

Horváth, Roman; Jonášová, Júlia

Working Paper

Central banks' voting records, financial crisis and future monetary policy

IES Working Paper, No. 35/2014

Provided in Cooperation with:

Charles University, Institute of Economic Studies (IES)

Suggested Citation: Horváth, Roman; Jonášová, Júlia (2014) : Central banks' voting records, financial crisis and future monetary policy, IES Working Paper, No. 35/2014, Charles University in Prague, Institute of Economic Studies (IES), Prague

This Version is available at:

<https://hdl.handle.net/10419/120428>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Institute of Economic Studies, Faculty of Social Sciences
Charles University in Prague

Central Banks' Voting Records, Financial Crisis and Future Monetary Policy

Roman Horváth
Júlia Jonášová

IES Working Paper: 35/2014



Institute of Economic Studies,
Faculty of Social Sciences,
Charles University in Prague

[UK FSV – IES]

Opletalova 26
CZ-110 00, Prague
E-mail : ies@fsv.cuni.cz
<http://ies.fsv.cuni.cz>

Institut ekonomických studií
Fakulta sociálních věd
Univerzita Karlova v Praze

Opletalova 26
110 00 Praha 1

E-mail : ies@fsv.cuni.cz
<http://ies.fsv.cuni.cz>

Disclaimer: The IES Working Papers is an online paper series for works by the faculty and students of the Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague, Czech Republic. The papers are peer reviewed, but they are *not* edited or formatted by the editors. The views expressed in documents served by this site do not reflect the views of the IES or any other Charles University Department. They are the sole property of the respective authors. Additional info at: [ies@fsv.cuni.cz](http://ies.fsv.cuni.cz)

Copyright Notice: Although all documents published by the IES are provided without charge, they are licensed for personal, academic or educational use. All rights are reserved by the authors.

Citations: All references to documents served by this site must be appropriately cited.

Bibliographic information:

Horváth R., Jonášová J. (2014). “Central Banks’ Voting Records, Financial Crisis and Future Monetary Policy” IES Working Paper 35/2014. IES FSV. Charles University.

This paper can be downloaded at: <http://ies.fsv.cuni.cz>

Central Banks Voting Records, Financial Crisis and Future Monetary Policy

Roman Horváth^{a,b}

Júlia Jonášová^a

^aInstitute of Economic Studies, Faculty of Social Sciences, Charles University in Prague, Smetanovo nábřeží 6, 111 01 Prague 1, Czech Republic
E-mail: roman.horvath@gmail.com

^bInstitute for East and Southeast European Studies, Regensburg, Germany

December 2014

Abstract:

We examine whether central banks' voting records help predict the future course of monetary policy in the Czech Republic, Hungary, Poland, Sweden and the United Kingdom, controlling for financial market expectations. Unlike previous research, first, we examine the period of the global financial crisis, characterized by a high level of uncertainty, and second, we examine the predictive power of voting records at longer time horizons, i.e., not only for the next monetary policy meeting. We find that voting records predict the policy rate set at the next meeting in all central banks that are recognized as independent. In some central banks, voting records are found—before, but not during, the financial crisis—to be informative about monetary policy even at more distant time horizons.

Keywords: voting records, financial crisis, central bank, monetary policy

JEL: D78, E52, E58

Acknowledgements: We thank two anonymous referees and Davide Romelli for helpful comments. We appreciate support from the Grant Agency of the Czech Republic, no. P402/12/G097.

I. Introduction

An enormous increase in central bank transparency over the last two decades has attracted extensive research efforts aimed at uncovering the implications of increased transparency (Blinder et al., 2009, Geraats, 2009). While theoretical research has mainly focused on the welfare effects of increased transparency (Morris and Shin, 2002, Angeletos and Pavan, 2007, Cornand and Heinemann, 2008, Dale et al., 2011, Hahn, 2012), empirical research has examined the implications of increased transparency with respect to monetary policy predictability (Gerlach-Kristen, 2004, Crowe, 2010, Sturm and de Haan, 2011, Horvath et al., 2012a), macroeconomic outcomes (Dincer and Eichengreen, 2014) and dissent among central bankers (Meade and Stasavage, 2008).

In this paper, we analyze whether central banks' voting records help predict the future course of monetary policy, a question that has been examined by Gerlach-Kristen (2004) and Horvath et al. (2012a). The seminal paper of Gerlach-Kristen (2004) examines the Bank of England voting record and constructs the variable *skew*, defined as the difference between the average policy rate voted for by individual committee members¹ and the policy rate that is the outcome of the majority vote. Gerlach-Kristen (2004) finds that *skew* is informative, even controlling for financial market expectations. Horvath et al. (2012a) provide international evidence and confirm for a group of five inflation-targeting central banks — that release the voting records of their central bankers — that voting records are indeed informative about future monetary policy.

