Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

BACHELOR THESIS

Voting in central banks: An empirical analysis

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Academic Year: **2013/2014**

Declaration of Authorship

I hereby declare that I wrote this thesis on my own under the leadership of my supervisor and using only the listed resources and literature.

I further declare that the thesis has not been used previously for obtaining any university degree.

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Prague, July 30, 2014

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Acknowledgments

I would like to express my gratitude to doc. Roman Horváth, Ph.D. for valuable insights and advice. I am grateful to my parents ï RNDr. Melinda Jonágová and Mgr. Róbert Jonág, for being patient.

Abstract

The aim of the thesis is to assess informative power of the voting records of central banks. The research concentrates on the following aspects: predictability of future repo rate changes based on the voting records in longer horizons, level of disagreement in Monetary policy committee (MPC) and financial marketsô expectations, comparison between results of the analysis before and during the financial crisis and weighting every vote according to attendance of the policymaker. The results confirm that voting records are, indeed, informative about future monetary policy changes and can increase predictability of the particular central banks. Negative dispersion coefficient for the Bank of England (BoE) and Czech National Bank (CNB) suggests that increase in uncertainty stimulates looser monetary policy. For the BoE and Riksbank voting records signal the change of the repo rate approved also at the further meetings, which is partially true for the Czech Republic and Poland. Regarding the period of financial crisis, it is shown that markets heavily rely on the minutes as the source of knowledge and the magnitudes of the estimate for the skew coefficient are much higher. The effect of experience is present in the case of CNB and National Bank of Poland (NBP).

JEL Classiýcation	D78, E43, E47, E52, E58
Keywords	voting, monetary policy transparency, central banks

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Abstrakt

Cieľom tejto práce je posúdiť informačnú silu záznamov hlasovania. Výskum sa zameriava na nasledujúce aspekty: predvídateľnosť budúcich repo zmien na základe záznamov z hlasovania v dlhších horizontoch, úroveň neistoty vo Výbore pre monetárnu politiku a očakávania finančných trhov, porovnanie výsledkov pre obdobie pred a počas finančnej krízy a prisudzovanie váh každému hlasu podľa účasti ľena na stretnutiach. Výsledky potvrdzujú, že hlasovacie záznamy sú informatívne v súvislosti s budúcimi zmenami v monetárnej politike a teda, zvyšujú predvídateľnosť určitých centrálnych bánk. Negatívny koeficient rozptylu pre Bank of England (BoE) a Česká národná banka (ČNB) naznačuje, že nárast neistoty podporuje uvoľnenejšiu monetárnu politiku. Pre BoE a Riksbank hlasovacie záznamy signalizujú zmenu úrokovej miery na ďalších stretnutiach, čo platí len čiastočne pre Česku republiku a Poľsko. Výsledky ďalej dokazujú, že trhy sa spoliehajú do väčšej miery na záznamy ako zdroj informácií a väčšosti koeficientov pre premennú skew sú oveľa vyššie. Vplyv skúseností je prítomný v ČNB a Národnej banke Poľska (NBP).

Klasifikace	D78, E43, E47, E52, E58
Klíčová slova	hlasování, transparence měnové politiky, centrální banky

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Acronyms

BoE	Bank of England
BoJ	Bank of Japan
CNB	Czech National Bank
ECB	European Central Bank
FED	Federal Reserve
LIBOR	London interbank offered rate
NBP	National Bank of Poland
MNB	Magyar Nemzeti Bank (Hungarian National Bank)
MPC	Monetary policy committee
UK	United Kingdom
WIBOR	Warsaw Interbank Offered Rate

Bachelor Thesis Proposal

The aim of this bachelor thesis is to examine whether publishing voting records can increase predictability of certain central banks. We will focus our research on the central banks of these inflation targeting countries: the Czech Republic, Hungary, Poland, Sweden, and the United Kingdom. We will try to answer the question whether the voting records can signal future monetary policy at next policy meeting. The uniqueness of this thesis stems from the fact that we will also examine the possible existence of signals of the monetary policy at longer horizons. Then, we will compare the results based on the data from the period before and during the financial crisis. We will use ordered probit model due to the discrete nature of the data. Finally, we expect we will analyze the sensitivity of the response of the financial markets to the voting of the governors and new members and judge whether financial markets tend to rely more on the strategy of voting of the governor and less on the strategy of the new ones.

1 Introduction

Recently, there has been a growing pressure on transparency in almost every field. Central banking is not an exception. In the past decades transparency of the conduct of monetary policy of most of the central banks increased significantly (Dincer et al., 2009). Lange et al. (2001) suggest that anticipation of monetary policy of FOMC in financial markets has significantly improved from mid 80´s to 2000. The disclosure of variety of information in different ways such as publishing the voting records is undoubtedly beneficial for making central banks more transparent. Is there any boundary that central bank transparency should not cross? Mishkin (2004) claims that increase of transparency will lead to complications in the communication and result in distraction of central banks from focusing on long-run objectives. Communication regarding financial stability is of greater importance in more developed financial systems. Monetary policy and financial system are, therefore, interconnected. Objectives of monetary policy cannot be fulfilled while the financial markets are not working properly and the financial system is not able to function appropriately within the environment of prevailing unstable currency. *ñThe financial system is the channel through which monetary policy affects the economy, its growth and inflation rates.ò (Baldwin et al., 2012)* Moreover, the mentioned publishing of the voting records can help the financial market correctly predict the future path of monetary policy (Horváth et al., 2012 or Gerlach-Kirsten, 2004). Research also provides empirical evidence that central banks are capable of influencing financial markets by the means of their communication, especially voting records and minutes (as well as statements and press conferences) (Knütter et al., 2011).

The aim of this bachelor thesis is to examine whether publishing voting records can increase predictability of certain central banks. We will focus our research on the central banks of these inflation targeting countries: the Czech Republic, Hungary, Poland, Sweden, and the United Kingdom. The main objective of our research is to answer the question whether the voting records can signal future monetary policy at next policy meeting. The analysis covers the period until 2014:M6.

The uniqueness of this thesis stems from examination of the possible existence of signals of the monetary policy at longer horizons. This might be very interesting since this field has not been covered so far and it could help us decide to reject or not reject the hypothesis of markets´ power to be more than one step ahead of the monetary policy decisions.

Financial crisis bursting out in 2008 brought some unexpected turnovers not only in lives of ordinary people, but also in the huge systems such as financial markets. Uncertainty risen during this turbulent period was a cause of markets´ inability to predict the future development. We try to shed more light on the informative power of the voting records published during the crisis. Furthermore, the comparison of the results based on the data from the period before and during the financial crisis will be provided and discussed.

Finally, we will analyze the sensitivity of the response of the financial markets to the voting of the governors and new members and judge whether financial markets tend to rely more on the strategy of voting of the governor and less on the strategy of the new ones. It is very essential to establish the potential of individual Monetary policy committee (MPC) members to influence the markets´ anticipation. Markets may trust less the votes of the new members since he is supposed to have less experience in the process of decision-making.

Changes in interest rates are not continuous and due to this discrete nature of the data the application of ordered probit model is the most suitable econometric approach. We will follow and extend the model presented by Horváth et al. (2012) in International Journal of Central Banking. While the previous research by Horváth et al. (2012) focused only on the signals of monetary policy changes at the next meeting, this thesis also examines whether voting records can help predict the changes made during the first and second meeting after the following one, e.g. we want to study the impact on the interest rate decision at time t+2 and t+3. Moreover, another extension of the previous paper is that the results before and during the financial crisis are compared. Furthermore, the calculation of the main variable is modified in order to capture the effect of experience and its impact on marketsô ability to anticipate the repo rate change.

The thesis is divided into seven sections and organized as following. The second chapter provides brief literature review, where the relevant studies are presented. Description of decision-making process in individual central banks is encompassed in the third chapter. The subsequent chapter presents data description. Econometric method and models used in this thesis are explained in details in chapter five. Empirical results are presented and discussed in the sixth chapter. Last chapter ï Conclusion summarizes the main findings of the empirical analysis.

2 Literature review

A myriad of empirical research of central banks has been performed in the last decades. Most of the analysis was focused on the central banks that are powerful and very influential at the same time, e.g. Federal Reserve (FED), Bank of England (BoE) and European Central Bank (ECB). We are aware of the worldwide significance of these. However, we decided to examine and have a closer look at relatively smaller central banks and include BoE as well. Although central banks we focus on in our empirical study might not be as important as FED or BoE in the global context, it does not imply that our research and their existence is meaningless. ó*Each central bank can be seen as a small, real-world laboratory of high stakes decision making.*ôô *(Eiffinger et al., 2013a)* In the following description we provide a literature review on available empirical studies concentrated on the importance of voting records, as one of the ways of central bank communication, for financial markets. Moreover, we include in this section an insight to the literature aiming at behavioral and preferential characteristics of committee members.

Ehrman et al. (2007) examine methods of MPC´s communication in 3 central banks- ECB, BoE, FED and existence of influence on financial markets. They suggest that markets can be influenced by MPC´s communication. This research paper proves that the FED communication strategy exerts the same effectiveness in terms of predictability and responsiveness of financial markets as that of the ECB, although their strategies differ. They conclude that "there may not be a single best approach to central bank communication".

Gerlach-Kristen (2004) examines possible informative ability of the MPC´s voting record concerning future United Kingdom (UK) monetary policy. This research paper provides evidence that the predictability of the future policy rate changes is increased by the voting record of the MPC. It is also suggested that publication of the voting records in the form of minutes is beneficial in terms of more transparent monetary policy. A proof of adjustment of the market expectation due to the minutes publication is also provided, as in Reeves et al. (2005). They investigate the

hypothesis if financial markets respond to different forms of BoE communication, such as minutes, inflation report, speeches and parliamentary committee hearings, and if these methods of communication convey relevant information to investors with a measurable impact on financial market prices. In their discussion paper they focus on the variance (rather than mean) of financial asset prices. A significant effect of BoE´s communication is found and they conclude that the responsiveness of financial markets to the publication of minutes can be observed. Another research paper analysing voting records in BoE was written by Brooks et al. (2008), who propose two-equation system consisting of a long-run equation, with the focus on a propensity to change the interest rate, and a short-run equation (adjustment equation) using a simple monetary policy rule. They also take into account unobserved heterogeneity in both equations and create the (Correlated) Inflated Ordered Probit. Applying the data of the BoE´s MPC members to the proposed model they find the evidence of different reactions of external and internal members of the MPC to the economic environment.

Besley et al. (2008) focus on the voting strategies of internals and externals in order to compare the differences between members according to their status, experience or academic background. The conclusion is that BoE MPC exerts heterogeneity in the decisions. Weber (2010) develops a theoretical model of individualistic decision policymaking and examines whether revealing of heterogeneous members´ views can enhance welfare. Reaction of financial market participants to the information in voting records depends on their ability to interpret correctly preferences of MPC members revealed in minutes. Financial markets can gain knowledge of public information precision and that will result in less noisy voting records and financial markets´ better attachment of correct weights to the public information. Therefore, there is an evidence of usefulness of publication of voting records in long horizons provided. However, this may not hold in the short term. Using spatial voting model, Eiffinger et al. (2013 a, b) try to estimate preferences of individual member of MPC for a certain policy. Providing thorough analysis of systematic patterns in preferences of BoE MPC members, the results show the presence of different diversity of policy preferences between internal and external committee members. Tendency to hold moderate policy preferences can be attributed to internal members whereas external

members prefer pronounced policies most of the times. Members having experience in the field of academia and industry exhibit more homogenous preferences than those with central banking experience. Focusing on Magyar Nemzeti Bank (Hungarian National Bank) (MNB) it is pointed out that most of the members of MPC in MNB is appointed by government (suggesting the possibility of member not being independent). They provide evidence of much more dovish preferences of external members than the internal ones which might be an indicator of a political appointment channel. In National Bank of Poland (NBP) members appointed by the president tended to have dovish preferences (during the period of seven years 1998-2004), whereas in 2004-2010 the dovish preferences were much more typical for the appointees by the lower house. Furthermore, the research paper shows that 2 out of 3 governors of the Czech National Bank (CNB) were dovish, where the other one seemed to hold the middle ground. The chairmen of the Riksbank appear to stand for the centrist position. This fact is in favour of a perception of a chairman as a builder of consensus. Gerlach-Kristen (2008) further investigates the importance of the chairman in the process of setting monetary policy in 2 different types of collegial MPCs, focusing on the path of interest rates and the distribution of votes, omitting the assumption of strategic behaviour of committee members. An evidence of positive correlation between the quality of interest rate setting and Chairman´s "economic" and "moderating" skills is provided. Another important issue is dissenting from majority. Recent study (Horváth et al., 2014) examines factors of dissenting. Results show that economic factors (except of the volatility of food prices), psychological factors and status (position) are not important determinants of dissent.

