted with instrument independence and the short term interest rates became the main operational instrument of monetary policy. The Law also defined a new decision making body—the Monetary Policy Committee (MPC). The main task of the MPC is to formulate the monetary policy strategy, which includes setting the policy rates and communicating future monetary policy.

At the initial stages of the new regime, monetary policy lacked control over the longer end of the yield curve, because under high public debt and short maturities, the volatile risk premium manifested itself as excess variability in the exchange rates.

[5] Implicit inflation targeting can be defined as a period under which inflation targets are announced to the public, but not the regime and its details as such. It involves the country acting as if inflation targeting were in place without a formal adoption of the regime. Typically, the central bank would also have other intermediate targets, as Turkey did between 2002-2005 in the form of monetary targets.

Increased volatility in exchange rates coupled with fast and high exchange rate pass-through—inherited from the exchange rate targeting regimes—made forecasting inflation even more difficult, limiting the forecast horizon to a mere couple of months. Therefore, CBT was not able to provide a medium term perspective regarding future inflation or monetary policy. Under these circumstances, statements following the interest rate decisions were mainly focused on justifying the actions rather than providing explicit information regarding the future course of policy rates.[6] In other words, the forward-looking component of the communication, which is the main interest of this study, was limited.

Following the examples of the major central banks across the world, CBT started announcing interest rate decisions with an accompanying statement, although these statements at the beginning did not involve information regarding the future course of policy rates. Monetary policy statements during 2002-2004 mainly focused on the implementation of the structural reforms—especially regarding fiscal policy, which would support the decline in risk premiums. The main driver of inflation expectations during this period was fiscal policy (see Celasun *et al.* 2004). Therefore, the strategy of the CBT during this period was to "reward" the government with policy rate cuts, should the structural reform and fiscal consolidation make progress. Since sovereign risk premium largely reflected the market's perceptions of the fiscal stance, the CBT closely monitored the risk premiums in setting the policy rates.

[6] See Kara (2008) for an account of the CBT's communication and decision-making process during implementation of the implicit inflation targeting regime.

Overall, in the aftermath of the 2001 crisis, monetary policy in the first three years of implicit inflation targeting (the period between 2002 and 2004) can be characterized as a highly discretionary and rather opaque decision-making process: Since the economy was under a stabilization program with many structural changes, the statements mainly concentrated on structural reforms, fiscal policy, and hence the risk premiums, rather than broad economic analysis regarding the business cycle. Timing of the policy decisions was not predictable, and the statements focused on justifying the decision itself, without providing systematic information on the future course of monetary policy. The basic information provided in these statements was that the continuation of the interest rate cuts would depend on the implementation of structural reforms. While the meeting calendar was not known in advance, policy decisions were announced with an accompanying statement at 10:00 AM in the morning.

2.2. 2005: Adopting Fixed Decision Dates

The CBT envisioned implicit inflation targeting as a transition period for full-fledged inflation targeting, during which the communication, transparency, and the institutional setup would be enhanced gradually. The decision-making process shifted to a more predictable and systematic setup in 2005 with the adoption of pre-announced fixed decision dates. The MPC meetings, which were held on the 8th of each month, were followed by a prompt release of a policy statement outlining the rationale behind the decisions, as well as providing the (consensus) opinion of the MPC. The statement underlying the decisions was made public at 9:00 AM on the day after the meeting. These statements not only justified the immediate decisions but also provided signals

regarding the future course of interest rates. Although the signal content of the statements was weak at the beginning, it gained strength through time. As time went by, more and more information was shared with the public, and the ability of CBT to act as an "expectations manager" improved considerably.

2.3. 2006-to-date: Monetary Policy Communication under Inflation Targeting

The Central Bank of Turkey adopted full-fledged inflation targeting at the beginning of 2006. The regime brought many innovations in terms of decision-making process and the role of communication. In terms of communication aspects, there were two main innovations: First, the CBT started to publish the medium term inflation forecasts along with some qualitative information regarding the future policy path. Second, the CBT enhanced the forward looking information content of the policy statements, providing more specific guidance regarding the revisions in the policy stance. In sum, the implementation of full-fledged inflation targeting, coupled with the new strategy adopted by the MPC, has increased the forward looking component of the monetary policy.

With the adoption of full-fledged inflation targeting, monthly MPC statements became one of the main tools of monetary policy communication.[7] The MPC statement,

[7] In addition to policy statements, there are other communication tools to inform the public. Examples of such tools are the biannual testimony of the Governor before the Council of Ministers and the Planning and Budget Commission of the Grand National Assembly of Turkey; monthly "Price Developments" reports issued on the following working day of the release of inflation figures; biannual "Financial Stability Report"; press releases, presentations and speeches made by the Central Bank authorities in Turkey and abroad. In addition, working papers, booklets, technical notes, conferences and workshops arranged by the

published immediately after the decision, typically consists of two main paragraphs. The first paragraph provides MPC's assessment of economic conditions relevant for inflation outlook. The second paragraph is the "policy paragraph", which directly elaborates on the MPC's view of the likely course of future interest rates. We utilize the information content of both paragraphs while quantifying the monetary policy communication.

Timing of the MPC Statements

Since 2005, meetings are based on a pre-announced schedule with an annual timetable. In 2005, the meetings were held on the 8th of each month or the closest business day if the 8th corresponded to a weekend. The policy statements were published the next morning at 9:00 AM. In 2006, MPC meetings were held at dates close to the end of month, whereas from 2007 to present the meetings are scheduled around mid-month.[8] Since 2006, the interest rate decision and the related MPC statement is announced by the Central Bank in a press release at 7:00 PM on the same day and posted on the website of the Bank.

3. Measuring Communication

Central bank communication is a broad concept. Although there are many different reasons why central banks communicate with the public, central bank

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Bank also work as different means of the communication policy. However, these communication tools generally do not reveal extra information other than those disseminated through inflation reports and monthly policy statements.

[8] There were two inter-meetings of the MPC that took place in June 2006, following the financial turmoil triggered by a sell-off in emerging markets.

communication efforts in general concentrate on two interrelated issues: (i) anchoring long term inflation expectations, (ii) increasing the effectiveness of the monetary policy. In this paper, we focus on the latter. Effectiveness of the monetary policy depends on the control over the yield curve. This basically boils down to communicating the future path of the policy rates, aiming to shape up the term structure of market interest rates in the desired direction. In this context, this paper has two goals: First, we assess whether central bank communication affects the predictability of future policy rate decisions. Second, we investigate whether the communication has an impact on the yield curve, after controlling for the surprise component of the rate decision. To tackle these ambitious tasks, we construct a database by quantifying both the information regarding the policy decisions implied in the CBT's main published documents and the surprises in policy statements as perceived by the market participants. We set up two different types of communication variables aiming to capture (i) the direction of the next interest rate decision, and (ii) surprise in communication.