We extend these two studies in two directions. First, we update them to cover the period of the global financial crisis, a period characterized by a high degree of economic uncertainty. The theoretical model of Horvath et al. (2010) shows that voting records should be informative about future monetary policy unless the economic environment is too volatile, in which case, voting records are too noisy. Therefore, our sample allows us to test the hypothesis with actual data, thus determining whether it is indeed the case that voting records lose predictive power in

¹ We use the terms “monetary policy committee members,” “bank board members” and “central bankers” interchangeably in this paper.

more uncertain economic environments. In addition, we also examine whether the size of *skew* matters for the probability of policy rate change to shed more light on how many board members have to dissent so that the future policy rate change is highly likely.

Second, Gerlach-Kristen (2004) and Horvath et al. (2012a) examine whether voting records help predict the monetary policy rate at the next meeting (i.e., at time $t+1$). We examine whether voting records are informative about monetary policy meetings not only at time $t+1$ but also times $t+2$ and $t+3$. It may well be that some “early birds” receive a signal about the appropriate course of monetary policy “too early”, and it may take some time for other central bankers to recognize this signal and finally change the policy rate in an optimal way.

We find that central banks’ voting records help predict the monetary policy rate set at the next monetary policy meeting in all central banks, except Hungary. This is an interesting result in light of concerns about central bank independence in Hungary (see, for example, Reuters, 2014, among others). The European Central Bank (ECB) expressed its concerns about the lack of Hungarian central bank independence in a legal opinion issued on January 31, 2014 (ECB, 2014). Therefore, the financial markets may pay less attention to the voting records released by the Hungarian central bank. Our findings regarding Hungary broadly correspond with Jung and Kiss (2012) and Eijffinger et al. (2013a).

In addition, we find that voting records are informative, to a certain extent, about monetary policy meetings at times $t+2$ and $t+3$. However, if we restrict our sample period to the period of the global financial crisis, we find that voting records are never significant and therefore are uninformative about future monetary policy. This finding supports the hypothesis that voting records are informative unless the economic environment is too volatile. Finally, we find that the probability of policy rate change increases with the size of *skew* and that many central bankers precedes the collective decision and may be considered as “early birds”.

The remainder of the paper is structured as follows. A literature survey is provided in section 2. Our model is presented in section 3. Section 4 provides our empirical

results. Concluding remarks are presented in section 5. An appendix, including a description of the data, additional figures and regression results, follows.

II. Literature Survey of Central Bank Voting

We provide a very brief literature survey in this section, largely focusing on theoretical and empirical research that examines whether central bank voting records help forecast future policy adjustments. We refer the reader to the following more comprehensive surveys. Reis (2013) provides a general survey of central bank governance, while Blinder et al. (2009) survey central bank communication strategies. Geraats (2002, 2009) provides surveys of central bank transparency.

Riboni and Ruge-Murcia (2014) present a theoretical model of committee decision-making and show under what conditions dissent helps predict future policy adjustments. They find that frictions in the decision-making of committees are behind the predictive power of current dissent for future policy. Frictions in turn arise from two factors: committee members wish to achieve consensus, and policy changes are discrete (typically with magnitudes of 25 basis points).

Horvath et al. (2010) note that, for dissent to be informative about future policy, actual monetary policy cannot precisely follow optimal policy. Under imperfect information, some board members receive a signal of a change in the optimal rate sooner than others and vote accordingly. Another condition for dissent to contain information about future policy is that central banks must maintain decision-making rules that allow dissent. The theoretical model of Horvath et al. (2010) also stipulates that voting records (dissent) are informative about future policy adjustments if the economic environment is not too volatile, as voting records become too noisy under conditions of high economic volatility.

Gerlach-Kristen (2004) empirically examines whether voting records contain useful information about future policy adjustments. Using UK data, she finds that this is indeed the case, even after controlling for financial market expectations. Horvath et al. (2012a, 2012b) confirm her results for a broader set of central banks: the Czech Republic, Hungary, Poland, Sweden, the UK and the US. Neuenkirch (2013)

examines the Bank of England's voting record regarding asset purchase decisions, finding that it helps forecast future asset purchase decisions.