Promptly release of the minutes with voting records attached by National Bank of Poland is very important for better public anticipation of monetary policy and predictability. Research has also shown that reduction of the informational asymmetry and refinement of the public understanding of the monetary policy process emerges from the publication of voting records (Sirchenko, 2010).

Although, the ECB does not publish voting records (one of the reasons might be pressure of pursuing national interests), they hold press conferences. Research paper

by Gies (2005) provides evidence of significant reaction of the market rates to the bias occurring in the statements, in particular to statement changes in consecutive meetings. Furthermore, he suggests that expectations of future monetary policy are significantly influenced by the communication of the ECB on meeting days. Jansen et al. (2006) concentrate their research on the ECB as well and try to answer the question whether its communication and macroeconomic data are helpful for predictability of its interest rate decisions using ordered probit model based on Taylor rule. They find that changes in expectations of inflation, economic sentiment and comments on future inflation and the main refinancing rate are useful for prediction of interest rate decisions. The models exhibit some difficulties in explanations of changes in the rate but usually predict correctly the cases of unchanged rates.

3 Decision-making process in central banks and voting records

3.1 The Czech National Bank

The meetings of the Bank Board were held on a monthly basis until 2007. Since 2008 the MPC members meet up eight times a year - at the end of March, June, September and December, at the beginning of February, May, August and November. The Monetary Policy Recommendation, which involves reasoning for setting lower or higher interest rates and a recommendation made by the Monetary and Statistics Department, is presented during the meeting. After the presentation, MPC members discuss possible uncertainties as well as risks of the current forecast. This discussion is followed by voting on the monetary policy action. Unanimous voting is not always a result of this process and the final decision may not correspond with the message of the current forecast and the recommendation. The immediate disclosure of the adopted measures is made in the press release, and subsequently during the afternoon press conference the explanation and description of details of the measures is provided together with ratio of the votes cast. Eight days later, the minutes including report of the discussion and the record of individual membersô votes attached with their names. However, attributing names was not always the practice. ôô*Voting ratio was released without an explicit statement on how the individual board members voted for the monetary policy decisions in the Czech Republic in 2000ï 07. From mid-2000 to January 2006 the (unattributed) voting record was published in the minutes only, while since February 2006 the voting record has been released at the press conference held about three hours after the announcement of the interest rate decision.*ôô*(Horváth et al., 2012)*

3.2 The Riksbank ï central bank of Sweden

The Executive Board leading the Riksbank consists of six members who meet up six months a year on prescheduled monetary policy meetings. Report of staff´s view of future development of economic activity and inflation is presented to the Executive Board. However, Monetary Policy Report is published together with the announcement of the monetary policy decision included in the press release. In contrast with the Czech National Bank, press release is published no sooner than the

day after the meeting. Moreover, the minutes are released approximately two weeks after the meeting, containing the record of the discussion based on which the decision on interest rate was made, as well as individual members´ reasoning for their votes. If the differences in opinions occur and there is no majority identified, the Governor of the Riksbank has the casting vote (Riksbank webpage).

3.3 The National Bank of Poland

The voting records started to be published and included in the quarterly Inflation Report 2001. MPC holds meetings every month, where individual preferences for interest rates are revealed together with the reasoning behind the proposal. The chairman chooses the most õextremeö proposal followed by voting on this interest rate. Voting on the next proposal is held if the majority does not agree on the former one and this continues unless the majority of the votes is reached. The MPC consists of nine external members (appointed by the upper house of Parliament, its lower house, and the President of the Republic) and one internal member, the chairman, with mandates of six years. (Sirchenko, 2011)

3.4 The Hungarian National Bank

In 2004 the Hungarian National Bank published minutes including voting record, however, it was just in a form of balance of votes (without attribution). Attribution of individual votes to members started to be included only in October 2005. Soon after, in October 2008, during the most turbulent time of the crisis, they did not provide the voting record. The Monetary Council meets up on a monthly basis without having pre-meetings. Committee members take into consideration Bank´s Inflation Report while deciding on interest rate. Interest rate setting discussion consists of two stages. In the first stage individual members express their preferences for interest rates, where the chairman is the last one to reveal his preference, and in the second stage they comment on the options proposed (Jung et al., 2012). The formal voting follows and right after that the MPC statement is released. At the moment the Monetary Council is composed of four externals and three internal members who are appointed for six years. However, the size was not always the same as it is now.

3.5 The Bank of England

The MPC is composed of nine members ï four externals appointed by Chancellor and five internals, who meet up every month for two days, typically Wednesday and Thursday. Announcement of the interest rate is released on the second day at noon. The minutes together with the voting record are published on Wednesday, second week after the meeting. Each member of the MPC has one vote and in case of no majority agreeing during the decision-making process, the Chairman has the casting vote (BoE webpage). It is stated in the legislation that in national interest the Government can intervene in the process of interest rate setting and give instructions to the Bank concerning the interest rate. But this applies only in extreme circumstances and lasts just for limited period.

4 Econometric method and models

Since preferences as well as information sets of MPC members can differ, they might have different opinions on the appropriate level of interest rate. This gives space for disagreement, which is one of the cornerstones of our research. In order to measure the degree of disagreement at time *t* we will use the variable *skew* defined as the difference between the average interest rate voted for by members of the monetary committee at time *t* and the monetary policy rate by at time *t* , as proposed by Gerlach-Kristen (2004).

$$skew_t = average(i_{j,t}) - i_t \quad (1)$$

If MPC members unanimously agree on the interest rate, then the average interest rate is equal to the repo rate i_t. This case, however, does not always occur in reality (more in section data description). Assuming that one member deviates from the rest and decides to vote for the lower rate leads to average vote lower than the repo rate and therefore, resulting in negative skew. Thus, this observation suggests direct relationship between the size of the dissenting minority and average interest rate voted for.

Following Horváth et al. (2012) we estimate the regression model for individual countries in order to provide assessment of informative character of voting records with regard to future monetary policy. At the beginning a simple model (2) will be estimated.

$$\Delta i_{t+1} = a_0 + a_1 \Delta i_t + a_2 skew_{(t)} + u_{t+1} \quad (2)$$

Throughout building the model the following notes were made:

The MPC decides on interest rate at time *t*.

The publication of the votes is made at time U(t), in the period bounded by *t* and *t+1* (time of subsequent interest rate decision). As it could have been noticed from the part describing voting process, minutes including the voting records are usually published within two weeks after the interest rate decision at *t*.

As a method of estimation ordered probit technique is used. This method was chosen due to the discrete nature of interest rates (Greene, 2003). For the measure of goodness of fit we calculate adjusted pseudo R-squared (McFaddenôs) based on the log likelihood of restricted and full model (Shtatland et al., 2002).

Following the approach suggested by Horváth et al. (2012) we classify the dependent variable based on its magnitude into five categories: large decrease, decrease, no change, hike, and large hike.[1]

We expect parameters a_1 and a_2 to be positive. As noted above, skew depends on the deviation of MPC members from the actually approved repo rate. Therefore, if some of them prefer higher interest rate, skew is positive and thus, under assumption of informative power of voting records, there is higher probability that the future interest rate increases. Coefficient a_1 explains the process of interest rate smoothing and policy makers trying to avoid unexpected policy changes. Significance of the coefficient a_2 implies that the voting record contains extra information based on which interest rate is formed in the subsequent period.

The model is further extended by including the information that can be obtained by the ýnancial markets. This information set can be approximated from the yield curve. If there is some information known by the MPC members but unknown to the financial markets, voting records can be considered as an additional source of knowledge for markets´ participants. Hence, we would expect parameter b_1 to be significant. In case that agents possess the same information as the MPC members (therefore, the same as in the minutes published) and their ability to evaluate it is as effective as bank board members´, b_2 should be insignificant.

Furthermore, taking into account uncertainty that bank members face, dispersion as a proxy for the uncertainty is added to the model. This new independent variable is measured as standard deviation of the individual votes.

Model representing these ideas can be written as:

[1] ≤−50,−25, 0, +25, and≥+50 basis point changes, respec□vely

$$\Delta i_{t+1} = b_0 + b_1 \Delta i_t + b_2 skew_{\sigma(t)} + b_3 (i_{\sigma(t),L} - i_{\sigma(t),S}) + b_4 dispersion_t + u_{t+1} \quad (3)$$

Slope of the term structure is described as difference $i_{\sigma(t),L} - i_{\sigma(t),S}$ (three-month interbank rate and one-month interbank rate 3M – 1M or alternatively difference between one-year and three-month interbank rate 12M – 3M), L and S represent long and short maturities (L>S). σ(t) describes the time period between the new and old interest rate decision, and the data on interbank offered rates will be chosen from the day before the voting record was published in the minutes (e.g. σ(t)<Ű(t)). It is not obvious what sign of b_4 we should expect, even though less uncertainty could suggest tighter monetary policy (Bekaert et al., 2010 and Soderstrom, 2002).

This model provides basis for answering the main research question whether the voting records can signal future monetary policy at next policy meeting. Based on the outcome of the significance of the skew coefficient we will be able to assess the informative power of the minutes. Even though this might be very interesting to observe, influence of the voting records on future monetary policy at longer horizons may raise some new implications. In order to test the idea we rebuild model (3). Firstly, we want to study the impact on the interest rate decision at time t+2. The respective model can be written as:

$$\Delta i_{t+2} = b_0 + b_1 \Delta i_t + b_2 skew_{\sigma(t)} + u_{t+2} \quad (4)$$

And when controlling for markets' expectations:

$$\Delta i_{t+2} = b_0 + b_1 \Delta i_t + b_2 skew_{\sigma(t)} + b_3 (i_{\sigma(t),L} - i_{\sigma(t),S}) + u_{t+2} \quad (4.1)$$

Secondly, our focus will be aimed at the impact on the interest rate decision at time t+3. Respective model will be created in a similar manner as the previous one:

$$\Delta i_{t+3} = b_0 + b_1 \Delta i_t + b_2 skew_{\sigma(t)} + u_{t+3} \quad (5)$$

And if we account for markets' expectations:

$$\Delta i_{t+3} = b_0 + b_1 \Delta i_t + b_2 skew_{\sigma(t)} + b_3 (i_{\sigma(t),L} - i_{\sigma(t),S}) + u_{t+3} \quad (5.1)$$

Significance of coefficient b_1 will suggest whether to reject our null hypothesis of the informative power of the minutes or not. However, our research does not stop at this stage and goes further - sensitivity analysis of the response of the financial markets to the voting of particular MPC members is examined. The aim is to clarify whether

financial markets tend to rely more on the strategy of voting of the governor and less on the strategy of the new members or whether they do not take this type of factor into consideration at all. In order to account for this fact, we will attribute different weights to individual members based on the number of meetings the member was present ï the more meetings the higher the weight to his vote due to assumed longer experience in the field. We set arbitrarily the weight for the governor twice as high as for the most ñexperiencedò member. In case that each member attended the same amount of meetings, the weights will be the same for each member (except for the governor).