The documents we use to extract the forward looking signals regarding future monetary policy are the monthly statements accompanying interest rate decisions. Clearly, there are other forms of verbal or written communication tools available such as speeches/interviews by the governor or other members of the MPC. Nevertheless, during the inflation targeting period, intermeeting speeches or interviews were not commonly used as active tools to manage the market's expectations of future policy. The monetary policy strategy of the Central Bank of Turkey was mainly communicated via monthly MPC statements and inflation reports. This behavioral pattern mainly stems from MPC's "collegial" structure: MPC members speak in harmony regarding monetary policy, and

opposing views (if any) among the members are not disclosed. When decisions are communicated as a consensus view, it is natural to disseminate the key messages regarding future interest rates through the main institutional documents such as inflation reports and monthly policy statements. Therefore, the speeches and interviews by the MPC members (including the governor) during the intermeeting period do not typically reveal additional information other than those indicated in the official documents.[9] Accordingly, we restrict our attention to the monthly MPC statements, which are the most tractable sources for quantifying the signal regarding the next interest rate decision along with the inflation reports. We leave the task of measuring the communication impact of inflation reports for future studies.

3.1. Quantifying the Signal Regarding the Next Policy Decision

One of the goals of this paper is to assess whether the CBT's words match its deeds. In order to answer this question, we need to quantify the signal embedded in the policy statement regarding the next interest rate decision. In this section, we describe the way we construct the variable indicating the bias regarding the next interest rate decision, namely, communication variable, D_t^{COM}. To this end, we classify all monthly MPC statements according to their implications for the likely path of interest rates over the near term. We classify statements into those that indicate an inclination towards raising policy rates for the next meeting, those that suggest a rate cut and those that are neutral. We also quantify the strength of the signal given by the MPC. Therefore, the tightening and

[9] There are some exceptional occasions when the Governor or the MPC members attempted to change the misunderstandings regarding the policy statements; however such cases are rare.

the easing bias are further classified into two sub-categories as "weak" and "strong". Next, all the classifications are coded on a numerical scale**.**

We rely on the following principles in generating indicator variables for each statement:

(i) If a need for increasing (decreasing) the overnight inter-bank borrowing rate is expressed *explicitly* in the statement or if there are judgments about economic analysis end/or inflation prospects that *clearly* imply the need of a rate hike (cut) in the short term, then the variable is assigned the value 2 (-2),

(ii) If a need for increasing (decreasing) the overnight inter-bank borrowing rate is expressed vaguely in the statement or if there are judgments about the economic analysis and/or inflation that weakly imply the need of a rate hike (cut) in the short term, then the variable is assigned the value 1 (-1),

(iii) If the evaluations in the statement do not imply the need of a change in the policy rate over the near future, the variable is assigned the value zero.

Accordingly, one of the five potential values is assigned for each written statement as follows:

$$D_t^{COM} = \begin{cases} +2 & \text{strong tightening inclination} \\ +1 & \text{weak tightening inclination} \\ 0 & \text{signaling no change} \\ -1 & \text{weak easing inclination} \\ -2 & \text{strong easing inclination} \end{cases}$$

The communication variable, D_t^{COM} , constructed in the above manner tracks changes in the statements regarding the future course of monetary policy. Indeed, even small wording changes in the statement may suggest a change in the strength of the signal

regarding the next policy decision. To illustrate this case, consider the following examples.

Example 1: On its February 2008 meeting, CBT cut interest rates by 25 basis points. The following paragraph shows the relevant section of the accompanying policy statement regarding the next interest rate decision:

"… The *timing of further easing will depend* on developments regarding global market conditions, external demand, fiscal policy implementation, and other factors affecting the medium term inflation outlook. (emphasis added)"

The statement explicitly mentions a rate cut but emphasizes that the timing will depend on developments. Therefore, we interpret this as a relatively weak signal of a further rate cut and set D_t^{COM} =-1.[10]

Example 2: In the March 2009 meeting, the CBT cut the interest rates by 100 basis points. The following information was released with the policy statement:

"…The Central Bank will continue to take the necessary measures to contain the adverse effects of the global financial turmoil on the domestic economy, provided that they do not conflict with the price stability objective. Looking forward, the Committee envisages that *the next rate cut may be measured, and that it may be necessary for the monetary policy to maintain an easing bias for a considerable period*. (emphasis added)"

[10] A natural question one might ask at this point is how confident we are regarding the interpretation of these nuances in the policy statements. We believe that our interpretation is very close to the true intentions of the policy makers because we discussed and checked the validity of our interpretation with the officials at the CBT.

Here the MPC makes it clear that another rate cut is highly likely. In this case, we set D_t^{COM} =-2 to account for the stronger signal released by the CBT. Table A1 in the appendix provides further examples from the policy statements regarding the preparation of D_t^{COM} while the third column in Table 1 shows the values attained by the D_t^{COM} variable for the full sample.

3. 3. Surprise in Communication

One of the main goals of this paper is to assess whether central bank communication has an impact on the term structure of interest rates. The indicator variable constructed in the previous section does not help to answer this question, as we need to pin down the *surprises* in policy statements in order to identify the impact of the communication on asset prices. Therefore, in this section, we construct a separate indicator variable to detect unanticipated changes in the policy statements by directly going through market commentaries associated with each policy statement.

Revisions in the wording of policy statements are closely watched by market participants to extract the forward looking information regarding the policy path. Market participants form their expectations about the content of these statements and adjust their positions accordingly. As a result, if we want to measure the impact of policy statements on asset markets, we need to identify those cases where the changes in the policy statement were not anticipated by market participants.

In order to identify whether the statement involves any surprise, we use the market commentaries that are regularly published before and after the statement/report is released. To this end, we use the database of Reuters News, a newswire service that is

frequently used by financial market participants. We search this database for the market participants' commentaries both before and after the policy decision. Prior to the meeting, the market participants not only report their expectations on policy decisions but occasionally mention the messages they expect the CBT to deliver with respect to the future course of interest rates. We check all market commentaries reported before the meeting to understand the expectations with respect to the statement. Then, we compare these expectations with market commentaries reported after the policy decision. We seek to detect surprises in communication perceived by the market participants, such as an unexpected change in the MPC's assessment of the economic conditions or the monetary policy outlook.

In general, market commentaries do not elaborate much on the expected policy statement before the meeting. However, if the statement delivers an unexpected message, it is mentioned in the commentaries following the meeting. It is also possible to identify the direction of the surprise (whether the statement was more "hawkish" or "dovish" than expected) directly from the market commentaries. Although we are not able to measure the size of the market surprise, we nevertheless believe that this methodology of identifying the surprises is still innovative and useful.

Accordingly, we rely on the following principles in generating the indicator variable to capture the surprise change in the policy statement ($Surp\Delta ST_t$):

(i) If comparison of the market reports/commentaries before and after the MPC meetings reveals that the statement was more hawkish (dovish) than market expectations, then the variable is assigned the value 1 (-1).

(ii) If the market reports/commentaries do not indicate a surprise in communication, then the variable is assigned the value 0.[11]

$$Surp\Delta ST_t = \begin{cases} 1 & \text{The statement was more hawkish than expected} \\ 0 & \text{No Surprise} \\ -1 & \text{The statement was more dovish than expected} \end{cases}$$

In order to illustrate our methodology, look at the market commentary following the policy statement in July 2007:

> "MPC's action as to leave the interest rates unchanged as expected *but the surprise announcement that gradual easing may start in the last quarter* is expected to pull the market interest rates and the exchange rates down (emphasis added)"

In our analysis, we interpret that the policy statement in July 2007 were perceived as more dovish than expected for market participants, and thus we set the surprise variable $Surp\Delta ST_t$ = -1, although the policy decision itself (leaving rates constant) was completely expected.

