

# Is the CNB Predictable?

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## 1. Introduction

The adoption of the inflation targeting strategy by the Czech National Bank (CNB) in 1998 secured a clear framework for monetary policy-making. This paper asks whether this clarity of the new framework was transmitted to the predictability of the policy-making. After some definition issues and literature review further down in this section, the second section summarizes the key features of the past policy meetings and shows a few historical figures. The third section refines the analysis and the fourth section concludes.

Monetary policy is predictable if economic agents generally expect the monetary policy decisions taken by the central bank. This holds particularly in the case where agents understand how the decisions on policy rates are reached and are consequently able to predict the sign and size of the interest rate change. The central bank contributes to this understanding by having explicit goals (e.g. inflation targets), by explaining its decision-making (e.g. during press conferences or minutes) and by informing the public about the data set for the decision (e.g. the forecast).

Central banks can effectively control only one asset price. This is usually some short-term interest rate – from the overnight rate (Fed) to the two-week repo rate (CNB, ECB). Longer-term interest rates are then determined by the market following an arbitrage-based expectations hypothesis of the term structure of interest rates. In short, long rates are a function of current and expected future short rates and possibly some term premium.

For example, the one-year interest rate ( $IR12M_t$ ) is determined from the current two-week repo rate ( $repo_t$ ) and from expected future two-week repo rates. Disregarding the term premium, we can write down the corresponding “term structure equation” in the following form (1) (where we assume that one year has 52 weeks):

$$IR12M_t = \frac{1}{26} \cdot \sum_{i=0}^{26} repo_{t+i}^e \quad (1)$$

If the money market fully comprehends the central bank’s decision-making

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TABLE 1 Number of Monetary Policy Meetings, Repo Rate Changes and Changes in Direction

	Whole period	Conditional forecast period	Unconditional forecast period
Number of meetings	98	63	35
– irregular	12	12	0
Repo rate changes	35	25	10
Changes in direction	5	3	2

Note: “Changes in direction” show how many times the CNB changed the direction of the interest rate changes from tightening to easing and *vice versa*.

ing process, then the change in the repo rate will be expected and will be priced into market interest rates with maturities longer than 2W. These market rates should thus not change immediately after the Bank Board decision. On the other hand, if the Central Bank changes the interest rate unexpectedly, and the decision is thus not fully “priced in”, then this unexpected development will be followed by a change in market rates.

We use an illustrative indicator based on (Bernhardsen – Kloster, 2002), that we further develop. The idea behind it is rather simple: the Bank Board holds meetings and makes decisions about interest rates every month. The one-month money market rate (1M PRIBOR) is thus a good indicator of expectations about the *current* Bank Board decision. Longer-term interest rates (e.g. 12M PRIBOR) also embody expectations about *future* Bank Board decisions.<sup>1</sup> The difference in market rates between the day after and the day before the Bank Board meeting implies to what extent the policy decision was (un)expected. If the decision was fully in accordance with expectations, then the difference is zero. If the difference is non-zero, it means that the decision was to some extent unexpected.

This approach is similar to the one taken by Podpiera (2000). His focus, however, lies in testing the efficiency of the Czech financial market (with a negative conclusion). Interest rate responses several days before and after repo rate changes are thus analyzed separately.

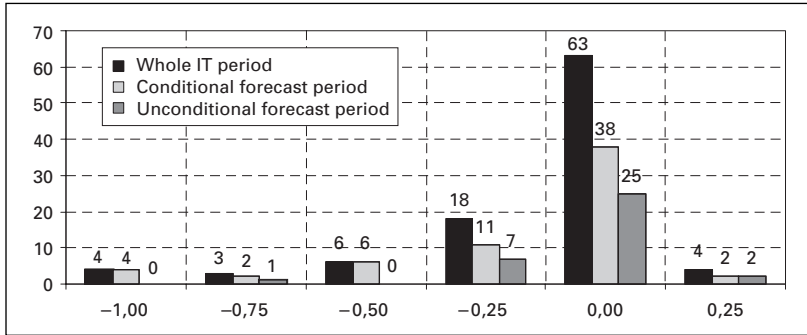
Matoušek (2001) also examines the reaction of interest rates to the change in the CNB’s policy rate. His focus is, however, different from ours. In his view, no reaction of short-term interest rates to a repo rate change implies transparent policy, and no change in long-term interest rates can be understood as highly credible policy. Comparing the market reaction to the repo rate changes prior to the introduction of IT to the IT period, he concludes that IT added to policy transparency.