Hence, the skew* is calculated as:

$$skew_t^* = \frac{\text{[illegible]}}{\frac{\sum \text{[illegible]}}{N}} - \text{[illegible]} \quad (6)$$

Where, N is number of members present at meeting at time t, n_m is number of meetings attended so far by member m, n_j is the maximum of $\{n_1,....n_k\}$ (k - number of members present excluding governor, therefore $N=k+1$ and $j \in \{1,...,k\}$), i_G represents interest rate voted by governor.

Substituting $skew_t$ by $skew_t^*$ model (2) is re-estimated.

$$\Delta i_{t+1} = \beta_0 + \beta_1 \Delta i_t + \beta_2 skew^*_{t(t)} + u_{t+1} \quad (7)$$

If the outcome of the regression is that parameter β_1 is insignificant, it will suggest that markets´ participants do not care whether minutes contain attributed or unattributed voting records. Otherwise, it would mean that financial markets take into account while making decisions even the experience of MPC members.

Finally, we divide our datasets in two subgroups according to period ï before and during financial crisis and re-estimate models (3) (dispersion variable excluded), (4.1) and (5.1) for the period during financial crisis, containing data obtained from the period 2007:M8-2014:M6. This will enable us to compare the possible change of informative power of the minutes due to uncertainty risen during 2007 in respective countries.

5 Data description

Dataset used during the research contains information on voting of individual members of MPC and interbank offered rate representing expectations of financial markets. These data were sufficient for calculation of the variables skew, dispersion and changes in interest rates that are needed for the regression models. The analysis focuses on particular inflation targeting central banks and therefore, the data collected concentrate on financial markets and monetary policy of the Czech Republic, Hungary, Poland, Sweden and the United Kingdom. Since the history and development of the particular central banks differs, the observation period is not the same. Following periods were used: for the sample of voting records in the Czech Republic 1998:M2 - 2014:M6, Hungary 2005:M10 - 2014:M5, Poland 2000:M2 - 2009:M12, Sweden 1999:M1 - 2014:M6 and in the United Kingdom 1997:M7 - 2014:M6.

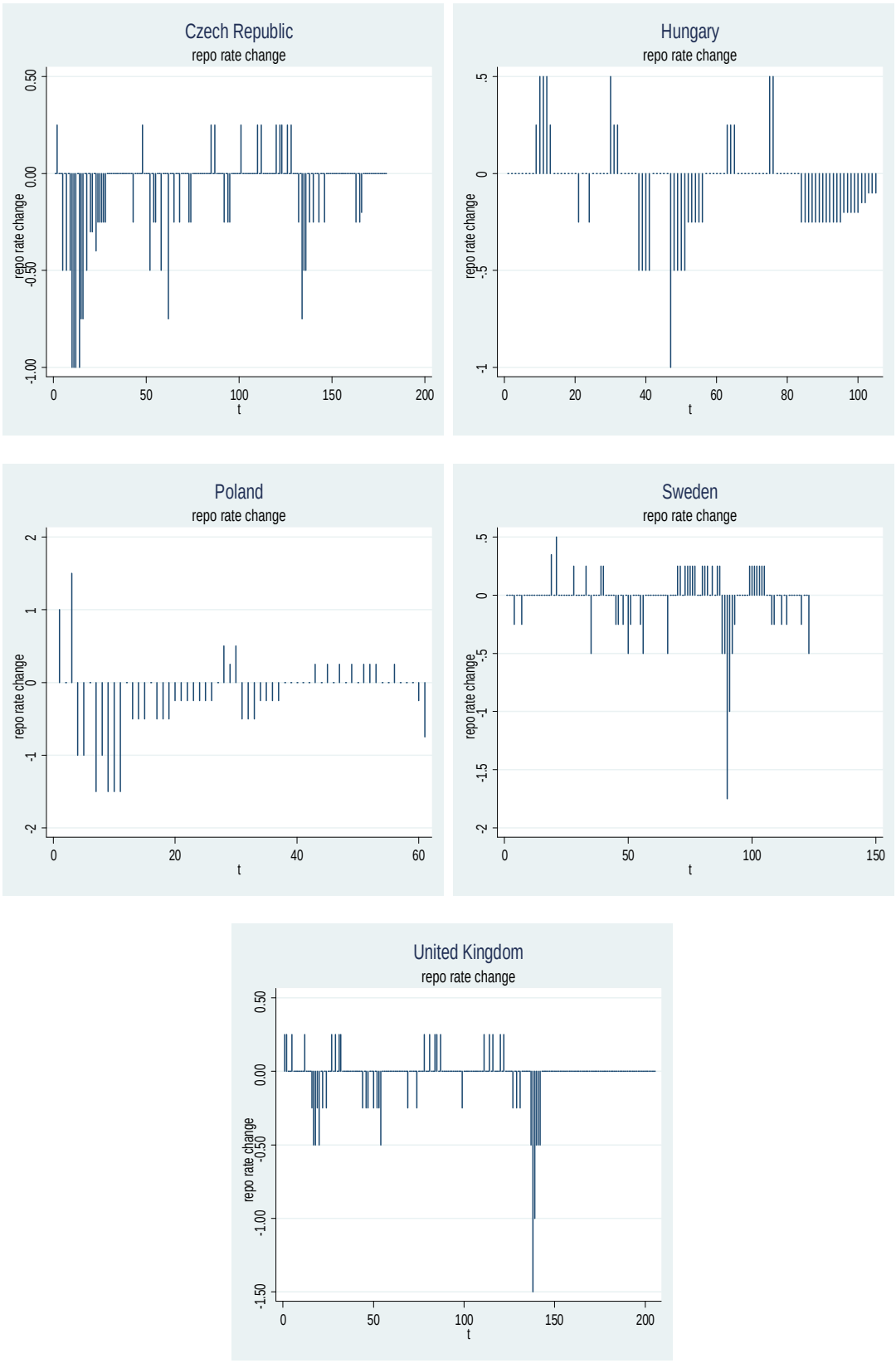
Due to different length of time periods for individual central banks even the number of observations varies: 178, 105, 61, 123, and 205 (the Czech Republic, Hungary, Poland, Sweden, the United Kingdom, respectively). The reason behind having shorter period of observations for Poland is unavailability of individual voting records. Although the National Bank of Poland publishes on its web pages voting records, they contain information only about votes for and against particular interest rate change and no precise numerical votes.

Throughout the work various sources of data were used. For information on voting of individual members of the bank boards, voting records published by respective central banks (e.g. CNB, Riksbank, MNB, BoE, NBP) as well as interbank offered rates for the Czech Republic, Sweden and Hungary were obtained from the banks´ web pages. As a source of information on London interbank offered rate (LIBOR), time series by Federal Reserve Economic Data were included. Furthermore, Polish interbank offered rates Warsaw Interbank Offered Rate (WIBOR) were collected from Stooq.pl. Regarding the data about voting in the NBP, we used the same dataset

as in the research by Horváth et al. (2012). It needs to be highlighted that Sweden has not used 12 month maturity since 2013.

Frequency of unanimous voting is not the same in these central banks. Statistics for our sample periods show that members of MPC voted unanimously in the United Kingdom at 48,06% of all meetings, in Sweden 42,28% voting was unanimous, no dissents in the CNB were recorded at 42,7% meetings and MPC of MNB exhibits the smallest % of meetings without dissenting votes - 25,47%. Voting in the NBP was not unanimous in 46% of cases. These huge differences might be connected with the size of the MPC.

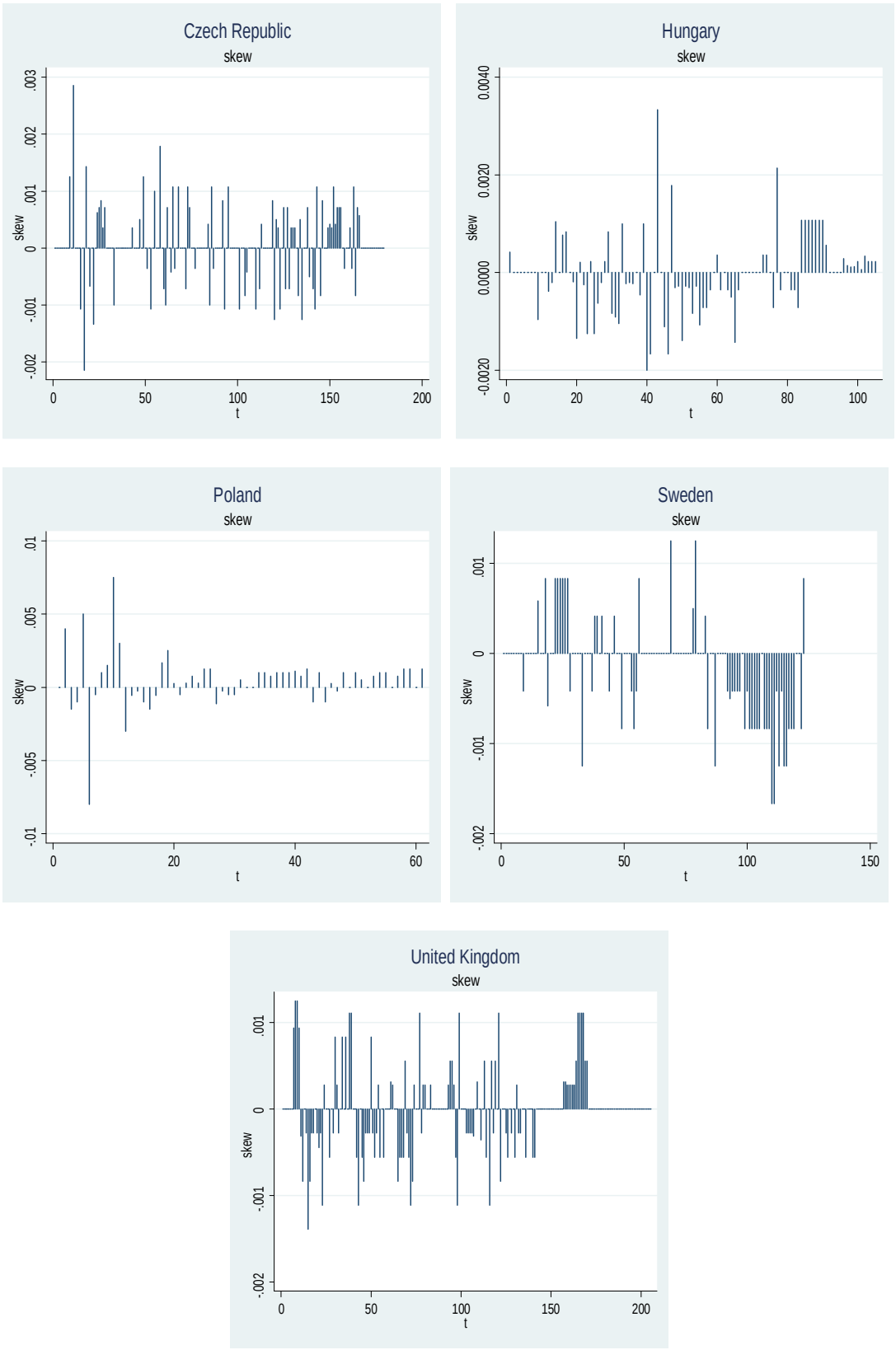
Figure 1: Repo rate change - time series



Note: x axis ï t denotes the number of the meeting in sequence in our sample
Source: Authorôs calculations

The biggest decrease in interest rate (1,75%) in our sample could be observed in Sweden 3 December 2008. Similarly, MPC of BoE decided to decrease the rate by 1,5% 6 November 2008. Hungary and the Czech Republic were more moderate and never decreased the interest rate by more than 1% (27 September 2009 and December 1998, respectively). This suggests that the most radical changes were applied during the financial crisis. Interestingly, interest rate in the United Kingdom have not changed since 5 March 2009 and repo rate of the Czech Republic has remained at the same level (0,5%) for almost two years. In Poland, the highest increase of the repo rate approved was 1,5% (August 2000) and the lowest -1,5% in 2001.