[11] According to our methodology, if the market commentaries do not indicate any unanticipated policy move, we interpret this as "no surprise". This may be due to two reasons: (i) market participants correctly anticipated the changes in the wording of the statement (ii) market participants did not notice the implications of the changes in the wording of the statement. Unfortunately, our methodology cannot differentiate between these cases. On the other hand, market response would be identical in both scenarios on the day of the announcement because in both cases, market participants would not respond to the information released in the statements. Therefore, even though our methodology is subject to limitations, these problems do not lead to any econometric problems.

Surprises in the statements may arise due to various reasons such as disagreement between the CBT and the market's views on the inflation outlook, unexpected changes in the CBT's objectives, market's misinterpretation of CBT's signals and so on. In this paper we do not distinguish between these cases. We rather take an agnostic view and identify statement surprises directly from the market commentaries. Based on this information, we are also able to ask the following question: Do the market players update their expectations when they are faced with a statement surprise? If the answer is a "yes", this means the monetary authority has some leverage to shape up the yield curve towards its intended direction. If the answer is a "no", that would suggest the market largely ignores the signals given by the CBT. Therefore, in our setup, by assessing the significance of the impact of statement surprises on financial markets, we also implicitly test the degree of central bank credibility. Table A2 in the appendix illustrates the construction of ($Surp\Delta ST_t$) with a few examples based on market commentaries. The sixth column in Table 1 shows the values of the $Surp\Delta ST_t$ variable for the full sample.[12]

4. Empirical Analysis

This section evaluates the different aspects of monetary policy communication on financial markets. In the first part, we investigate whether the CBT's signal regarding the next interest rate decision (D_t^{COM}) has improved the predictability of CBT. In the second part, we assess the effects of central bank communication over the yield curve.

[12]Notice that this variable is only available after 2005 because market commentaries were not available on a regular basis before that date.

4.1. Changes in the Predictability of Central Bank

Successful communication by the central bank is expected to improve the predictability of the central bank's actions in the near future. One way to test this is to check whether the signal that is released by the central bank regarding the future policy move (D_t^{COM}) is helpful in predicting the size of the next policy move.[13]

Table 1 provides a quick look at the data. The first column in this table shows the policy rate while the second column tracks those instances when the policy rate was changed. The third and the fourth columns show D_t^{COM} and D_{t-1}^{COM} respectively.[14] Successful signaling by the CBT implies non-zero values in column 2 to be associated with non-zero values in column 4, and zeros in column 2 to be associated with zeros in column 4. In table 1, those instances of accurate signaling are shaded. Note that the frequency of the shaded rows increase substantially over time. Indeed, in the period before 2005, there were 15 cases (white rows in Table 1) in which the policy action was not consistent with the signal released in the previous month. This is a whopping 43 percent of the observations for that period. Meanwhile, there are only six incidences, or 9

[13]At this point we should remind the reader that the variable D_t^{COM} is prepared by consulting with the officials at the CBT. Hence, it is constructed so as to capture the true intentions of the central bank. Instead, if D_t^{COM} were prepared by a computer or a neutral third party, we would be testing whether an outsider's *interpretation* of the next policy move is helpful in predicting the next move of the central bank (rather than the actual message sent by the central bank), which would be a different question to answer.

[14] Table 1 is constructed at the monthly frequency. In the period before 2005, MPC meeting schedules were not public knowledge and only policy rate changes were announced publicly. In those months when there were no policy announcements, D_t^{COM} is set equal to zero.

percent of observations, in which the policy change was inconsistent with the previous signal in the period after 2005.

While a close correspondence between D_{t-1}^{COM} and the current policy action points to successful communication by the central bank, the reverse is not necessarily true. This is because lack of a correspondence between D_{t-1}^{COM} and the current policy action may arise from a quick reversal of market developments that force the central bank to change its intentions since the last policy meeting. The policy easing that came in response to the financial turmoil in September 2007 is a good example of this situation. During its policy meeting in August 2007, the CBT signaled that policy rates would stay constant in September, and hence D_t^{COM} was set equal to zero in that month. The outbreak of the crisis in the US mortgage market in August 2007 led the CBT to update the external outlook on the downside and initiate an earlier-than expected easing cycle in September 2007.

Whether the signals provided by the CBT improves the predictability of the policy decisions can be tested formally by measuring the informative capacity of D_{t-1}^{COM} in predicting the CBT's next policy decision. The forecasting model developed by Hamilton and Jorda (2002), the Autoregressive Conditional Hazard (ACH) model, is a very suitable tool for this purpose. In the next sub-section we briefly describe the ACH model. Readers who are familiar with (or not interested in) the technical aspects of this model can move on to the following sub-section where we interpret our results derived from the ACH model.

The Autoregressive Conditional Hazard Model

The time series of policy rate changes has unusual statistical properties and are typically referred to as a *marked point processes* in the statistics literature. One of these properties is that the policy rate is changed irregularly in time. That is, we are uncertain about when the policy rate will be changed next, given information available today. The process describing when events take place in time is called a point process. The value that the point process takes at each event time is called the mark. For the purposes of this paper, we are only interested in the points and not the marks. This is because the variable, D_t^{COM}, only provides information about the direction of the next policy move without its size.

In particular, let x_t= 0 if there is no change in the policy rate after the policy meeting in month t, and x_t= 1 if there is a change—thus, x_t describes the process for the points (Column 2 in Table 1). Let z_t denote a vector of exogenous variables that capture the information that were released at the last policy meeting, which is D_{t-1}^{COM} in our exercise. Let Ω_t denote the information set in month t. Our task is to model the probability distribution of x_t conditional on the past.

The ACH model seeks an answer to the following question: What is the probability that during the next policy meeting, the policy rate will be changed, conditional on information available today? Denote this probability by h_t, typically referred to as the hazard in the duration literature. Then, $h_t = P(x_t = 1 | \Omega_{t-1})$. In addition, we define the following auxiliary variables. Let $\{\omega_{1t}\}$, $t = 1, 2, ..., T$ be a

sequence that, for any date *t* records the date of the most recent change in the policy rate as of time *t*,

$$\omega_{1t} = t\,x_t + (1 - x_t)\omega_{1,t-1} \qquad \text{for} \qquad t = 1, 2, ..., T$$

so that $\omega_{1t} = t$ if the policy rate changes on month *t* and $\omega_{1\tau}$ stays at *t* for subsequent months τ until a new rate change. In general, let ω_{jt} be the date of the j^{th} most recent policy rate change as of date *t*:

$$\omega_{jt} = x_t \omega_{j-1,t-1} + (1 - x_t)\omega_{j,t-1} \text{ for } j = 2, 3, ... \text{ and } t = 1, 2, ..., T$$

Using this notation, $\omega_{1,t-1} - \omega_{2,t-1}$ corresponds to the length of the duration between the most recent two policy rate changes as of date $t-1$ (Column 5 in Table 1). In general, the duration between the j^{th} and the $(j+1)^{th}$ most recent policy rate changes is $u_{j,t-1} = \omega_{j,t-1} - \omega_{j+1,t-1}$.