## 2. The CNB’s Past Behavior

As a warm-up for our analysis we start this section with a brief description of the frequency and direction of monetary policy decisions. *Table 1*

<sup>1</sup> Note that the causal link between repo rate and longer-term rates is going through the expectations hypothesis. It is impossible to prove it with common causality tests since the process is unevenly distributed throughout time and is expectations-dependent.

FIGURE 1 Histogram of the Size of the Repo Rate Changes



shows some statistics on the CNB’s monetary policy meetings and the decisions taken. The CNB holds regular monthly meetings on monetary policy. Besides these, a number of irregular meetings were held during the earlier period. Table 1 and Figure 1 present results also for two sub-samples that recruit from different forecasting methodologies (regarding the treatment of the policy-maker within the forecast) used in the relevant historical time.

Figure 1 presents a histogram of the repo rate changes. The interest rate changes were not restricted to gradual movements (meaning 0.25 p.p. changes), but were also carried out in larger steps. However, the more aggressive changes (cuts) took place almost exclusively in the conditional forecast period until mid-2002.

This brief description shows that the latter period is connected with “smoother” monetary policy, in the sense that there were no irregular meetings and the repo rate changes were more gradual. This increased “smoothness” can to a large extent be attributed to the end of the disinflation period and fewer external shocks.

Coming back to the methodology of Bernhardsen and Kloster (2002) outlined above, in Figure 2, we plot the difference in 1M PRIBOR interest rate between the day after and the day before the Bank Board meeting. For the sake of comparison, we also plot the actual repo rate change.

Note that since we consider the decisions to leave rates unchanged just as important as decisions to change rates, we analyze both. However, we return to this important point below in section three. The change in the 1M PRIBOR measures the degree of surprise. A positive value, e.g. +0.25 p.p., means that the money market expected an interest rate 0.25 p.p. lower than was realized. In August 1998, for example, the money market expected the CNB to lower the rate by approximately 0.25 p.p., but in fact the CNB lowered it by 0.50 p.p., therefore the surprise was approximately  $-0.25$  p.p. In December 2002, the CNB decided to keep the interest rate unchanged. However, part of the market expected it to fall. On the other hand, in October 2002, the CNB lowered the interest rate by 0.25 p.p., which (as Figure 2 shows) was completely in accord with money market expectations.

Apart from looking at the reaction of short rates, we also examine the ex-

FIGURE 2 The 2W Repo Rate and 1M PRIBOR – Difference between the Day After and the Day Before the Bank Board Meeting (in p.p.)