Figure 2: Skew - time series



Note: x axis ï t denotes the number of the meeting in sequence in our sample
Source: Authorôs calculations

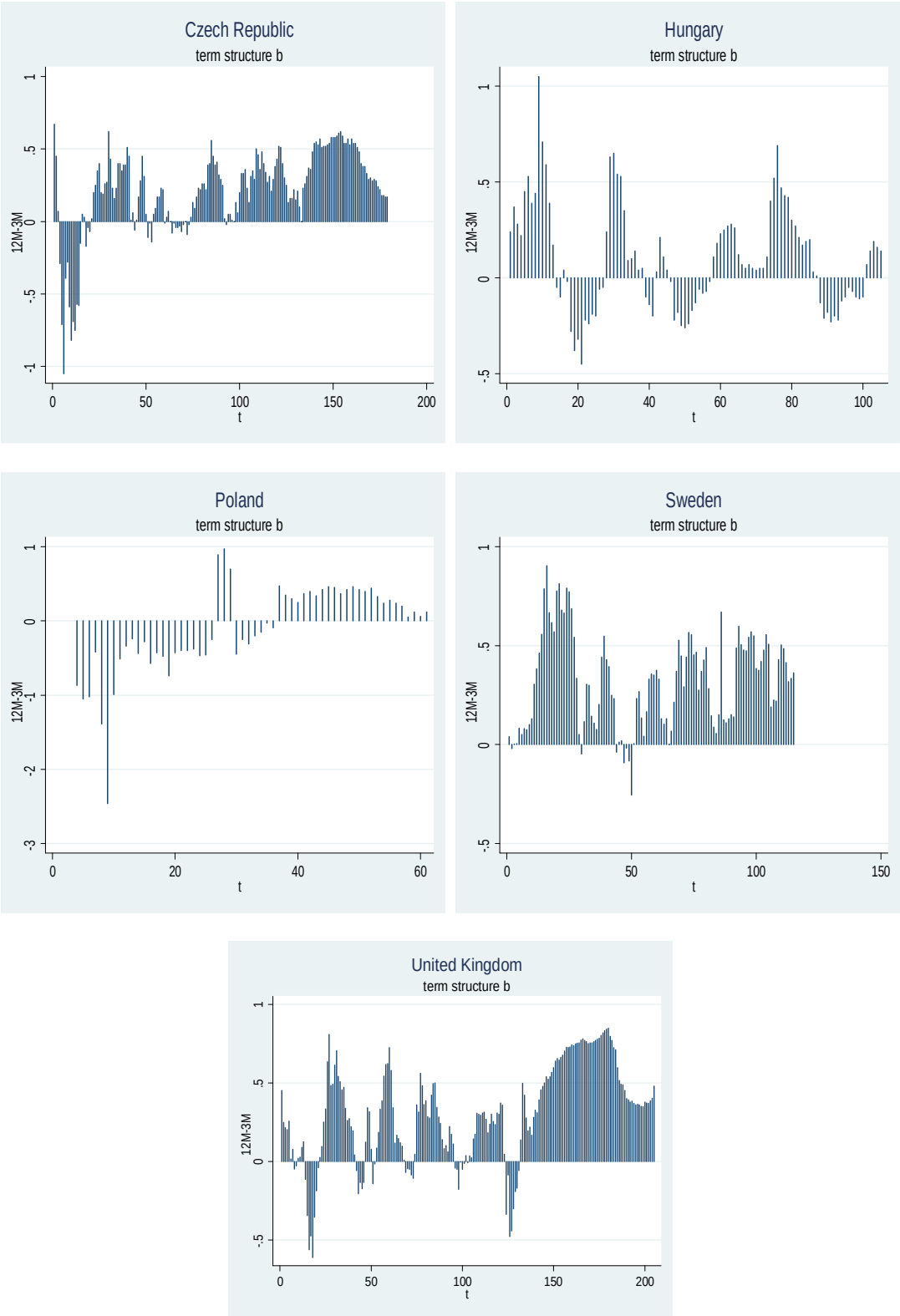
In the Czech Republic skew remains the same 0% since December 2012 due no dissents. The biggest disagreements are observed at the beginning of the time series (1998). The values of skew did not exceed 0,2% since then. The lowest skew value is -0,21% and the highest is 0,29%. During the last 14 meetings skew did not exceed 0,3% in MNB. The largest degree of disagreement was in absolute terms 0,33% and -0,2%. For the case of Poland the magnitudes of skew are not so diverse as in the Czech Republic and Hungary. The lowest and highest skew value observed are -0,8% and 0,75%, respectively. The most frequent skew values are 0 and -0,083% for the Riksbank. The disagreement level ranges from -0,167% to 0,125%. In the United Kingdom, there has been unanimous voting since August 2011. The lowest skew value is -0,14% and the highest is 0,125%.

Figure 3: Term structure a - time series

Note: x axis ï t denotes the number of the meeting in sequence in our sample, term structure a stands for difference between 3M and 1M interbank offered rate
Source: Authorôs calculations

Czech data show that the difference 3M-1M exerts values from -0,74% (November 1998) to 0,45% (October 1999). The largest value for the term structure is 0,64% (June 2006) and the lowest -0,22% (April 2007) in MNB case. For the case of NBP, the largest difference 1,12% was observed in June 2000. The smallest slope of the term structure is -1,35% (October 2001) in our sample for Poland. As for the Riksbank, proxy for market expectations takes on values from -0,11% (June 2003) up to 0,68% (October 1999). Marketsô expectations, calculated as the difference between three month and one month maturity, ranges from -0,28% to 0,68% (October 1998 and December 2008, respectively) in the United Kingdom.

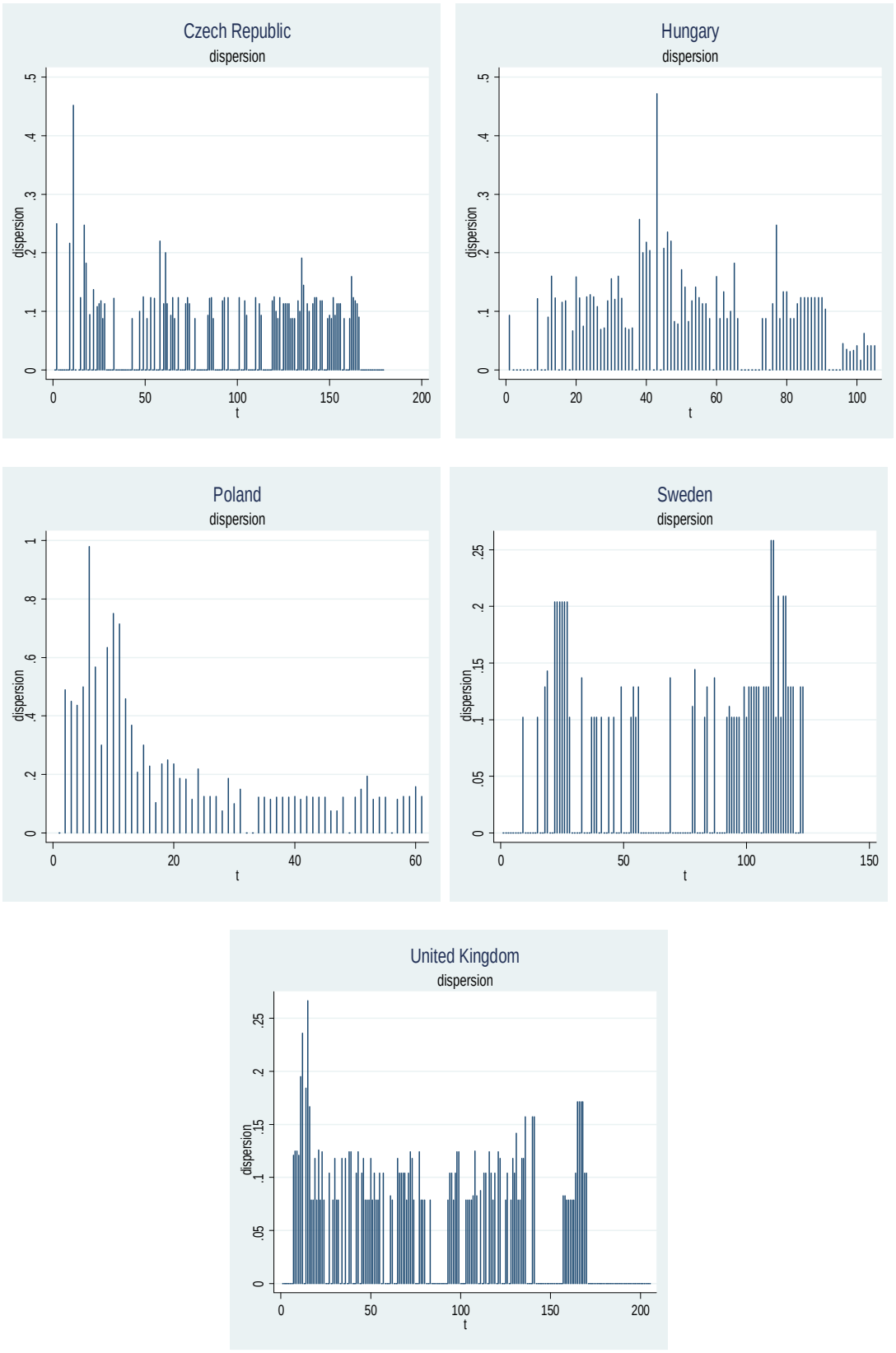
Figure 4: Term structure b - time series



Note: x axis ï t denotes the number of the meeting in sequence in our sample, term structure b stands for difference between 12M and 3M interbank offered rate
Source: Authorôs calculations

Marketsô expectations, calculated as the difference between twelve month and three month maturity, ranges from -1,05% to 0,67% (1998) in the Czech Republic. As for the Riksbank, proxy for market expectations takes on values from -0,26% (June 2003) up to 0,90% (August 1999). For the case of MNB, the largest difference 1,05% was observed in June 2006. The smallest slope of the term structure is -0,45% (June 2007) in our sample for Hungary. Polish data show that the difference exerts values from -2,46% (October 2001) to 0,97% (June 2004). The largest value for the term structure is 0,85% (May 2012) and the lowest -0,61% (December, 1998) in BoE case.