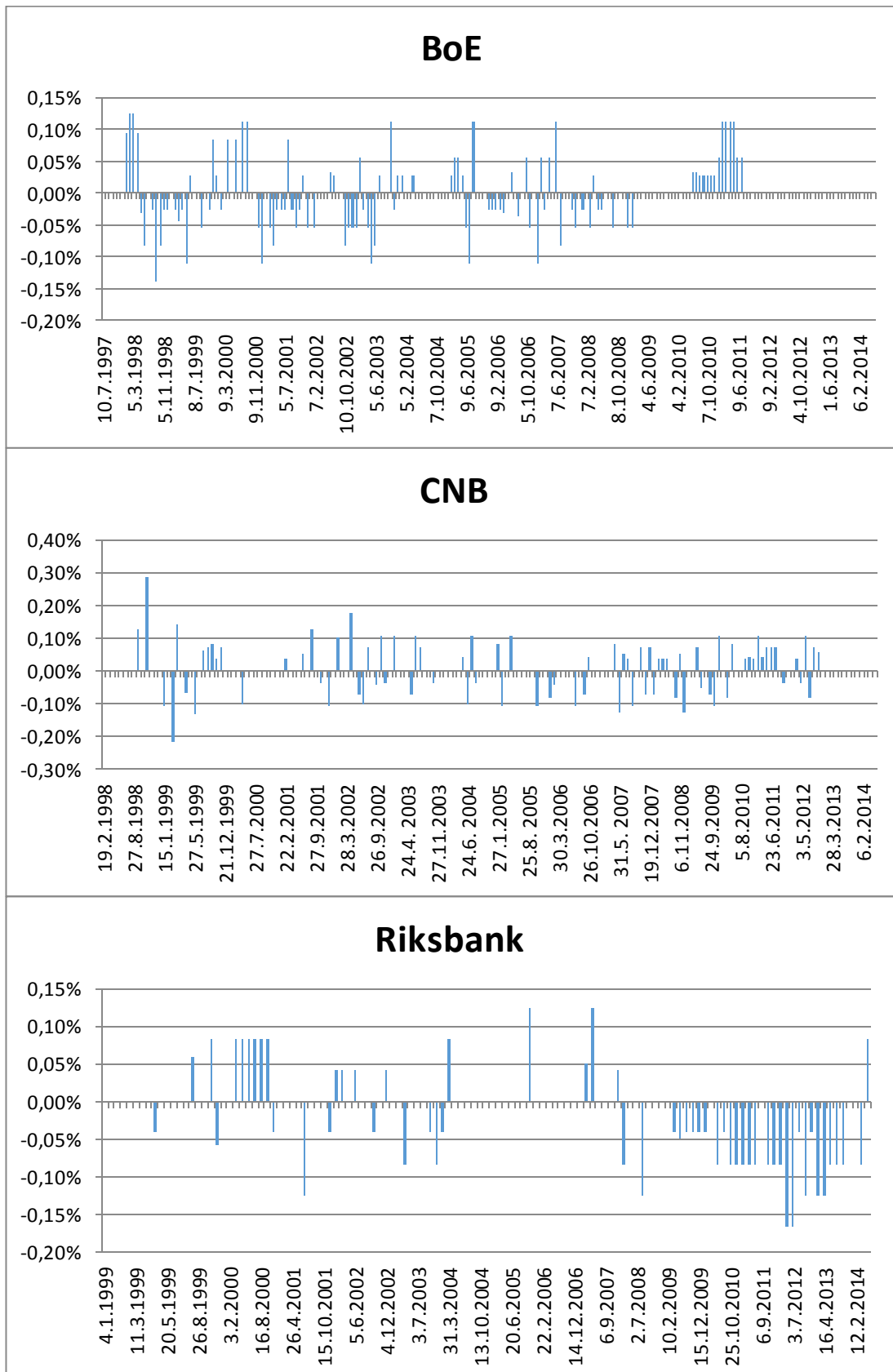
Additional research that examines different aspects of central banks' voting records include Chappell et al. (2005), Besley et al., (2008), Bhattacharjee and Holly (2014), Brooks et al. (2011), Eijffinger et al. (2013a, 2013b), Farvaque et al. (2009), Gerlach-Kristen and Meade (2010), Jung and Kiss (2012) and Tillmann (2011), among others. Interestingly, Neuenkirch and Siklos (2013, 2014) examine the voting records of so-called shadow committees of professional and academic economists, which provide alternatives to the official voting records of central banks. Hayo and Neuenkirch (2010) examine the effect of communication strategy on monetary policy predictability in the US.