Going back to the hazard rate, note that if the only information contained in Ω_{t-1} were the dates of previous policy rate changes, the hazard rate h_t would not change until the next policy rate change. Let ψ_t denote the expected length of time until the next change, then

$$\psi_t = \sum_{j=1}^{\infty} j(1 - h_t)^{j-1} h_t = \frac{1}{h_t} \qquad (1)$$

It is natural to generalize expression (1) by allowing ψ_t to have a traditional linear time series representation for the conditional first moment and to incorporate the effects of exogenous variables, linearly. In an expression similar to that adopted in Hamilton and Jordá (2002),

$$\begin{cases} h_t = (\psi + \delta' z_{t-1})^{-1} \\ \psi_t = \omega + \sum_{j=1}^{\infty} \theta_j u_{j,t-1} + \sum_{j=1}^{\infty} \beta_j \psi_{\omega_{j,t-1}} \end{cases} \quad (2)$$

where the denominator is appropriately constrained to ensure that it is positive and $h_t \in [0,1]$.

The likelihood associated with expression (2) is simply

$$L(\theta) = \sum_{t=1}^{T} \{x_t \log(h_t) + (1 - x_t) \log(1 - h_t)\} \quad (3)$$

which can be maximized numerically with respect to the vector of population parameters by standard procedures.

The Estimation Results from the ACH Model

The ACH model is estimated for our sample period that spans from February 2002 through July 2010.[15] Table 2 reports the maximum likelihood estimates of the final ACH model for the full sample (column 1) as well as the period before 2005 (column 2). The estimates suggest somewhat persistent serial correlation in the hazard for the pre-2005 sample, with $\theta + \beta = 0.34$, which disappears for the full sample, with $\theta + \beta = 0.13$.

Our primary goal in estimating the ACH model is to check the predictive ability of the communication variable, D_{t-1}^{COM}. In order to test whether there is any asymmetry between the easing and the tightening signals, we decompose this variable into D_{t-1}^{COM} (Positive), D_{t-1}^{COM} (Negative), and D_{t-1}^{COM} (Neutral). Accordingly, D_{t-1}^{COM} (Positive) reflects

[15] We exclude June 2006 from the analysis. During this month there were two intermeeting changes one before and one after the regularly scheduled policy meeting.

the value of D_{t-1}^{COM} when it is positive. That is, this variable captures those instances when the CBT signaled a tightening for the next month, and is 0 otherwise. The negative and significant coefficient associated with this variable indicates that the probability of a policy change rises significantly when the CBT sends a stronger tightening signal, an expected result.[16] The variable D_{t-1}^{COM} (Negative) tracks the values of D_{t-1}^{COM} when the CBT sends an easing signal. Hence, the values of this variable range between -2, -1, and 0, with -2 reflecting the strongest easing signal and 0 reflecting a neutral signal. The coefficient associated with D_{t-1}^{COM} (Negative) is positive and significant. Increases in this variable, which indicate weaker signals towards an easing and stronger signals towards no change, decrease the probability of an interest rate change. In fact, the coefficient estimates associated with D_{t-1}^{COM} (Positive) and D_{t-1}^{COM} (Negative) are almost the mirror images of each other and the difference between them is not statistically significant. This result suggests that there is no asymmetry regarding the signals sent before policy easings or tightenings. Finally, the indicator variable D_{t-1}^{COM} (Neutral) takes the value of 1 when the CBT sends a neutral signal (i.e. D_{t-1}^{COM} =0) and 0 otherwise. The positive and significant coefficient associated with this variable indicates that a neutral signal decreases the chances of a rate change, consistent with the nature of the message. These results are very intuitive and suggest that the CBT sends the right messages to prepare the markets about its next policy action. Meanwhile, the second column shows the estimates

[16] Recall from equation (2) that the vector of explanatory variables, z_t, is inversely related to the hazard rate. Hence, a "negative" coefficient estimate in Table 2 indicates that the particular variable in question lowers the denominator and hence "increases" the hazard rate.

of the model for the period before 2005. None of the components of D_{t-1}^{COM} are significant for this sample.[17] This is consistent with the institutional setup of monetary policy during the post-2005 period, where the CBT made no explicit effort to signal its next interest rate move through policy statements (see section 2.1).

In addition to model fit, we also explored the model's forecasting performance. The ACH produces forecasts of the probability that, conditional on information signaled by D_{t-1}^{COM}, the CBT will change the policy rate in the next month. We termed this probability as the hazard and we denote its forecast by $\hat{h}_t$. On the basis of this probability forecast, one can construct the series of predicted changes, $\hat{x}_t$ by comparing $\hat{h}_t$ to the average hazard over the period, $\overline{h}$ as follows,

$$\hat{x}_t = \begin{cases} 0 & \text{if} \quad \hat{h}_t < \overline{h} \\ 1 & \text{if} \quad \hat{h}_t \geq \overline{h} \end{cases}$$

The statistics literature provides two conventional measures to gauge the model's performance: *specificity* and *sensitivity*. Specificity measures the proportion of events (i.e. $x_t = 1$) that were properly forecasted ($\hat{x}_t = 1$) while sensitivity measures the proportion of non-events ($x_t = 0$) properly forecasted ($\hat{x}_t = 0$). As an illustration, had we chosen the forecast: "$\hat{x}_t = 1$ for all *t*," our specificity measure would have scored a perfect 100% while our sensitivity measure would have scored a disastrous 0%. The

[17]Note that there are no tightening signals (or a rate hike) in the period before 2005 and hence D_{t-1}^{COM} (Positive) is dropped from that sample.

values attained by the ACH models are quite well balanced and strikingly high for the full sample (76% and 83% respectively). The predictive power of the model is substantially lower for the pre-2005 sample with the specificity and the sensitivity measures of 42% and 50% respectively. These results are highly consistent with the discussion in section 2.1 that prior to 2005 the timing of the policy decisions was not predictable and the statements did not provide systematic information on the future course of monetary policy. Meanwhile, with the significant steps taken towards transparency after 2005, the CBT now provides a substantial amount of information regarding its next policy move.

4.2. The Yield Curve Response to Monetary Policy Surprises

So far, we have shown that the CBT pursues a successful communication policy through its written statements in preparing the markets for its next policy decision. In other words, the CBT guides the markets in the right direction.

In this section, we go one step further and try to assess the impact of monetary policy on the term structure of interest rates. Since financial markets respond only to unanticipated information released in policy statements, we measure the response of the yield curve to monetary policy surprises. Monetary policy surprises can take place either by *actions* or *words*. Therefore, we first evaluate the impact of the surprises in interest rate decisions (actions); next, we move to the main theme of the paper and evaluate the effects of the surprises in policy communication (words).