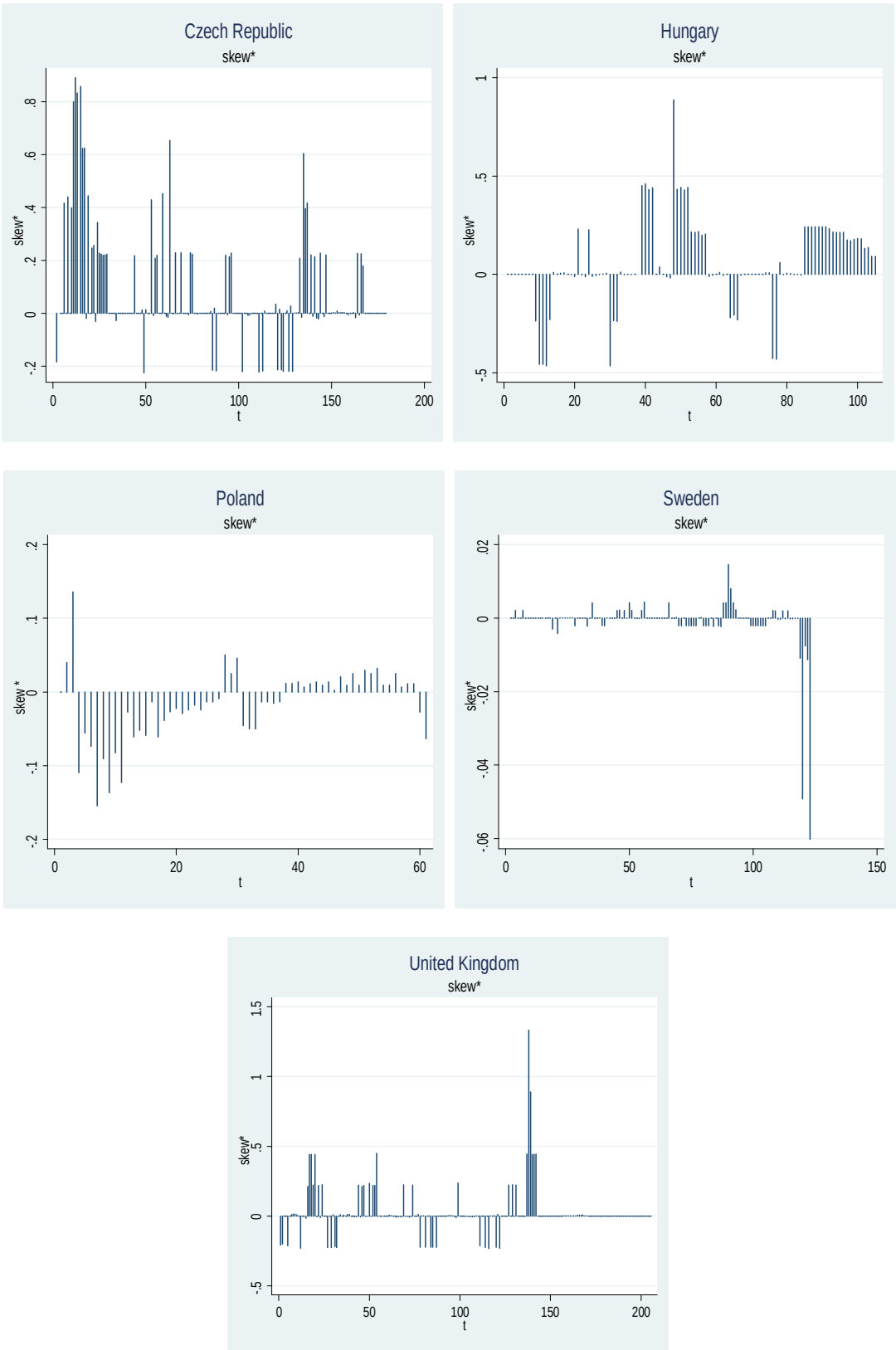
Figure 5: Dispersion - time series



Note: x axis ï t denotes the number of the meeting in sequence in our sample
Source: Authorôs calculations

In the Czech Republic, the highest level of uncertainty was reported in November 1998. Since December 2012 the magnitudes are equal to 0. In the case of Hungary, the dispersion reached the largest value 0,47% in February 2009 during the financial crisis. As for the Poland, MPC members faced the biggest uncertainty 0,98% in May 2001. The degree of uncertainty reached the highest level 0,26% in April and July 2012 and stayed at the same level 0,13% from October 2010 until July 2011 in case of the Riksbank. 0,26% was the largest dispersion (reported in September 1998) in the United Kingdom.

Figure 6: Skew* - time series



Note: x axis ï t denotes the number of the meeting in sequence in our sample
Source: Authorôs calculations

In the Czech Republic the lowest skew* value is -0,22% and the highest is 0,89%. The largest weighted degree of disagreement was 0,89% in August 2009 and -0,46% in September 2006 in the MNB. For the case of Poland the magnitudes of skew* are in the range from -0,15% (June 2001) to 0,14% (August 2000), while the weighted disagreement level in the Riksbank ranges from -0,06% (February 2000) to 0,015% (December 2008). In the United Kingdom the lowest skew* value is -0,2% (January 2007) and the highest is 1,33% (November 2008).

6 Empirical results

In this chapter empirical results of the analysis are presented for individual central banks. Specifically, the main attention is paid to the significance of the variable skew, which determines informative power of the minutes. Reports of the results and their interpretation are structured in the following manner: basic model, extended model, models for longer horizons, financial crisis period, effect of experience and summary of the main findings. Furthermore, comparisons with the related literature and cross-country comparisons are provided. In this section similarities and differences among the 5 central banks are pointed out.

6.1 The Bank of England

Basic model

Table 1 shows results of the regression (2). It can be seen that variable skew is significant at 1% level and the same holds also for the lagged interest rate change, implying interest rate smoothing and avoiding unexpected decisions for changes of interest rates. These two coefficients are positive as expected. Adjusted pseudo R-squared is 0,284, which is considered a good fit.

Extended model

After including expectations of the financial markets and dispersion, significance levels of parameters b_1 and b_2 do not change, however, their magnitudes change slightly. The estimate of b_4 is significant at 5% level and exerts negative sign. This suggests that the higher uncertainty is one of the reasons behind the decision for looser monetary policy. Regarding financial marketsô expectations, parameter b_3 is insignificant for both alternatives. However, estimation without dispersion gives significant b_3 (at 10%, but not for alternative specification 3M-1M). Therefore, expectations are not important for prediction of future monetary policy rate as long as information about the degree of disagreement and level of uncertainty are available. Adjusted pseudo R-squared takes value of approximately 0,31. (Table 2)

Models for longer horizons

Table 3 displays results of the regression models (4) and (5). In both cases the lagged interest rate change as well as skew parameters are significant at 1% with adjusted pseudo R-squared taking values 0,22 and 0,11, respectively. After controlling for the term structure, the significance level of skew changes only for model 5.1 with alternative term structure (12M ï 3M) to 5%. Coefficient b_3 is not significant for the case 3M ï 1M. It can be further noticed that the magnitudes are much lower in comparison with the regression for the subsequent period. Hence, we can conclude that level of disagreement in the MPC of the BoE has impact on anticipating interest changes even in longer horizons, although it might not be so strong.

Financial crisis

Using only data from 2007:M8 and onwards model (3) is re-estimated, dispersion excluding (table 4) and also models (4.1) as well as (5.1) (tables 4.1 and 4.2, respectively. Including slope of the term structure as 3M-1M, we get that skew and the lagged interest rate change are significant at 5%. Applying alternative difference for the market expectations, significance level for both coefficients is 1%. If we compare our results with those for data until the financial crisis reported by Horváth et al. (2012), it can be concluded that even though the significance level is higher, the magnitudes are much higher. Thus, voting records are of greater importance and provide information about future monetary policy also during the financial crisis. Regarding regression (4.1) and (5.1), skew remains significant at 10% only in case of model (4.1) including term structure as 3M ï 1M. For the rest of the regressions it is not significant. If data until financial crisis are applied, estimate of b_2 is significant at 5% (except for regression 5.1 alternative term structure, where it is 10%). It can be concluded that during the financial crisis voting records have the ability to predict the repo change only for time t+2 and therefore, their informative power decreased in comparison with period before financial crisis.

Effect of experience

Results of the regression (7) prove that $skew_t^*$ is not significant. Therefore, it can be said that financial markets do not attribute different weights to votes of individual members of the bank board and there is no ôeffect of experienceôõ.

Main findings

All in all, voting records play very important role in predicting future monetary policy. The results show that they are not helpful only for short horizons but also for longer ones. Adding financial marketsô expectations to our first model, it is revealed that minutes contain additional information that would not be known by markets otherwise. This knowledge is, therefore, beneficial and enables better anticipating. Moreover, it is found out that also the level of uncertainty influence future interest rate change. To be more precise, negative coefficient suggests that more uncertainty induces looser monetary policy. Even after controlling for dispersion, skew remains significant. As for the experience of MPC members, it is found out it has no influence on predictability of future monetary policy. Our models represent very good regression fit due to values taken on by McFaddenôs R-squared ranging from 0,11 to 0,74.

6.2 The Riksbank

Basic model

After executing regression (2) we got that skew and lagged interest rate change are significant at 1% and have positive sign as expected. Therefore, our conclusions of interest rate smoothing (sometimes referred to interest rate gradualism, Brooks et al., 2008) and sudden changes of interest rate as for the case of BoE hold. McFaddenôs R-squared is equal to approximately 0,18.

Extended model

In the next step we added expectations of financial marketsô participants and dispersion to our original model. It can be seen (Table 2) that magnitudes of b_1 and b_2 changed slightly (signs remaining the same) while their significance stayed unchanged 1%. Even term structure b_3 is significant at 5% (1% for alternative). This

implies that financial markets do not have the same information as members of MPC or cannot process it as efficiently as bank board members. Hence, voting records reveal extra information to agents. Coefficient b_4 for dispersion exerts negative sign, however, it is not significant. Thus, level of uncertainty faced by bank board members does not play a role in predicting future interest rate change. In addition, our results are robust to including dispersion and financial marketsô expectations. Regarding adjusted pseudo R-squared, it takes on values 0,20 and 0,28 for the alternative (12M-3M). These values are considered to be very good.

Models for longer horizons

Looking at the results of regression (4) and (5), we can conclude that skew remains significant, but significance level is higher ï 5%. However, the magnitude of coefficient b_2 is much smaller than in the previous regression (3). This means that minutes serve as one of the relevant tools for predicting future monetary policy change even for longer horizons than subsequent meeting. Coefficient b_1 is significant at 1% as in the previous case but of smaller magnitude. Adjusted pseudo R-squared is approximately 0,08 and 0,06 for models (4) and (5) respectively. It is very small and suggests that the models miss other explanatory variables. When expectations of the financial markets are accounted for in these models, significance level of b_2 changes to 10% in case of model 5.1 including alternative term structure, but stays unchanged 5% for the rest of the cases.

Financial crisis

To account for financial crisis we include data only after August 2007. Results in the table (4) show that magnitudes of skew coefficient b_2 are higher and the significance levels are lower (1%) in comparison with the results for the period before financial crisis. The same holds for the lagged interest rate change coefficient b_1. However, expectations (3M-1M) are insignificant, whereas the alternative is significant at 1% level. Financial markets, therefore, attribute more importance to information included in the minutes during the crisis than before. Adjusted pseudo R-squared exerts value of 0,55. The results of regressions (4.1) and (5.1) show that skew is not

significant if data during crisis are applied. However, if we account only for the period before the crisis, estimate of b_2 is significant at 5% (10% for alternative) in model (4.1). In case of model (5.1) skew is insignificant. This suggests that importance of the voting records and their ability to help anticipate future monetary policy change in longer horizons decreased as the financial crisis began. Adjusted pseudo R-squared is very low in these regressions, with the highest value of 0,12.

Effect of experience

$\check{U}_2$ coefficient is insignificant, suggesting that participants of financial markets do not take into account whether the particular vote was done by a new member or old (or the chairman).

Main findings

To sum up, voting records contain relevant information for financial markets and are informative about future interest rate change. They are significant in all of the regression models. Furthermore, it implies that minutes can be used for anticipating future change of the interest rates for more than 1 meeting ahead and thus, enhance the predictability for longer horizons. Level of uncertainty is not significant in our models for Swedish environment. Additionally, skew as a measure of disagreement, remains significant during the crisis, whereas short run marketsô expectations are not. Informative character of the minutes decreased in regard to anticipation for long horizons. Model (7) gives evidence that experience of individual members does not have impact on explanation of future repo rate changes. Since the adjusted pseudo R-squared for individual models is reasonably high (except for (4) and (5)), these models can be considered to be very good and fairly representing actual predictability of the Riksbank.

6.3 The Czech National Bank

Basic model

Regression (2) gives us outcome that is in accordance with our null hypothesis (skew is significant and hence, minutes are informative). To be more precise, reported significance level for both ï skew and lagged two week repo rate coefficients, is 1%.