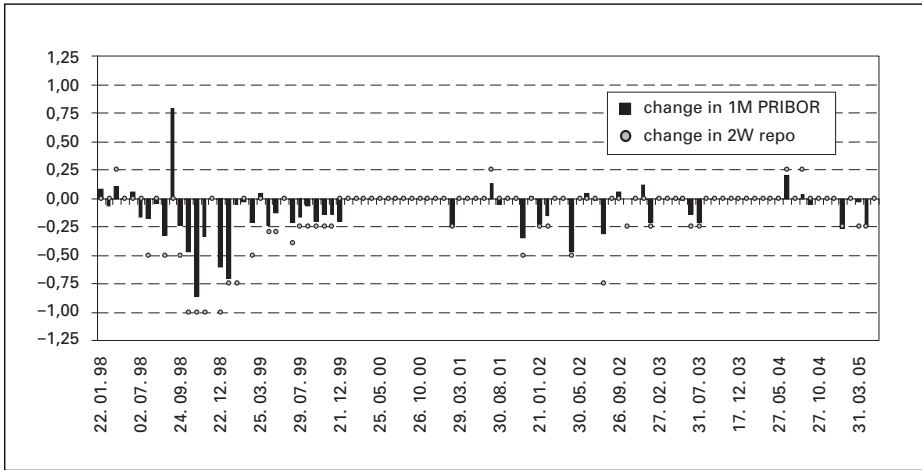
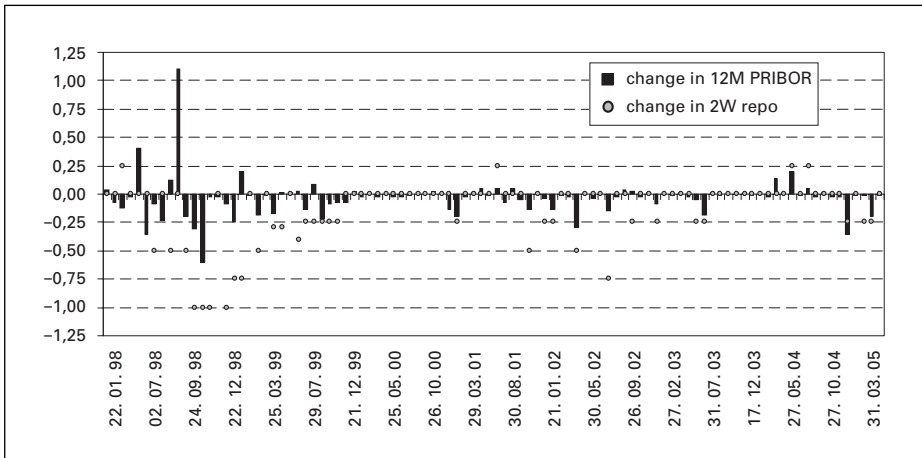


FIGURE 3 The 2W Repo Rate and 12M PRIBOR – Difference between the Day After and the Day Before the Bank Board Meeting (in p.p.)



tent to which the decision is “priced in” in longer rates (12M PRIBOR). One reason to do this is that longer-term interest rates influence output and subsequently inflation. Therefore, the ability to influence long-term interest rates determines whether the CNB is successful in stabilizing the economy and fulfilling its targets. Another reason is that while longer-term interest rates carry only very vague information on the timing of policy moves, they do matter for the expected direction of policy moves. *Figure 3* shows the difference in the 12M PRIBOR (and repo rate) between the day after and the day before the Bank Board meeting.

TABLE 2 Matrix of Reactions after the Bank Board Meeting

	No change in 12M PRIBOR	Change in 12M PRIBOR
No change in 1M PRIBOR	Decision was expected and outlook was not changed.	Decision was expected and outlook was changed.
Change in 1M PRIBOR	Decision was not expected and outlook was not changed.	Decision was not expected and outlook was changed.

### 3. Beyond the Expectations Hypothesis

The matrix of all the possible combinations, which can occur after the Bank Board meeting with respect to the change in the short and the long money market rate is shown in *Table 2*. If the decision was expected and it did not change the money market outlook, the 1M and 12M PRIBOR did not change (first quadrant). But if the decision was expected and long-term interest rates changed at the same time, it could mean that communication changed the outlook regarding the future assumed repo rate development (second quadrant).

The two other combinations relate to situations where the 1M PRIBOR changed, i.e. the market was surprised by the decision taken. If a change in 1M PRIBOR met with no change in the 12M PRIBOR, it could indicate that (i) the repo rate change was not credible, or (ii) the change was in accord with the money market's longer-term expectations, but the timing was different (third quadrant). On the other hand, if an unexpected decision (a change in the 1M PRIBOR) was accompanied by a change in the 12M PRIBOR, this could mean that this unexpected change was credible and, together with communication, influenced the money market's repo rate outlook (fourth quadrant).