Surprises in Interest Rate Decisions

Following Kuttner (2001), the responsiveness of financial markets to policy rate changes is typically tested through equation (4) where the change in the term rate is regressed on the expected and surprise components of a policy change:

$$\Delta r = \alpha + \beta_1 Exp\Delta PR_t + \beta_2 Surp\Delta PR_t \quad (4)$$

where Δr is the change in the term rate, $Exp\Delta PR_t$ and $Surp\Delta PR_t$ are the expected and surprise components of the change in the policy rate. In this paper, we calculate the anticipated and the unanticipated components of the policy rate based on (i) surveys or (ii) market based measures. The market based measure of the unanticipated policy change is calculated as the daily change in one-month constant maturity series following Rigobon and Sack (2004). Because of the short maturity of the underlying security, we do not expect the surprise component to reflect any information regarding the unanticipated component of the policy statement (which covers a longer time span). For robustness purposes, Equation (4) is calculated using the expected and surprise series that are derived via both methodologies.

We estimate equation (4) for six-month, one-year, two-year, and three-year government bond rates as well as the benchmark interest rate.[18] Tables 3a and 4a show the estimation results using survey based and market based measures of expectations respectively. The results indicate that Turkish financial markets act consistently with the expectations hypothesis, as also shown by Aktaş *et al.* (2008) and Demiralp and Yılmaz (2010). Following a policy action, market participants only respond to the unanticipated

[18] "Benchmark" interest rate is the interest rate of the most liquid government security in Turkey (typically with maturity between one and two years).

portion of the policy change. Overall, the estimates obtained from the two measures are pretty close to each other and close to those obtained for the US by Kuttner (2001). Unlike the US case, however, there is not a significant decline in the response coefficients when the maturity of the security lengthens. Specifically, in response to a percentage point surprise change in the policy rate, the yield curve shifts about 50 basis points.

Surprises in Communication

The specification in equation (4) implicitly assumes that the only driving force behind interest rate movements following a policy action is unanticipated interest rate changes. It overlooks any potential response to unanticipated changes in policy statements. Meanwhile, it is not very difficult to think of examples where the market response was driven solely by surprise statements rather than the decision itself. In our sample, we have several such cases: Figure 2 shows the changes in the yield curve on the days after the MPC meeting in April 2007, July 2007, April 2008, and September 2008. What is common for all these dates is that there was no interest rate change and this was perfectly anticipated by market participants. Nevertheless, the CBT changed the monetary policy stance by changing the wording in all four cases, which took market participants by surprise. In April 2007 and April 2008, the CBT adopted a tighter policy stance than expected. As a result, the yield curve shifted up on these days. In July 2007 and September 2008, this time the CBT changed the wording of the statement by implying an easier stance than expected which led to a downward shift of the yield curve. These examples illustrate that even if there is no interest rate surprise, unanticipated

changes in policy statements are very relevant in explaining changes in the yield curve. The rest of this section seeks to verify this observation through empirical analysis. To this end, we augment equation (4) with statement surprises and estimate the following equation:[19]

$$\Delta r = \alpha + \beta_1 Exp\Delta PR_t + \beta_2 Surp\Delta PR_t + \beta_3 Surp\Delta ST_t \quad (5)$$

where $Surp\Delta ST_t$ refers to the surprise changes in policy communication as described in section 3.3. To the extent that the information contained in interest rate changes are related to changes in policy statements, equation (5) provides a more comprehensive version of equation (4) and addresses any potential bias due to omitted variables. If, on the other hand the information contained in interest rate changes are orthogonal to the forward looking information reflected in the statements, then tests of the sensitivity of the yield curve to monetary policy announcements via equation (4) following Kuttner (2001) should produce valid coefficient estimates even though equation (5) is a more comprehensive specification.[20]

Tables 3b and 4b show the estimation results from equation (5). Note that the market response to policy statements is in line with expectations and highly significant for the unanticipated changes. We observe that the yield curve shifts by up to an additional 20 basis points due to surprise changes in policy statements (row five). The explanatory power of the regression increases significantly by five to ten percentage

[19] The sample period starts in 2005 because market commentaries of policy statements are only available after this date.

[20] The simple correlation coefficient between $Surp\ \Delta PR_t^{CBT}$ and $Surp\Delta ST$ is 0.45 while the simple correlation coefficient between $Surp\ \Delta PR_t^{Market}$ and $Surp\Delta ST$ is 0.30.

points depending on the underlying measure of expectations as shown by the $\overline{R}^2$ (row six). Note that a direct comparison between the coefficient estimates associated with interest rate surprises and statement surprises cannot be made based on Tables 3 and 4 because the units of measurement for the two variables are substantially different. Indeed, while the interest rate surprise variable, $Surp\Delta PR_t^{CBT}$, ranges between -240 and +20, statement surprise variable, $Surp\Delta ST$, ranges between -1 and +1 by construction. In order to provide a comparison of the order of magnitude effect between the two kinds surprises, we normalized both series and re-ran equation (5). We found that the coefficient estimates associated with interest rate and statement surprises were insignificantly different from each other for each maturity (not shown). This result is in line with Rosa (2011) who found that the impact of interest rate and statement surprises had comparable effects on the US dollar exchange rate.

Our findings are consistent with the earlier literature in the sense that the impact of the signals regarding the future stance of monetary policy tends to increase with the maturity of the contract (see Andersson *et al*. 2006, Kuttner, 2001, Demiralp and Jorda, 2004, Kohn and Sack, 2004). Indeed, the coefficients associated with surprise statements are significantly different between six-month and three-year maturity contracts for both expectations measures.

Next, we investigate how the responsiveness of the yield curve to unanticipated policy statements changes over time. To that end, we consider a 25-observation rolling windows analysis of equation (5). Figure 3 shows the results from this exercise. The upper panel of the figure plots the coefficients associated with unanticipated interest rate surprises (β_2) while the lower panel plots the coefficients associated with unanticipated

statements (β_3) that are significant at 95 percent level of confidence. The first estimation period ends in November 2006, which is the starting point in the graph. Figure 3 illustrates that the responsiveness to interest rate surprises declines through time, while the responsiveness of the yield curve to policy statements have increased over time. This type of a "substitution effect" may reflect that with the improvements in the information content of the CBT's statements, market participants started placing more emphasis on policy statements at the expense of interest rate surprises given that policy statements provide more forward looking information that are relevant for longer term securities.

Moreover, we note that longer-term securities are more responsive to the message released in policy statements relative to shorter-term securities. This finding is intuitive because the information regarding the monetary policy stance is more likely to be influential over a longer horizon. Furthermore, the sensitivity of the different maturities to policy statements also increases over time. That is, the wedge between the responsiveness of the shortest maturity asset (6-month) and the longest maturity asset (3-year) widens over time. The visible jump in the responsiveness to statement surprises around 2008 is related to the overall elevation of uncertainty during the financial crisis and a series of well-pronounced policy surprises in this period. Because of the long lasting nature of the crisis, longer-term assets are affected more from these crisis-related surprises relative to shorter-term assets.