Moreover, they are positive. Interpretation of this result from economic point of view is that publishing voting records help improve predictability of future monetary policy change and policy makers prefer changing interest rates in series of small steps instead of few large ones (smoothing).

Extended model

McFaddenôs R-squared is very small for regression (2), it is only 0,13 and suggests that some independent variables should be included. We added to the original model (2) dispersion and term structure, which caused an increase in adjusted pseudo R-squared to 0,21 (0,24 for alternative term structure) suggesting better model. All of the coefficients are positive (except for the dispersion which exerts negative sign) and significant at 1% level (Table 2). It is observed that magnitudes of b_1 and b_2 changed just slightly. Significance of b_2 leads us to conclusion that minutes contain additional information useful for financial markets indeed. Negative b_4 can be interpreted as following: more uncertainty faced by policy makers triggers laxer monetary policy and hence, not so aggressive responses to shocks.

Models for longer horizons

Regarding model (4), it is found out that skew coefficient b_2 is significant at 10%, however, it is of much smaller magnitude than in the regression (2). McFaddenôs R-squared is only 0,12. Results of the regression (4.1) suggest that skew remains significant at 10% (except for the alternative 12M ï 3M, where it is insignificant). Adjusted pseudo R-squared increases only slightly to 0,13 (0,16 for the alternative term structure).

In case of model (5), the regression provides that skew is not significant and McFaddenôs R-squared is even smaller than in (4). The same conclusions hold for the regression of model (5.1). Small adjusted pseudo R-squared implies that both models could be improved, e.g. by including more independent variables in order to increase the goodness of fit. Different significance of skew parameters suggest that information obtained from minutes are helpful only for predicting changes at the meeting after the subsequent one and do not have any influence on predicting changes at longer horizons than this one.

Financial crisis

Table 4 shows that skew remains significant at 1% as it was before the financial crisis, however, it is of higher magnitude, suggesting a bit stronger influence on future monetary policy change. Regarding coefficient for lagged interest rate change it remains approximately the same except for the case alternative term structure, where it is higher than in the period until August 2007. Surprisingly, the sign of the term structure is negative and therefore opposite to results for the data before the financial crisis. Regarding the predictions for longer horizons, estimates of b_2 are insignificant before the crisis as well as during.

Effect of experience

From the regression (7) it can be seen that $skew_t$* is significant at 1% level. It indicates that effect of experience is present in the Czech environment and suggests that financial markets take into consideration even the number of meetings a member has attended so far, or whether it is governor who voted for a particular change of interest rate and attribute the importance of the vote according to this criterion. The estimate exerts negative sign, which is rather unexpected, indicating that the probability of the increase in repo rate decreases as the skew gets larger.

Main findings

Results confirm our expectations that voting records are informative and beneficial. It is shown that significance stayed the same even after controlling for uncertainty and marketsô expectations. Additionally, minutes can be viewed as a source of extra knowledge for financial markets. Even though, they cannot help predict the interest rate change at time t+3, it is possible to use the information contained in the voting records to anticipate the interest rate change at time t+2. Moreover, there is an empirical evidence for the presence of attribution of different importance of individual MPC membersô votes.

6.4 The Hungarian National Bank

Basic model

Results of the regression (2) show that skew is positive and significant at 10%, however, magnitude of coefficient is relatively small. Lagged interest rate change is positive as well and therefore, it is consistent with our expectations of interest rate gradualism, and it is significant at 1%. Adjusted pseudo R-squared is 0,37, which is sufficiently satisfying.

Extended model

After accounting for term structure and dispersion, skew becomes insignificant. This implies that financial markets have all the necessary information and can process them at least as effectively as bank board members and thus, do not need minutes as an additional source. Dispersion has negative sign and is insignificant at the same time, suggesting that level of uncertainty is not relevant for predicting future change of interest rate. Term structure and lagged interest rate change are positive and significant at 1%. McFaddenôs R-squared takes on value 0,41 indicating improvement of the basic model.

Models for longer horizons

Since skew was not significant in the previous case for short horizons it could be assumed it will not be significant in the longer ones either. Results confirm this, and it is noticed that even magnitude is very small. This holds also for models (4.1) and (5.1) extended by the term structure. Therefore, minutes do not increase the predictability of the future monetary policy change at longer horizons. Regarding the quality of these models, adjusted pseudo R-squared ranges from 0,09 to 0,21. These values are low suggesting that models are lacking independent variables with better explanatory power.

Financial crisis

Applying data from August 2007, it is shown that skew coefficient b_2 stays still insignificant and coefficient of term structure remains positive and significant at 5% for both cases as well as lagged rate change, which is significant at 1%. The results indicate that despite the financial crisis and uncertainty prevailing among participants

of the financial markets, voting records do not play an important role in anticipating the future repo rate changes, whereas the data before the crisis confirm the informative power of the minutes (significance level 5%). Adjusted pseudo R-squared exerts values 0,37 and 0,36 for the alternative term structure.
Skew stays insignificant even when examining its explanatory power for longer horizons. The same conclusion holds for the data until financial crisis.

Effect of experience
Since $skew_t$* coefficient is not significant, it cannot be concluded that financial markets are interested in experience of bank board members while making their decisions.

Main findings
We found out that voting records are informative about repo rate change at next meeting. However, this is no longer true if we account also for the level of uncertainty and financial marketsô expectations, suggesting the information contained in minutes is not needed by participants of the financial markets in order to anticipate future monetary policy changes. Moreover, further research gives evidence that minutes are not helpful when it comes to predicting repo rate changes at the meetings after the subsequent one. Therefore, our hypothesis regarding longer horizons is rejected. Surprisingly, degree of disagreement does not seem to be important during the crisis. Insignificance of $skew_t$* suggest that financial markets do not differentiate between the votes by individual members based on their experience.

6.5 The National Bank of Poland

Basic model
Table 1 shows results for the regression (2). It can be noticed that skew coefficient a_2 and lagged repo rate change coefficient exert positive sign and are significant at 1%. The positive sign is in accordance with our expectations for interest rate smoothing and increase of probability for future interest rate growth as the skew gets larger. Adjusted pseudo R-squared is very low - 0,16.

Extended model

After adding dispersion and term structure into the basic model (2), McFaddenôs R-squared gets larger ï 0,38 (0,41 for the alternative). Coefficient b_4 is positive as well as coefficient b_3 for lagged interest rate change. Thus, results suggest that higher level of uncertainty is connected with tighter monetary policy. The significance levels for these coefficients do not hold anymore in case of alternative (12M-3M). However, skew and term structure stay significant at 1% and the magnitude of b_2 changes only slightly. The significance of estimated b_2 suggests that minutes contain additional information for financial markets.

Models for longer horizons

Results of the regression (4) show that skew is significant at 10%, but the magnitude of the respective coefficient is very small in comparison with previous regressions. In regression (4.1) b_2 is significant at 5% for the case of alternative term structure 12M-3M, (otherwise insignificant). The estimate b_2 in model (5) as well as in (5.1), is, on the other hand, insignificant. Hence, interpretation is that minutes have informative power but not for very long horizons. It needs to be pointed out that adjusted pseudo R-squared is extremely low ranging from 0,02 to 0,21, suggesting some space for improvement of the models.

Financial crisis

Table 4 shows that skew is significant at 10% (this holds only for alternative maturities in the term structure), while being significant at 1% in the period until the financial crisis. The magnitude of the estimate is much larger. This fact indicates that minutes sustain their importance even during the crisis. Regarding the goodness of fit, adjusted pseudo R-squared equals 0,51, suggesting very good fit.

The estimate of b_2 is not significant when considering predictability in longer horizons. However, before the financial crisis, skew is significant at 5% in regression (4.1 alternative term structure), but otherwise, it is not significant.

Effect of experience

Estimate of the $skew_t^*$ coefficient is positive and significant at 10%. Therefore, Polish financial markets do focus their attention to experience of the members and the governor.

Main findings

Skew stays significant even after controlling for the term structure and dispersion and thus, there is some extra information in the minutes. However, minutes by the National Bank of Poland do not serve as a good tool for predicting changes in interest rates in very long horizons (t+3). Moreover, it is found that participants of financial markets do attribute different weights to votes by different MPC members based on their experience in policy making. Furthermore, dispersion exerting positive sign implies that more uncertainty does not trigger looser monetary policy, but in the contrary, tighter policy.

Table 1. Estimates for basic model (2)

$$\Delta repo_{t+1} = a_0 + a_1 \Delta repo_t + a_2 skew_{(t)} + u_{t+1}$$

Country Sample	**Czech Rep. 1998:M2–2014:M6**	**Hungary 2005:M10–2014:M5**	**Poland 2000:M2–2009:M12**	**Sweden 1999:M1–2014:M6**	**United Kingdom 1997:M7–2014:M6**
Lagged Repo Changes a_1	0,74*** (0,15)	1,56*** (0,18)	0,68*** (0,14)	0,92*** (0,15)	1,18*** (0,18)
Skew a_2	0,88*** (0,17)	0,26* (0,16)	0,30*** (0,094)	0,89*** (0,21)	1,51*** (0,23)
Adj. Pseudo R-squared	0,13	0,37	0,16	0,18	0,28
Observations	178	104	60	122	204

Notes: *, **, and *** represents statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses.

Source: Authorôs calculations

Table 2. Estimates for extended model (3)

$$\Delta i_{t+1} = b_0 + b_1 \Delta i_t + b_2 skew_{(t)} + b_3 (i_{\sigma(t),L} - i_{\sigma(t),S}) + b_4 dispersion_t + u_{t+1}$$

Country Sample	**Czech Rep. 1998:M2– 2014:M6**		**Hungary 2005:M10– 2014:M5**		**Poland 2000:M2– 2009:M12**		**Sweden 1999:M1– 2014:M6**		**United Kingdom 1997:M7– 2014:M6**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	0,76*** (0,15)	0,57*** (0,16)	1,30*** (0,20)	1,26*** (0,20)	0.38** (0,18)	0,13 (0,22)	0,86*** (0,16)	0,75*** (0,16)	1,21*** (0,18)	1,14*** (0,19)
Skew b_2	1,00*** (0,19)	0,97*** (0,19)	0,19 (0,17)	0,18 (0,17)	0,34*** (0,12)	0,40*** (0,13)	0,95*** (0,23)	0,71*** (0,24)	1,52*** (0,25)	1,44*** (0,26)
Term Structure b_3	1,81*** (0,63)	1,69*** (0,39)	3,53*** (1,35)	1,81*** (0,68)	5,33*** (1,08)	3,88*** (0,75)	2,47** (0,98)	2,41*** (0,62)	0,28 (0,61)	0,48 (0,40)
Dispersion b_4	-4,46*** (1,43)	-4,88*** (1,46)	-2,35 (0,17)	-1,94 (0,17)	2,99** (1,45)	1,62 (1,39)	-0,82 (1,63)	-2,19 (1,73)	-4,24** (1,74)	-3,70* (1,81)
Adj. Pseudo R-squared	0,21	0,24	0,41	0,41	0,38	0,41	0,20	0,28	0,31	0,31
Observations	178	178	104	104	60	57	122	115	204	204

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation for the difference between the three-month and one-month interbank rate and column 2, alternatively, difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published since 2001, therefore, the number of observations in column 1 is larger than that in column 2. Data on the twelve-month interbank rate in Sweden are only until 2013, thus, the number of observations in column 2 is smaller than in column 1.