It is possible to illustrate all the combinations mentioned in *Table 2* with examples from the history of IT in the Czech Republic. The first quadrant corresponds to the October 2002 meeting, where it was decided to cut the repo rate by 0.25 p.p., which was fully in accord with short-term and long-term expectations. The decision to cut the repo rate by 0.75 p.p. at the January 1999 meeting was expected, but the 12M PRIBOR increased at the same time. The money market began to expect a monetary policy tightening in the future. This expectation may have been influenced by a highlighting of the pro-inflationary risks by the Bank Board at the press conference. The meeting in January 2003 represents the third quadrant. The money market did not expect the repo rate cut (0.25 p.p.) this month. However, the no change in the 12M PRIBOR indicates either that a monetary policy easing was expected in the coming months or that the repo rate cut was not perceived as credible. An illustration of impacts on both short and longer rates (fourth quadrant) is given by the April 2005 interest rate cut of 0.25 p.p.

Before running the empirical part there were two important choices to be made. They go to the very heart of the issue we tackle although they may seem as rather technical at first glimpse. They relate to what we call "interest rate change": how big it must be and how quick it must take place.

TABLE 3 Share of Combinations for Each Quadrant (in %)

	No change in 12M PRIBOR	Change in 12M PRIBOR
No change in 1M PRIBOR	62 (59)	5 (8)
Change in 1M PRIBOR	16 (12)	17 (21)

Let's look at the magnitude of a what represents a "change" first. "No change" of interest rates after the meeting cannot be as strict as mathematically defined no change for two reasons. First, there is the usual trading noise in the data and supposing a zero change would omit it and bias our results. Second, the market is not homogeneous. In other words, it is not just one participant with a binary expectation (change/no change). If the data "price-in" a 5 bps rate hike, it means most participants probably expect stable rates but some expect a rate hike. These practical considerations led us to choose 12.5 bps as the "break-point" of no change. This equals to half of the 25bps change, which is by far the most frequented repo rate change. If rates move by more than 12.5 bps, it means that more than a half of participants did not expect the given policy move. The chosen break-point of 12.5 bps also corresponds to double the historical standard error of interest rate changes both for 1M rates and 12M rates over both windows.

The second issue is the length of the "window" we look at. The baseline case is based on the difference between rates the day after and the day before the Bank Board meeting. This short "window" (three days) minimizes the impact of other factors determining interest rates apart from the Bank Board meeting (e.g. foreign developments, release of new data). This is an advantage. On the other hand, market interest rates can take several days to adjust to the Bank Board decision. Podpiera (2000) estimates that it takes four days for the financial market to adjust fully to the change in the repo rate. Therefore, to check for robustness we also present the combinations based on the difference three days after and one day before the Bank Board meeting. The results for the five-day window are presented in parentheses in Table 3 and 4. They do not significantly change the conclusions.

### 3.1 All Decisions

Table 3 summarizes the percentage share of combinations in each quadrant (all decisions equal to 100 %). What does the table say? In 67 % of cases, the *decision in the given month* was expected (first and second quadrant). This number further increases if we look at the longer-term expectations. Summing the first and the third quadrant one can see that in three out of four policy meetings the market correctly anticipated the *direction of policy change*.

The results for the five-day window are not very different. Longer time to digest the decision is connected with further changes in the 12M rate, implying the communication at the press conference probably altered the out-

FIGURE 4 Absolute 10day Moving Average of “Surprises” (in percentage points)