5. Conclusions

Over the last decade, policy statements that accompany interest rate decisions became an indispensible policy tool across the world. However, measuring the effects of

policy statements on financial markets is challenging due to the difficulties involved in quantifying these statements and assessing the unanticipated component of these statements. In this paper, we follow a narrative approach to quantify the policy statements released by the CBT to evaluate the predictive power of these statements in forecasting the next interest rate decision. Our results suggest that policy statements became extremely helpful in predicting the direction of the next interest rate decision in the period after 2005. In a second contribution, we introduce a new way to measure the surprise component associated with policy statements. We identify the surprises in policy communication by using market commentaries/reports associated with monthly policy statements. Our results indicate that financial market participants in Turkey respond to the surprises in policy statements in a prompt manner, especially after the adoption of the inflation targeting regime. We also compare the impact of the surprise component of policy decisions (actions) with the surprises in policy communication (words) on the term structure of interest rates. Our results suggest that the relative influence of communication over the yield curve has increased through time. These findings lend support to the view that communication through written statements accompanying the interest rate decision is a key instrument of monetary policy especially under an inflation targeting regime.

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Table 1: Policy Rate and the Communication Signals

	Policy Rate	Event	D_t^{COM}	D_{t-1}^{COM}	Duration	$Surp\Delta ST_t$
Feb-02	57	1	-2			--
Mar-02	54	1	-2	-2	1	--
Apr-02	48	1	-2	-2	1	--
May-02	48	0	0	-2	1	--
June-02	48	0	0	0	1	--
July-02	48	0	0	0	1	--
Aug-02	46	1	-2	0	4	--
Sept-02	46	0	0	-2	4	--
Oct-02	46	0	0	0	4	--
Nov-02	44	1	-1	0	3	--
Dec-02	44	0	0	-1	3	--
Jan-03	44	0	0	0	3	--
Feb-03	44	0	0	0	3	--
Mar-03	44	0	0	0	3	--
Apr-03	41	1	-1	0	5	--
May-03	41	0	0	-1	5	--
June-03	38	1	-1	0	2	--
July-03	35	1	-2	-1	1	--
Aug-03	32	1	-2	-2	1	--
Sept-03	29	1	-2	-2	1	--
Oct-03	26	1	-1	-2	1	--
Nov-03	26	0	0	-1	1	--
Dec-03	26	0	0	0	1	--
Jan-04	26	0	0	0	1	--
Feb-04	24	1	-2	0	4	--
Mar-04	22	1	-1	-2	1	--
Apr-04	22	0	0	-1	1	--
May-04	22	0	0	0	1	--
June-04	22	0	0	0	1	--
July-04	22	0	0	0	1	--
Aug-04	22	0	0	0	1	--
Sept-04	20	1	0	0	6	--
Oct-04	20	0	0	0	6	--
Nov-04	20	0	0	0	6	--
Dec-04	18	1	-2	0	3	--
Jan-05	17	1	-1	-2	1	-1
Feb-05	16.5	1	-2	-1	1	0
Mar-05	15.5	1	-2	-2	1	0
Apr-05	15	1	-1	-2	1	1
May-05	14.5	1	-1	-1	1	0
June-05	14.25	1	-1	-1	1	0
July-05	14.25	0	0	-1	1	0
Aug-05	14.25	0	0	0	1	0
Sept-05	14.25	0	-1	0	1	0
Oct-05	14	1	-1	-1	4	0
Nov-05	13.75	1	-1	-1	1	0
Dec-05	13.5	1	0	-1	1	1
Jan-06	13.5	0	0	0	1	0
Feb-06	13.5	0	0	0	1	0

Mar-06	13.5	0	-1	0	1	0
Apr-06	13.25	1	0	-1	4	0
May-06	13.25	0	0	0	4	0
June-06	15	0	1	0	4	0
July-06	17.5	1	0	1	3	0
Aug-06	17.5	0	0	0	3	0
Sept-06	17.5	0	0	0	3	0
Oct-06	17.5	0	0	0	3	0
Nov-06	17.5	0	0	0	3	0
Dec-06	17.5	0	0	0	3	0
Jan-07	17.5	0	0	0	3	0
Feb-07	17.5	0	0	0	3	0
Mar-07	17.5	0	0	0	3	0
Apr-07	17.5	0	0	0	3	1
May-07	17.5	0	0	0	3	0
June-07	17.5	0	0	0	3	0
July-07	17.5	0	0	0	3	-1
Aug-07	17.5	0	0	0	3	0
Sept-07	17.25	1	-2	0	14	-1
Oct-07	16.75	1	-2	-2	1	0
Nov-07	16.25	1	-2	-2	1	0
Dec-07	15.75	1	-2	-2	1	0
Jan-08	15.50	1	-2	-2	1	0
Feb-08	15.25	1	-1	-2	1	0
Mar-08	15.25	0	0	-1	1	0
Apr-08	15.25	0	1	0	1	1
May-08	15.75	1	2	1	3	0
June-08	16.25	1	2	2	1	0
July-08	16.75	1	1	2	1	0
Aug-08	16.75	0	0	1	1	0
Sept-08	16.75	0	0	0	1	-1
Oct-08	16.75	0	0	0	1	0
Nov-08	16.25	1	0	0	4	-1
Dec-08	15	1	-2	0	1	-1
Jan-09	13	1	-2	-2	1	-1
Feb-09	11.5	1	-2	-2	1	-1
Mar-09	10.5	1	-2	-2	1	0
Apr-09	9.75	1	-2	-2	1	0
May-09	9.25	1	-2	-2	1	0
June-09	8.75	1	-2	-2	1	-1
July-09	8.25	1	-2	-2	1	-1
Aug-09	7.75	1	-2	-2	1	-1
Sept-09	7.25	1	-2	-2	1	-1
Oct-09	6.75	1	-2	-2	1	0
Nov-09	6.50	1	0	-2	1	0
Dec-09	6.50	0	0	0	1	0
Jan-10	6.50	0	0	0	1	0
Feb-10	6.50	0	0	0	1	0
Mar-10	6.50	0	0	0	1	1
Apr-10	6.50	0	0	0	1	-1
May-10	6.50	0	0	0	1	0
June-10	6.50	0	0	0	1	-1
July-10	6.50	0	0	0	1	0

Table 2
Estimates for the ACH model

Dependent Variable: Indicator Variable of Changes in the Policy Rate

Variable	Full Sample	Pre-2005
1. Constant	1.18	6.70
	(1.74)	(0.76)
2. D_{t-1}^{COM} (Positive)	-0.79**	--
	(-2.11)	--
3. D_{t-1}^{COM} (Negative)	0.65*	3.52
	(1.92)	(0.80)
4. D_{t-1}^{COM} (Neutral)	3.15*	-5.18
	(1.83)	(-0.59)
5. Number of Observations	98	33
6. Mean Log-Likelihood	-42.85	-18.91
7. Persistence ($=\theta + \beta$)	0.13	0.34
8. Specificity	0.76	0.42
9. Sensitivity	0.83	0.50

t-statistics in parenthesis.**/* indicates significance at 95/90 level of confidence.
Data Frequency: Monthly.