Source: Authorôs calculations

Table 3. Estimates for models (4) and (5)

$$\Delta i_{t+2} = b_0 + b_1 \Delta i_t + b_2 skew_{(t)} + u_{t+2}$$

$$\Delta i_{t+3} = b_0 + b_1 \Delta i_t + b_2 skew_{(t)} + u_{t+3}$$

Country Sample	**Czech Rep. 1998:M2ï 2014:M6**		**Hungary 2005:M10ï 2014:M5**		**Poland 2000:M2ï 2009:M12**		**Sweden 1999:M1ï 2014:M6**		**United Kingdom 1997:M7ï 2014:M6**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	0,87*** (0,14)	0,62*** (0,13)	0,91*** (0,14)	0,61*** (0,13)	0,52*** (0,13)	0,23* (0,12)	0,59*** (0,14)	0,47*** (0,13)	1,15*** (0,17)	0,76*** (0,15)
Skew b_2	0,28* (0,16)	0,094 (0,15)	0,029 (0,14)	0,036 (0,14)	0,15* (0,084)	0,071 (0,083)	0,48** (0,19)	0,40** (0,19)	0,90*** (0,22)	0,70*** (0,21)
Adj. Pseudo R-squared	0,12	0,07	0,18	0,09	0,09	0,02	0,08	0,06	0,22	0,11
Observations	177	176	103	102	59	58	121	120	203	202

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation of the model (4) and column 2 reports estimates for model (5).

Source: Authorôs calculations

Table 3.1 Estimates for model (4.1)

$$\Delta i_{t+2} = b_0 + b_1 \Delta i_t + b_2 skew_{Q(t)} + b_3 (i_{Q(t),L} - i_{Q(t),S}) + u_{t+2}$$

Country Sample	**Czech Rep. 1998:M2– 2014:M6**		**Hungary 2005:M10– 2014:M5**		**Poland 2000:M2– 2009:M12**		**Sweden 1999:M1– 2014:M6**		**United Kingdom 1997:M7– 2014:M6**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	0,84*** (0,15)	0,69*** (0,15)	0,73*** (0,17)	0,61*** (0,18)	0,40*** (0,15)	0,17 (0,20)	0,54*** (0,14)	0,50*** (0,15)	1,16*** (0,17)	1,05*** (0,17)
Skew b_2	0,27* (0,16)	0,21 (0,16)	-0,02 (0,15)	-0,05 (0,15)	0,13 (0,09)	0,22** (0,11)	0,51** (0,20)	0,43** (0,21)	0,87*** (0,22)	0,75*** (0,23)
Term structure b_3	0,41 (0,61)	1,22*** (0,36)	2,15* (1,19)	1,70*** (0,62)	0,73 (0,46)	1,62*** (0,50)	1, 29 (0,87)	0,97* (0,50)	0,58 (0,59)	0,71* (0,37)
Adj. Pseudo R-squared	0,13	0,16	0,19	0,21	0,11	0,21	0,09	0,10	0,22	0,23
Observations	177	177	103	103	59	56	121	115	203	203

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation for the difference between the three-month and one-month interbank rate and column 2, alternatively, difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published since 2001, therefore, the number of observations in column 1 is larger than that in column 2. Data on the twelve-month interbank rate in Sweden are only until 2013, thus, the number of observations in column 2 is smaller than in column 1.

Source: Authorôs calculations

Table 3.2 Estimates for model (5.1)

$$\Delta i_{t+3} = b_0 + b_1 \Delta i_t + b_2 skew_{(t)} + b_3 (i_{\alpha(t),L} - i_{\alpha(t),S}) + u_{t+3}$$

Country Sample	**Czech Rep. 1998:M2–2014:M6**		**Hungary 2005:M10–2014:M5**		**Poland 2000:M2–2009:M12**		**Sweden 1999:M1–2014:M6**		**United Kingdom 1997:M7–2014:M6**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	0,56*** (0,14)	0,45*** (0,15)	0,43*** (0,16)	0,34** (0,17)	0,12 (0,14)	0,01 (0,18)	0,45*** (0,14)	0,36** (0,15)	0,76*** (0,15)	0,65*** (0,16)
Skew b_2	0,07 (0,16)	0,03 (0,16)	-0,01 (0,14)	-0,03 (0,14)	0,05 (0,09)	0,12 (0,10)	0,42** (0,20)	0,34* (0,21)	0,70*** (0,21)	0,54** (0,22)
Term structure b_3	1,14* (0,61)	1,04*** (0,35)	2,02* (1,15)	1,36** (0,58)	0,69 (0,44)	0,96*** (0,35)	0,65 (0,86)	0,77 (0,49)	0,04 (0,55)	0,80** (0,34)
Adj. Pseudo R-squared	0,09	0,10	0,10	0,11	0,04	0,09	0,06	0,06	0,11	0,13
Observations	176	176	102	102	58	55	120	115	202	202

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation for the difference between the three-month and one-month interbank rate and column 2, alternatively, difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published since 2001, therefore, the number of observations in column 1 is larger than that in column 2. Data on the twelve-month interbank rate in Sweden are only until 2013, thus, the number of observations in column 2 is smaller than in column 1.

Source: Authorôs calculations

Table 4. Period during the financial crisis - data from 2007:M8 and onwards

$$\Delta i_{t+1} = b_0 + b_1 \Delta i_t + b_2 skew_{(t)} + b_3 (i_{\sigma(t),L} - i_{\sigma(t),S}) + u_{t+1}$$

Country Sample	**Czech Rep. 2007:M8– 2014:M6**		**Hungary 2007:M8– 2014:M5**		**Poland 2007:M8– 2009:M12**		**Sweden 2007:M8– 2014:M6**		**United Kingdom 2007:M8– 2014:M6**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	1,04*** (0,39)	1,20*** (0,36)	1,22*** (0,23)	1,18*** (0,25)	1,50** (0,75)	-0,06 (1,13)	1,21*** (0,27)	1,78*** (0,48)	3,34** (1,42)	2,31*** (0,77)
Skew b_2	1,76*** (0,46)	1,70*** (0,44)	0,12 (0,17)	0,12 (0,17)	0,97 (0,77)	2,00* (1,06)	1,24*** (0,45)	2,58*** (0,95)	10,9** (4,53)	7,89*** (2,83)
Term Structure b_3	-7,17** (3,07)	-0,26 (1,15)	4,21** (1,95)	1,88** (0,95)	4,24 (4,36)	16,23** (7,62)	1,83 (2,14)	6,72*** (2,18)	2,91 (2,5)	0,31 (1,34)
Adj. Pseudo R-squared	0,36	0,29	0,37	0,36	0,18	0,51	0,28	0,55	0,74	0,72
Observations	56	56	82	82	14	14	42	35	82	82

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation for the difference between the three-month and one-month interbank rate and column 2, alternatively, difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published since 2001, therefore, the number of observations in column 1 is larger than that in column 2. Data on the twelve-month interbank rate in Sweden are only until 2013, thus, the number of observations in column 2 is smaller than in column 1.

Source: Authorôs calculations

Table 4.1 Period during the financial crisis - data from 2007:M8 and onwards for model (4.1)

$$\Delta i_{t+2} = b_0 + b_1 \Delta i_t + b_2 skew_{c(t)} + b_3 (i_{c(t),L} - i_{c(t),S}) + u_{t+2}$$

Country Sample	**Czech Rep. 2007:M8– 2014:M6**		**Hungary 2007:M8– 2014:M5**		**Poland 2007:M8– 2009:M12**		**Sweden 2007:M8– 2014:M6**		**United Kingdom 2007:M8– 2014:M6**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	0,72** (0,30)	0,90*** (0,29)	0,74*** (0,21)	0,62*** (0,23)	-0,84 (0,30)	-0,91 (1,37)	0,65*** (0,22)	0,63*** (0,21)	1,22*** (0,34)	1,06*** (0,29)
Skew b_2	0,19 (0,32)	0,14 (0,32)	-0,02 (0,16)	-0,05 (0,16)	-1,76 (0,43)	-1,21 (1,42)	0,05 (0,36)	0,20 (0,39)	1,72* (1,02)	1,06 (1,01)
Term Structure b_3	-6,16** (3,03)	0,84 (1,10)	1,62 (1,78)	1,31 (0,87)	-8,50 (7,11)	8,16** (3,91)	-0,42 (1,96)	1,00 (1,17)	0,56 (1,28)	1,30* (0,72)
Adj. Pseudo R-squared	0,17	0,13	0,16	0,17	1,19	0,30	0,10	0,13	0,34	0,39
Observations	55	55	81	81	13	13	41	35	82	82

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation for the difference between the three-month and one-month interbank rate and column 2, alternatively, difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published since 2001, therefore, the number of observations in column 1 is larger than that in column 2. Data on the twelve-month interbank rate in Sweden are only until 2013, thus, the number of observations in column 2 is smaller than in column 1.

Source: Authorôs calculations

Table 4.2 Period during the financial crisis - data from 2007:M8 and onwards for model (5.1)

$$\Delta i_{t+3} = b_0 + b_1 \Delta i_t + b_2 skew_{(t)} + b_3 (i_{\alpha(t),L} - i_{\alpha(t),S}) + u_{t+3}$$

Country Sample	**Czech Rep. 2007:M8– 2014:M6**		**Hungary 2007:M8– 2014:M5**		**Poland 2007:M8– 2009:M12**		**Sweden 2007:M8– 2014:M6**		**United Kingdom 2007:M8– 2014:M6**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	0,44 (0,31)	0,63** (0,28)	0,45** (0,21)	0,42* (0,22)	1,01 (1,30)	4,25 (3,22)	0,60*** (0,21)	0,40** (0,20)	0,46 (0,31)	0,58** (0,27)
Skew b_2	0,18 (0,30)	0,10 (0,31)	0,01 (0,15)	0,01 (0,15)	0,83 (1,32)	6,70 (4,51)	0,15 (0,37)	0,31 (0,40)	1,12 (0,80)	0,43 (0,89)
Term Structure b_3	-5,10* (2,92)	1,21 (1,10)	1,25 (1,75)	0,66 (0,84)	-4,34 (4,69)	43,52* (24,75)	-2,88 (2,00)	1,07 (1,16)	-1,24 (1,18)	1,60** (0,65)
Adj. Pseudo R-squared	0,10	0,08	0,07	0,07	0,07	0,63	0,08	0,07	0,17	0,24
Observations	54	54	80	80	12	12	40	35	81	81

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation for the difference between the three-month and one-month interbank rate and column 2, alternatively, difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published since 2001, therefore, the number of observations in column 1 is larger than that in column 2. Data on the twelve-month interbank rate in Sweden are only until 2013, thus, the number of observations in column 2 is smaller than in column 1.

Source: Authorôs calculations

Table 5. Effect of experience - model (7)

$$\varphi i_{t+1} = \check{U}_0 + \check{U}_1 \varphi i_t + \check{U}_2 skew^* \tilde{q}_t + u_{t+1}$$

Country Sample	**Czech Rep. 1998:M2ï 2014:M6**	**Hungary 2005:M10ï 2014:M5**	**Poland 2000:M2ï 2009:M12**	**Sweden 1999:M1ï 2014:M6**	**United Kingdom 1997:M7ï 2014:M6**
Lagged Repo Changes b_1	0,29** (0,13)	1,60*** (0,30)	0,20 (0,21)	0,74*** (0,15)	0,42 (0,52)
Skew b_2	-0,0026*** (0,000512)	0,0006 (0,00116)	0,0097* (0,006)	0,00147 (0,021)	-0,0022 (0,0021)
Adj. Pseudo R-squared	0,12	0,36	0,11	0,11	0,13
Observations	175	103	60	121	204

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses.