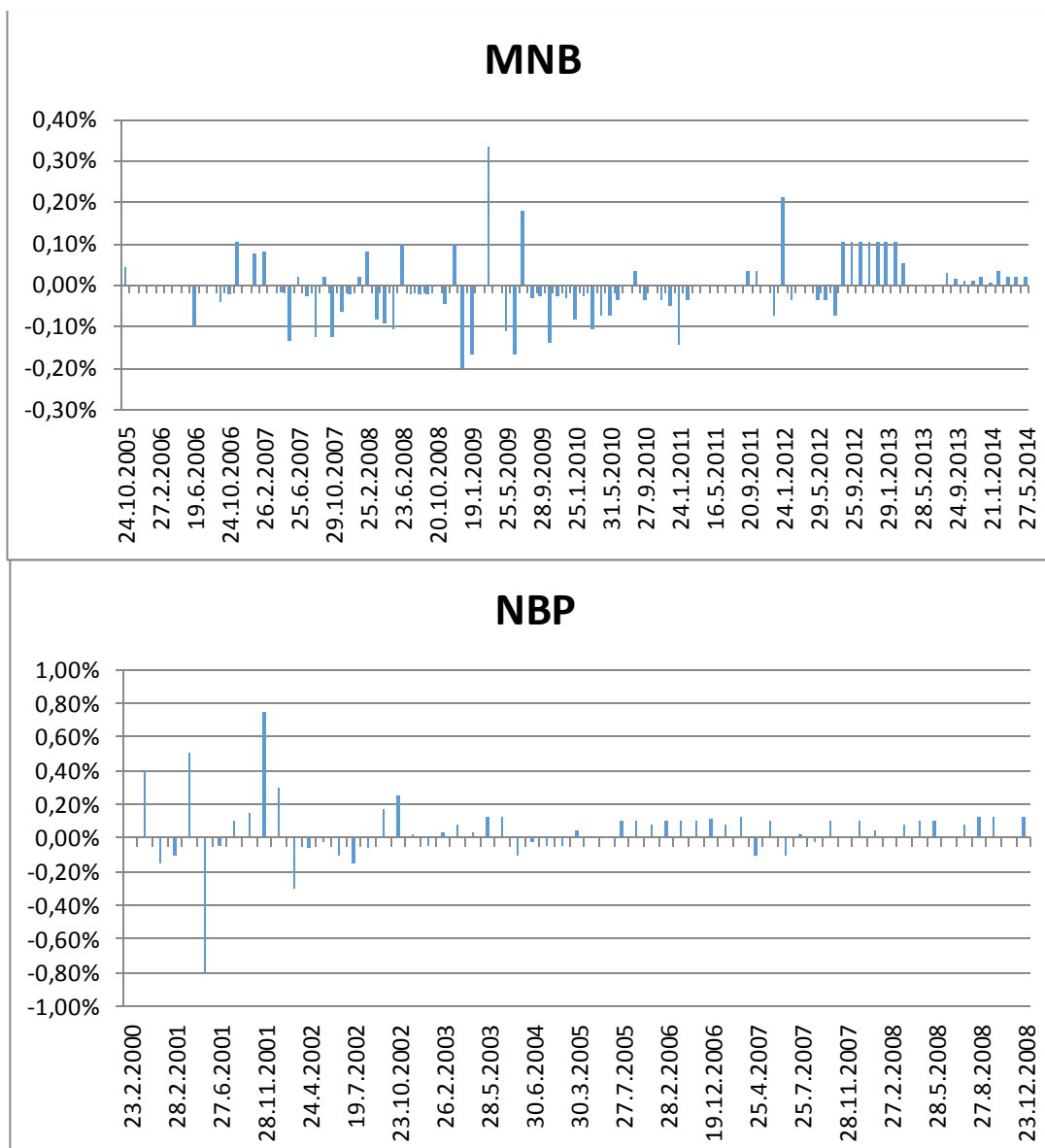
Note that few central banks release their voting records; therefore, most of the literature focuses on a single central bank or a narrow group of central banks. Most frequently, the US and UK central banks are examined, while evidence pertaining to other central banks, especially those in Central Europe, is more limited.

III. Empirical Model

Preferences and the information sets of bank board members may differ. As a result, the voting records of individual board members may also differ and evolve over time. Using our data, we find that the percentage of monetary policy meetings in the Bank of England without dissent is 35% before the financial crisis (e.g. up to August 2007) and it increased to 67% during the crisis. For the Polish central bank, the percentage of meetings without dissent is 7% before the crisis and 14% during the crisis. In other central bank, the percentage of meeting without dissent decreases during the financial crisis (68% of the meeting without dissent for Swedish central bank before the crisis and 28% during the crisis, the corresponding percentages are 46% vs. 37% for the Czech National Bank and 50% vs. 19% for the Hungarian central bank).