Table 3a: The Yield Curve Response to Interest Rate Changes (Using Survey-Based Measures of Expectations)
Sample Period: 1/11/2005-7/16/2010

		I. Δr_t^{6m}	II. Δr_t^{1yr}	III. Δr_t^{2yr}	IV. Δr_t^{3yr}
1.	Constant	0.53 (0.23)	0.39 (0.13)	0.85 (0.24)	-1.64 (-0.47)
2.	$Exp\Delta PR_t^{CBRT}$	-0.05 (-0.69)	-0.12 (-1.24)	-0.17 (-1.48)	-0.20 (-1.65)
3.	$Surp\ \Delta PR_t^{CBRT}$	0.54** (6.49)	0.46** (4.26)	0.49** (7.00)	0.46** (4.19)
4.	$\overline{R}^2$	0.41	0.21	0.17	0.14

t-statistics in parenthesis. **/* indicates significance at 95/90 level of confidence.

Table 3b: The Yield Curve Response to Policy Changes (Using Survey-Based Measures of Expectations)

Sample Period: 1/11/2005-7/16/2010

		I. Δr_t^{6m}	II. Δr_t^{1yr}	III. Δr_t^{2yr}	IV. Δr_t^{3yr}
1.	Constant	1.05 (0.47)	1.07 (0.37)	1.56 (0.47)	-0.88 (-0.28)
2.	$Exp\Delta PR_t^{CBRT}$	-0.06 (-0.79)	-0.13 (-1.39)	-0.18 (-1.51)	-0.21 (-1.64)
3.	$Surp\ \Delta PR_t^{CBRT}$	0.45** (5.11)	0.35** (3.06)	0.38** (4.36)	0.33** (2.68)
4.	$Surp\Delta ST_t$	11.78** (3.77)	15.34** (3.71)	15.92** (2.58)	17.39** (2.31)
5.	$\overline{R}^2$	0.47	0.30	0.25	0.24

t-statistics in parenthesis.**/* indicates significance at 95/90 level of confidence.

Table 4a: The Yield Curve Response to Interest Rate Changes (Using Market-Based Measures of Expectations)

Sample Period: 1/11/2005-7/16/2010

		I. Δr_t^{6m}	II. Δr_t^{1yr}	III. Δr_t^{2yr}	IV. Δr_t^{3yr}
1.	Constant	1.98 (0.88)	1.90 (0.69)	2.55 (0.83)	0.03 (0.01)
2.	$Exp\Delta PR_t^{Market}$	0.18** (2.63)	0.06 (0.96)	0.05 (0.61)	0.03 (0.46)
3.	$Surp\ \Delta PR_t^{Market}$	0.56** (7.20)	0.60** (5.78)	0.62** (5.15)	0.56** (6.74)
4.	$\overline{R}^2$	0.46	0.39	0.32	0.26

t-statistics in parenthesis.**/* indicates significance at 95/90 level of confidence.

Table 4b: The Yield Curve Response to Policy Changes (Using Market-Based Measures of Expectations)

Sample Period: 1/11/2005-7/16/2010

		I. Δr_t^{6m}	II. Δr_t^{1yr}	III. Δr_t^{2yr}	IV. Δr_t^{3yr}
1.	Constant	2.33 (1.09)	2.32 (0.89)	2.99 (1.06)	0.52 (0.18)
2.	$Exp\Delta PR_t^{Market}$	0.13** (2.28)	0.01 (0.18)	0.00 (-0.01)	-0.03 (-0.43)
3.	$Surp\ \Delta PR_t^{Market}$	0.49** (5.94)	0.51** (4.60)	0.53** (4.13)	0.45** (5.51)
4.	$Surp\Delta ST_t$	11.82** (3.67)	14.39** (3.58)	15.08** (2.50)	16.78** (2.29)
5.	$\overline{R}^2$	0.53	0.47	0.39	0.35

t-statistics in parenthesis.**/* indicates significance at 95/90 level of confidence.

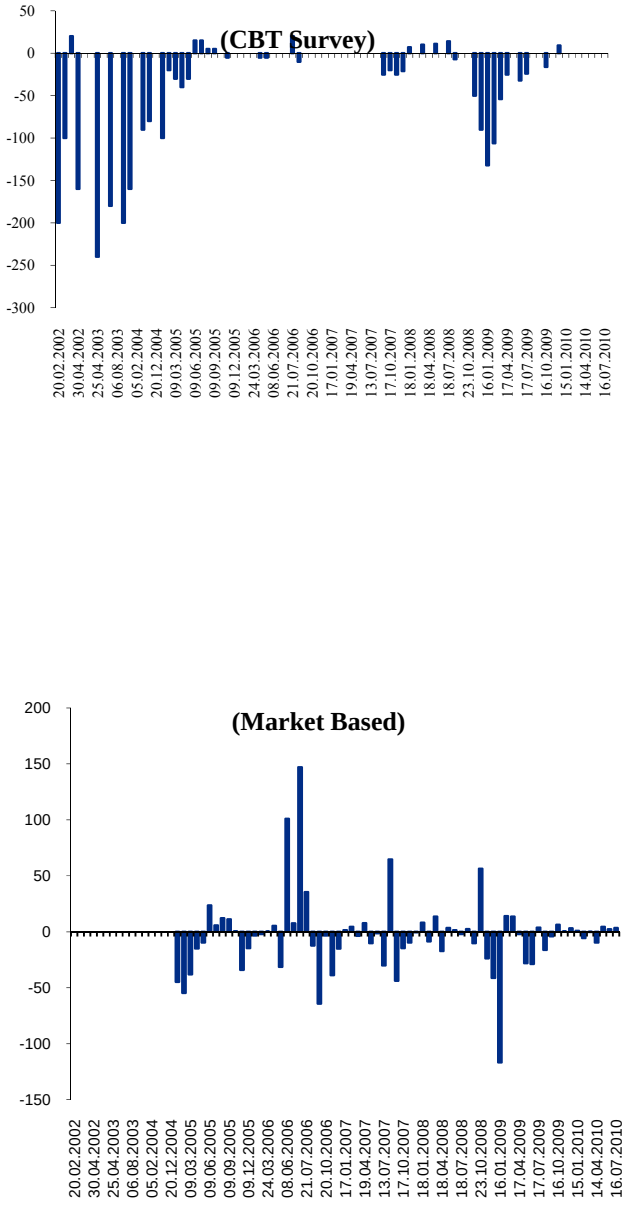


Figure 1
Unanticipated Component of Policy Rate Changes

The vertical axis shows the unanticipated changes in interest rates in basis points.