Source: Authorôs calculations

Table 6. Period until financial crisis

$$\Delta i_{t+1} = b_0 + b_1 \Delta i_t + b_2 skew_{(t)} + b_3 (i_{\sigma(t),L} - i_{\sigma(t),S}) + u_{t+1}$$

Country Sample	**Czech Rep. 2000:M7– 2007:M7**		**Hungary 2005:M10– 2007:M7**		**Poland 1998:M2– 2007:M7**		**Sweden 1999:M1– 2007:M7**		**United Kingdom 1997:M6– 2007:M7**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	1,24*** (0,31)	0,46 (0,42)	1,50*** (0,47)	1,22 (0,80)	0,64*** (0,13)	0,49** (0,20)	1,01*** (0,23)	0,67*** (0,27)	0,99*** (0,21)	0,46* (0,25)
Skew b_2	1,66*** (0,35)	1,14*** (0,40)	0,47 (0,47)	1,94** (0,92)	0,28*** (0,08)	0,62*** (0,15)	1,39*** (0,28)	0,84* (0,44)	1,57*** (0,29)	1,28*** (0,32)
Term Structure b_3		2,53 (1,15)		8,08** (3,19)		2,44*** (0,47)		2,24** (0,88)		2,99*** (0,68)
Adj. Pseudo R-squared	0,19	0,20	0,35	0,71	0,11	0,37	0,24	0,25	0,23	0,33
Observations	87	75	22	22	114	80	79	79	123	123

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are in parentheses. Ordered probit estimation. ñTerm Structureò stands for the difference between the one-year and three-month interbank rate in a given country. Data until 2007:M7 exclude the global financial crisis period. Data for the Czech Republic in column 2 are until 2006:M7 only. Data on the twelve-month interbank rate in Poland are available only from 2001 onwards; therefore, the number of observations in column 6 is smaller than that in column 5.

Source: Horváth et al., 2012

Table 6.1 Estimates for model (4.1) until financial crisis

$$\Delta i_{t+2} = b_0 + b_1 \Delta i_t + b_2 skew_{Q(t)} + b_3 (i_{\alpha(t),L} - i_{\alpha(t),S}) + u_{t+2}$$

Country Sample	**Czech Rep. 1998:M2– 2007:M7**		**Hungary 2005:M10– 2007:M7**		**Poland 2000:M2– 2007:M7**		**Sweden 1999:M1– 2007:M7**		**United Kingdom 1997:M7– 2007:M7**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	0,78*** (0,18)	0,57*** (0,18)	0,05 (0,45)	-0,32 (0,55)	0,32** (0,16)	0,13 (0,22)	0,39* (0,22)	0,30 (0,24)	0,76*** (0,23)	0,64*** (0,24)
Skew b_2	0,28 (0,19)	0,23 (0,19)	-0,11 (0,65)	-0,01 (0,94)	0,13 (0,09)	0,24** (0,11)	0,82** (0,36)	0,72* (0,38)	0,63** (0,26)	0,60** (0,26)
Term structure b_3	1,06 (0,83)	1,66*** (0,45)	5,19** (2,42)	6,87** (3,26)	0,77 (0,49)	1,54*** (0,51)	2,03 (1,32)	1,19 (0,73)	3,79*** (1,23)	2,21*** (0,64)
Adj. Pseudo R-squared	0,13	0,18	0,25	0,45	0,09	0,20	0,11	0,11	0,23	0,25
Observations	122	122	22	22	46	43	80	80	121	121

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation for the difference between the three-month and one-month interbank rate and column 2, alternatively, difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published since 2001, therefore, the number of observations in column 1 is larger than that in column 2. Data on the twelve-month interbank rate in Sweden are only until 2013, thus, the number of observations in column 2 is smaller than in column 1.

Source: Authorôs calculations

Table 6.2 Estimates for model (5.1) until financial crisis

$$\Delta i_{t+3} = b_0 + b_1 \Delta i_t + b_2 skew_{(t)} + b_3 (i_{\alpha(t),L} - i_{\alpha(t),S}) + u_{t+3}$$

Country Sample	**Czech Rep. 1998:M2– 2007:M7**		**Hungary 2005:M10– 2007:M7**		**Poland 2000:M2– 2007:M7**		**Sweden 1999:M1– 2007:M7**		**United Kingdom 1997:M7– 2007:M7**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged Repo Changes b_1	0,43** (0,17)	0,34* (0,18)	-0,29 (0,45)	-1,34* (0,74)	0,04 (0,15)	-0,06 (0,20)	0,29 (0,21)	0,27 (0,24)	0,50** (0,22)	0,31 (0,23)
Skew b_2	-0,01 (0,20)	-0,02 (0,19)	-0,67 (0,69)	-1,67 (1,46)	0,03 (0,09)	0,10 (0,10)	0,39 (0,37)	0,42 (0,39)	0,50** (0,25)	0,42* (0,24)
Term structure b_3	2,45*** (0,92)	1,32*** (0,44)	5,56** (2,54)	10,31** (4,40)	0,60 (0,46)	0,86** (0,36)	2,44* (1,38)	0,90 (0,70)	2,47** (1,21)	2,00*** (0,60)
Adj. Pseudo R-squared	0,11	0,12	0,23	0,52	0,02	0,07	0,07	0,06	0,13	0,16
Observations	122	122	22	22	46	43	80	80	121	121

Notes: *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in parentheses. Column 1 represents estimation for the difference between the three-month and one-month interbank rate and column 2, alternatively, difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published since 2001, therefore, the number of observations in column 1 is larger than that in column 2. Data on the twelve-month interbank rate in Sweden are only until 2013, thus, the number of observations in column 2 is smaller than in column 1.

Source: Authorôs calculations

6.6 Cross country comparison

Our results show that skew is significant in all the cases in the basic model, indicating that minutes contain information that are helpful for financial markets when predicting future repo rate changes and thus, their release improves predictability of the central banks. Moreover, positive sign confirms our expectations that increase in probability of repo rate change goes hand in hand with higher skew which is in turn connected with preferences for higher rates by the bank board members. Estimate b_1 for lagged repo rate change is significant and positive for all the examined countries. Our expectations of interest rate gradualism are fulfilled.

Introducing new variables to the model (2) brings, however, more diverse results. After inclusion of dispersion and term structure in (2), skew appears to be insignificant in the case of Hungary, whereas it remains significant in all of the other countries, suggesting that voting records do not contain additional information for Hungarian financial markets. Furthermore, the sign of the dispersion estimate differs: for NBP it exerts positive sign while it is negative for all of the other banks. Its significance is detected only in the NBP, MNB and Riksbank.
Regarding predictions for the interest rate changes in longer horizons, skew remains significant for both models (4) and (5) as well as (4.1) and (5.1), in case of the BoE and Riksbank, and only for (4) and (4.1) in case of the CNB and NBP. It could be, therefore, pointed out that English and Swedish voting records have longer lasting influence than those released by the CNB and NBP. Interestingly, voting records of the MNB do not carry information about the repo rate approved at the meeting after the subsequent one.

Although the results show that voting records are important even during financial crisis, this conclusion does not hold for the MNB. In other cases, the comparisons indicate that skew coefficient b_2 are generally higher for the period of crisis. ñEffect of experienceò is present only in two countries, Poland and the Czech Republic, where in the latter case the estimate of b_2 is negative.

Throughout our research we found out some similarities as well as differences among individual countries. It is necessary to highlight that the differences are most

probably caused by different size of the datasets as well as different economic environments and backgrounds or institutional settings such as number of MPC members, etc.

6.7 Comparison of results with existing empirical and theoretical literature

Even though the literature dealing with voting records of these five central banks is rather limited, we were able to find some relevant empirical studies. In this subsection main findings are compared with the previous studies.

Research paper by Horváth et al. (2012) examines the same central banks and our results are in accordance with their findings that publishing the voting records is important and can be perceived as a proper tool to predict future changes in monetary policy. The only difference is in the results for the extended model in case of Hungary. Our findings suggest that skew is insignificant and therefore, minutes do not bring additional information to financial markets with respect to anticipation of monetary policy. In the research paper *Central Banksô Voting Records and Future Policy*, skew is significant only at 10%. This dissimilarity might be caused by different factors, such as extended sample period and thus, by having more observations for this particular central bank. Hence, our result could be considered relevant as well.

Empirical study by Gerlach-Kristen (2004) brings again the same implications regarding the informative power of the minutes of BoE. Moreover, our results are robust as well when slope of the term structure is included as a proxy for expectations of financial markets.

Sirchenko (2010) provides the same evidence for Poland that voting records of MPC matter especially with respect to public anticipation of future monetary policy. Previous research by Fujiki (2005) comes up with similar results for the Bank of Japan (BoJ). Our results comply with the paper by Andersson et al. (2006) studying monetary policy signalling in Sweden. Empirical findings presented in this thesis confirm the theoretical research done by Weber (2010) that voting records, as a way

of communication, have a great influence on expectations of financial markets. It also confirms that being transparent about variety of the opinions in the MPC is beneficial for predictability of the central banks.

There is also compliance of the results with the previous studies (Besley et al., 2008, Bhattacharjee et al., 2006 or Brooks et al., 2008) with regard to heterogeneity of preferences among individual MPC members since our study gives evidence of significance of the different opinions presence through measure of dissent.

It can be seen that the empirical findings of this thesis confirm the results of the studies published before. In general, it can be summarized that our conclusions are consistent with the findings of the previous research.

7 Conclusion

This work provides thorough empirical analysis of the voting in the central banks, especially votes regarding the changes of interest rates focusing on these five countries - the Czech Republic, Hungary, Poland, Sweden and the United Kingdom. The aim of the thesis is to assess informative power of the voting records. They are examined from various aspects. Firstly, following approach by Gerlach-Kristen (2004), we established the basic model which includes only skew and lagged repo change as independent variables. Secondly, in order to control for the possibility of different results as well as to account for the level of uncertainty in the MPC and financial marketsô expectations, we included new variables - dispersion and term structure, as suggested in the discussion paper by Horváth et al. (2012). In addition, our attention is also aimed at the predictability of future repo rate changes based on the voting records in horizons longer than next MPC meeting. Furthermore, comparison between the results of the analysis before and during the financial crisis (August 2007 and onwards) is made. Lastly, calculation of skew - variable of our primary interest, is changed. Instead of attributing the same weights for individual members we weighted every vote according to the experience of the policymaker, measured as the number of meetings he or she attended until the current meeting. This enables us to judge whether financial markets tend to rely more on the votes by members, who are in the bank board for longer time and therefore, are supposed to have more experience.

The results show that skew is positive and significant in the basic model as well as most of the cases of the extended models (exception is Hungary). This confirms our hypothesis that voting records are, indeed, informative about future monetary policy changes and therefore, can increase predictability of the particular central banks. Degree of uncertainty that MPC members face plays important role in anticipation of future repo rate changes in the Czech Republic, United Kingdom and Poland. The results cannot be interpreted in the same manner due to positive sign that b_4 estimate exerts in case of the NBP. This indicates that higher level of uncertainty is connected with tighter monetary policy. On the contrary, negative dispersion coefficient for the BoE and CNB suggests that increase in uncertainty stimulates looser monetary

policy. Our findings are consistent with those of previous research. Moreover, for the BoE and Riksbank voting records do not signal the change of the repo rate approved only at the next meeting but also at the further meetings. On the other hand, this is true just partially for the Czech Republic and Poland where it gives signals for change made at the meeting following the next one. Regarding the period of financial crisis, it is shown that markets heavily rely on the minutes as the source of knowledge and the magnitudes of the estimate for the skew coefficient are much higher. Even though, this does not hold when taking into consideration prediction for longer horizons. Interestingly, financial markets in the Czech Republic as well as Poland differentiate between the votes made by individual MPC members and attribute different weights of importance based on frequency of the attendance at the meetings. However, skew is negative in the case of the CNB, which is not what we expected.

Even though this research describes and gives insights into variety of fundamental issues concerning predictability of central banks based on the minutes they publish, there still remains space for further analysis and improvements. Datasets are relatively small and we focused only on particular 5 central banks, however, it might be interesting to make the analysis for other countries as well. Moreover, some of the models exert low adjusted pseudo R-squared and should be modified.

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