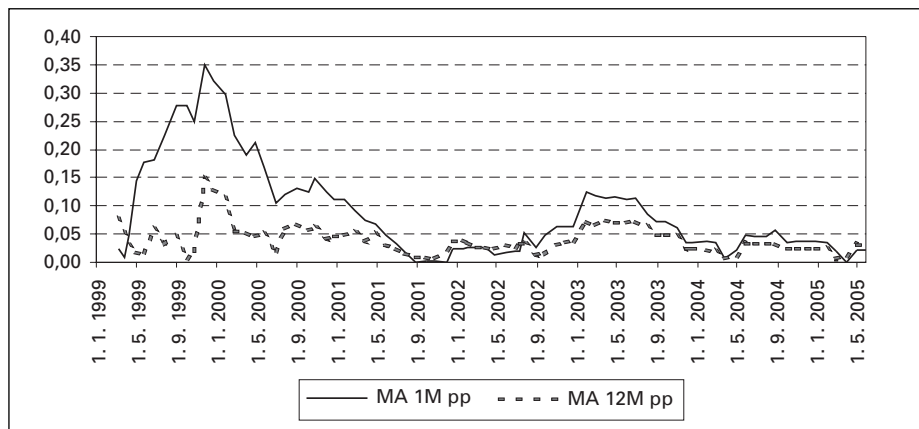
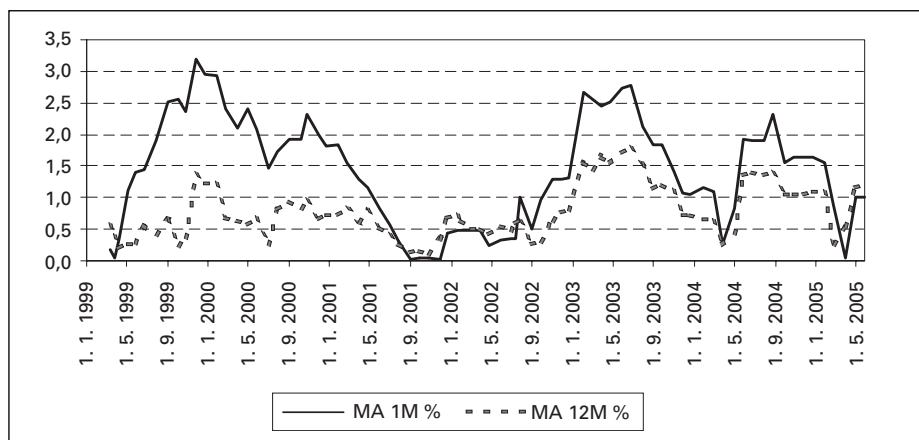


FIGURE 5 Relative 10day Moving Average of “Surprises” (in percent)



look of the markets for future policy moves. However, the general conclusions remain the same.

To check whether there has been any development of the predictability over time, we construct a ten-decisions moving average of the “surprise” in expectations (the three-day interest rate change around policy meetings) and plot it in *Figure 4*.

It seems that the predictability is rising over time. As suggested by one of the referees, this conclusion may be caused by generally lower level of interest rates in the latter part of our sample. In order to account for this possible bias, we constructed also a series of “relative surprises” by dividing the change in the interest rate by the level of the interest rate and obtained numbers presented in *Figure 5*. Inspecting this methodologically improved figure does not yield any clear conclusion as to the development of the predictability of the CNB over time.

TABLE 4 The Alternative Hypothesis

CNB	Market	Baseline hypothesis	Alternative hypothesis
Change	No change	Expected	Does not follow
Change	Change	Un-expected	Follows
No change	No change	Expected	Follows
No change	Change	Un-expected	Does not follow

### 3.2 Eliminating the “No Change” Decisions

The sample above includes all interest rate decisions since January 1998. The reason we made this “full sample” our baseline case is that we believe a decision to keep rates unchanged is just as important for the central bank and the economy as a decision to change a rate. After all, it is the *level* of the interest rate that matters for inter-temporal decision-making. By the same token, policy transmission both through the interest rate channel and through the exchange rate channel is based on the value of the interest rate, not on its first derivation.

However, it could be argued that for the financial markets, decisions to *change* the repo rate (as opposed to keep it stable) are more important. The reason is that market intermediaries live from changes in asset prices triggered by interest rate moves. It may thus be interesting to consider how our results would be affected if we eliminate the decisions at which no interest rate change was delivered.