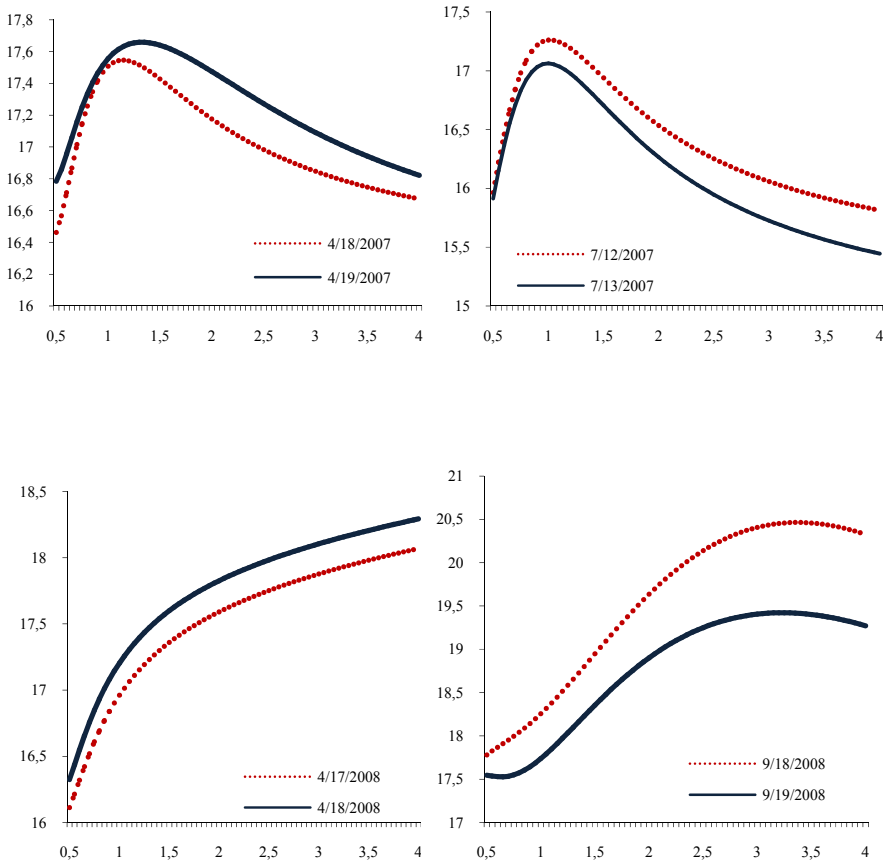
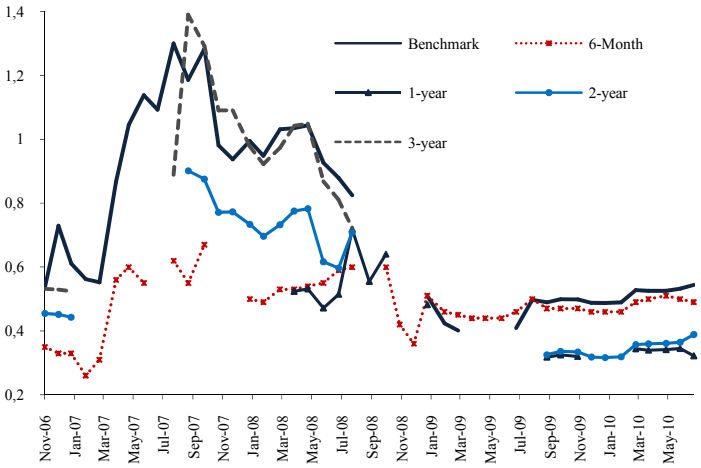


Figure 2
Shifts in the Yield Curve

Response to Interest Rate Surprises



Response to Statement Surprises

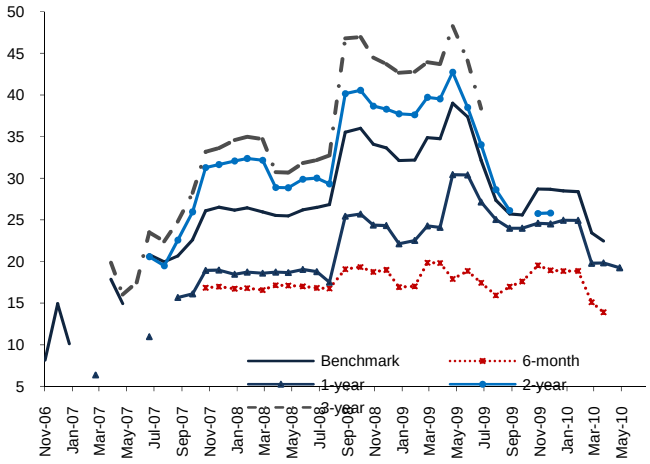


Figure 3
The Yield Curve Response to Policy Surprises
(25-Observation Rolling Windows Analysis)

Appendix 1:

Table A1: Examples of Policy Statements and their Coding with respect to the Next Policy Decision (D_t^{COM})

Date	Statement	D_t^{COM}
June 2008	The Central Bank will consider a further measured rate hike when needed, so as to prevent the potential second-round effects of such risk factors. **The extent and timing of a possible future rate hike will** depend on developments in global markets, external demand, fiscal policy implementation, and other factors affecting the medium term inflation outlook.	+2
July 2008	The Central Bank will consider a further measured rate hike when needed, so as to prevent the potential second-round effects of such risk factors. **The timing of a possible future rate hike** will depend on developments in global markets, external demand, fiscal policy implementation, and other factors affecting the medium term inflation outlook.	+1
March 2009	The Central Bank will continue to take the necessary measures to contain the adverse effects of the global financial turmoil on the domestic economy, provided that they do not conflict with the price stability objective. Looking forward, **the Committee envisages that the next rate cut may be measured,** and that it may be necessary for the monetary policy to maintain an easing bias for a considerable period.	-2
February 2008	Accordingly, the Committee will closely monitor the lagged impacts of the recent rate cuts. Besides, the second round effects on the wage and price setting behavior of elevated food and energy prices and of the developments in incomes policy will be watched closely. **The timing of further easing will depend on developments** regarding global market conditions, external demand, fiscal policy implementation, and other factors affecting the medium term inflation outlook.	-1
December 2005	It should be underlined here that the cautious stance of monetary policy should be maintained in order to achieve the inflation target. **In the light of currently available data, the short-term interest rates are less likely to move upward than to move downward or to remain stable in the medium term. However in the short term, the likelihood of the short-term interest rates to remain stable is gradually increasing compared to previous periods.** It is not possible to make a clear-cut statement about the future direction of this trend due to several factors.	0

Table A2: Examples of Market Commentaries and the Construction of D_t^S

Date	D_t^S	**Market Commentary**
April 2007	1	"The MPC did not change the policy rate as expected **but gave a stronger signal with respect to maintaining a tight monetary policy**. According to the market participants this signal weakened the expectations of policy rate cuts for early mid-2007. "
July 2007	-1	" The Central Bank did not change the policy rate as expected **but the surprise signal that the measured easing might start in the last quarter** is expected to put downward pressure on exchange and interest rates."
April 2008	1	"The central bank did not change the interest rates as expected. Nevertheless **the message in the policy statement was more hawkish than expected**. It is mentioned that a measured tightening may be considered when needed so this message heightened the expectations that the interest rates may rise in May. "
Nov. 2008	-1	"The policy decision is unexpected and surprising. Besides, **the explanation that there is a significant slowdown in domestic economic activity is also surprising**. "
Aug. 2009	-1	"In a more dovish change to the statement, MPC notes that recent developments heightened uncertainties regarding the strength of recovery in consumption demand. Following yesterday's decision, we continue to expect another 50 bps cut in September. However, **tone of the rate statement is a touch more dovish**, which strengthens the downside risks to our forecast for terminal policy rate at 7.25%. "