Another motivation to look at a partial sample is an attempt to differentiate between a possible alternative hypothesis to our baseline. The alternative hypothesis is that markets are in fact myopic and rather follow the CNB’s decisions. The relationship of this alternative hypothesis to our baseline hypothesis is depicted in *Table 4*.

In the alternative world a change of market interest rate after the repo rate change is interpreted as a “following” of the central bank by the market, not as an “unexpected” repo rate change. If the market rate does not change in response to a change in markets rate, it is interpreted as “not following” the central bank rather than as “expected” repo rate change. The trouble is with cases where the repo rate remains unchanged. The reason is that a response of “no change in market rates” can be interpreted as both expected move by the Central Bank and also as following the Central Bank. Thus, in order to differentiate between our baseline hypothesis and this alternative, one needs to eliminate the “no change” meetings from the sample. We do this below for the partial data sample (35 observations) and summarize the results in *Table 5*.

The results differ from the “full sample” case. Only 17 % of all decisions were now expected with *precision of one month*. The share of “*directional*” views that were right also goes down even though it stays above 50 %. The fact that in 54 % of cases the long-term money market rate remains stable after a change in repo rate could be taken as (a light form of) evidence against the alternative hypothesis. Another explanation for the de-



TABLE 5 Share of Combinations for Each Quadrant (in %)

	No change in 12M PRIBOR	Change in 12M PRIBOR
No change in 1M PRIBOR	17 (20)	0 (3)
Change in 1M PRIBOR	37 (26)	46 (51)

crease of the predictability in this case can be that zero rate changes are the most often policy outcomes and one should not thus be surprised these are easier to guess for market participants.

Notwithstanding the high “predictability” of the direction of CNB policy, it is interesting to note from the data that at the times the rate move was unexpected, the market was primarily surprised on the downside, regardless of the “window” we look at. The market systematically expected a higher interest rate than the Bank Board actually set. The reason may be that the money market is more backward-looking than the CNB. If the Central Bank is more forward-looking than other agents in the economy, then – in disinflations – it will lower interest rates more rapidly than is generally expected.

#### 4. Results

The aim of this paper was to analyze the predictability of the CNB’s interest rate decisions using the sample of January 1998 to May 2005. We designed a matrix of the possible combinations of reactions of money market rates with short and long maturities to policy outcomes. In the empirical part, we use a 3-day and a 5-day window to examine the reaction of the market rates to policy meetings. In order to examine an alternative hypothesis of myopic markets, we also tested separately for only the meetings where repo rate changed. The results are as follows.

First, the CNB can be considered as predictable on average since in two thirds of cases the short-term money market rates did not change significantly after the policy meeting. If we examine the reaction of the long-term money market rates, that capture the anticipated *direction of policy change*, the results are even better as three fourths of participants on average expected the policy outcome well.

Second, we examined how this policy predictability evolved over time. From a simple analysis of absolute degree of “policy surprise” it seems that the predictability increased over time. However, when the surprises are taken on a relative rather than absolute basis, the results show no clear trend.

Third, the analysis was also performed on a partial sample eliminating decisions at which rates were not change. Although it is clearly more difficult to predict policy outcomes at meetings where rates change, the alternative hypothesis of myopic markets does not seem to hold as policy direction was correctly estimated in more than half of the meetings. The relatively short sample, however, demands that a more profound analysis of the alternative hypothesis is undertaken as more observations are available.

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## SUMMARY

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This paper asks to what extent were the last one hundred policy decisions taken by the Czech National Bank (CNB) considered predictable by the market. The results are threefold. First, CNB policy decisions can be considered as predictable on average. Second, policy predictability followed no clear trend. Third, the analysis shows that it was more difficult for the market to predict policy outcomes regarding CNB Board meetings where interest rate were changed compared with meetings where repo rate were not changed.