Figure 1 - The Evolution of Voting Record *skew* over Time





Notes: on the x axis, t denotes the number of meetings in sequence in our sample. *Skew* is calculated as the difference between the average voted-for policy rate and the actually-implemented policy rate (in%).

Interestingly, dissent at monetary policy meetings is highest in Hungary. On the one hand, this might be attributed to the larger number of board members at the Hungarian central bank. On the other hand, the monetary policy committee in Poland is roughly the same size as that of Hungary, but the frequency of meetings without dissent in Poland is similar to those of the Czech Republic, Sweden and the UK.

Can we infer from these dissenting votes anything about future monetary policy? To examine this question, following Gerlach-Kristen (2004), we construct the variable *skew*, which is defined as

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

where $i_{j,t}$ is the interest rate voted for by individual bank board member j at a monetary policy meeting at time t , and i_t denotes the monetary policy rate. Therefore, $skew_{\tau(t)}$ is the difference between the average voted-for and the actually-implemented monetary policy rate at time $\tau(t)$, which is several days (roughly two weeks) after the monetary policy meeting at time t . We write “several days” because voting records are typically released with minutes. The number of days between a monetary policy meeting and the release of minutes can vary, for example, because of national holidays. Therefore, this information is available from the websites of central banks. Note that the votes are released at time $\tau(t)$, i.e., in the period between the interest rate decisions at t and $t+1$.

A positive (negative) value of $skew$ indicates that some central bankers preferred higher (lower) rates than the majority. Our hypothesis is that when $skew$ is positive, a future interest rate hike is more likely. The evolution of $skew$ over time is available in Figure 1. $Skew$ frequently differs from zero in all central banks.

Using our $skew$ measure, we estimate regressions of the following form:

$$\Delta i_{t+1} = b_0 + b_1 \Delta i_t + b_2 skew_{\tau(t)} + b_3 (i_{\chi(t),L} - i_{\chi(t),S}) + u_{t+1} \quad (2)$$

The term $(i_{\chi(t),L} - i_{\chi(t),S})$ controls for financial market expectations. $i_{\chi(t),L}$ and $i_{\chi(t),S}$ represent the money market rate at long (L) and short (S) maturities, respectively. Following Gerlach-Kristen (2004) and Horvath et al. (2012a), we use the difference between 12- and 3-month maturities and 3 months and 1 month, respectively. The data for $(i_{\chi(t),L} - i_{\chi(t),S})$ correspond to one day before the voting record is released (e.g., at time $\chi(t)$). These data are available in Figures A.2 and A.3 in the Appendix.

We estimate Eq. (2), using an ordered probit technique to account for the discrete nature of monetary policy rate changes (Δi_{t+1}).² As in Gerlach-Kristen (2004) and Horvath et al. (2012a), we stack the dependent variable into fewer categories, as very large interest rate changes are rare. In general, the dependent variable is stacked into the following categories: ≤ -50 , -25 , 0 , $+25$ and $\geq +50$ basis point changes. The number of categories is set according to the log-likelihood of regression models. Note that stacking the dependent variable into fewer categories reduces the effects of outliers in the dependent variable.

Using Eq. (2), we test whether voting records are informative about future monetary policy, controlling for financial market expectations. If the coefficient b_2 is positive and statistically significant, our results suggest that voting records convey new information to financial markets, additional to what they learn from the announcement of a monetary policy rate.

Gerlach-Kristen (2004) estimates Eq. (2), using voting records of the Bank of England for 1997-2002. Horvath et al. (2012a) apply this model to voting data from central banks in five countries: the Czech Republic, Hungary, Poland, Sweden and the UK. In Horvath et al. (2012a), the beginning of the sample period varies and depends on the date that a central bank releases its voting record for the first time. The end of their sample period is February 2009. Here, we use the same set of central banks as in Horvath et al. (2012a) but update the database through mid-2014, thereby more fully covering the period of the global financial crisis.

We extend the framework of Gerlach-Kristen (2004) and Horvath et al. (2012a) in the following way. We estimate Eqs. (3) and (4) and test whether voting records, controlling for current policy and financial market expectations, predict monetary policy rate changes two and three meetings ahead. Therefore, the dependent variable Δi_{t+1} is replaced by Δi_{t+2} and Δi_{t+3} in Eqs. (3) and (4), respectively. If we examine the voting patterns of individual bank board members, we observe that some early birds were followed by the majority with a lag greater than one monetary policy meeting (more on this in our results section).

² The discrete dependent variable has been stacked in fewer categories, as some policy change magnitudes rarely occur. The number of categories is set according to the log-likelihood of competing models. The data for monetary policy rate changes are depicted in Figure A.1 in the Appendix.

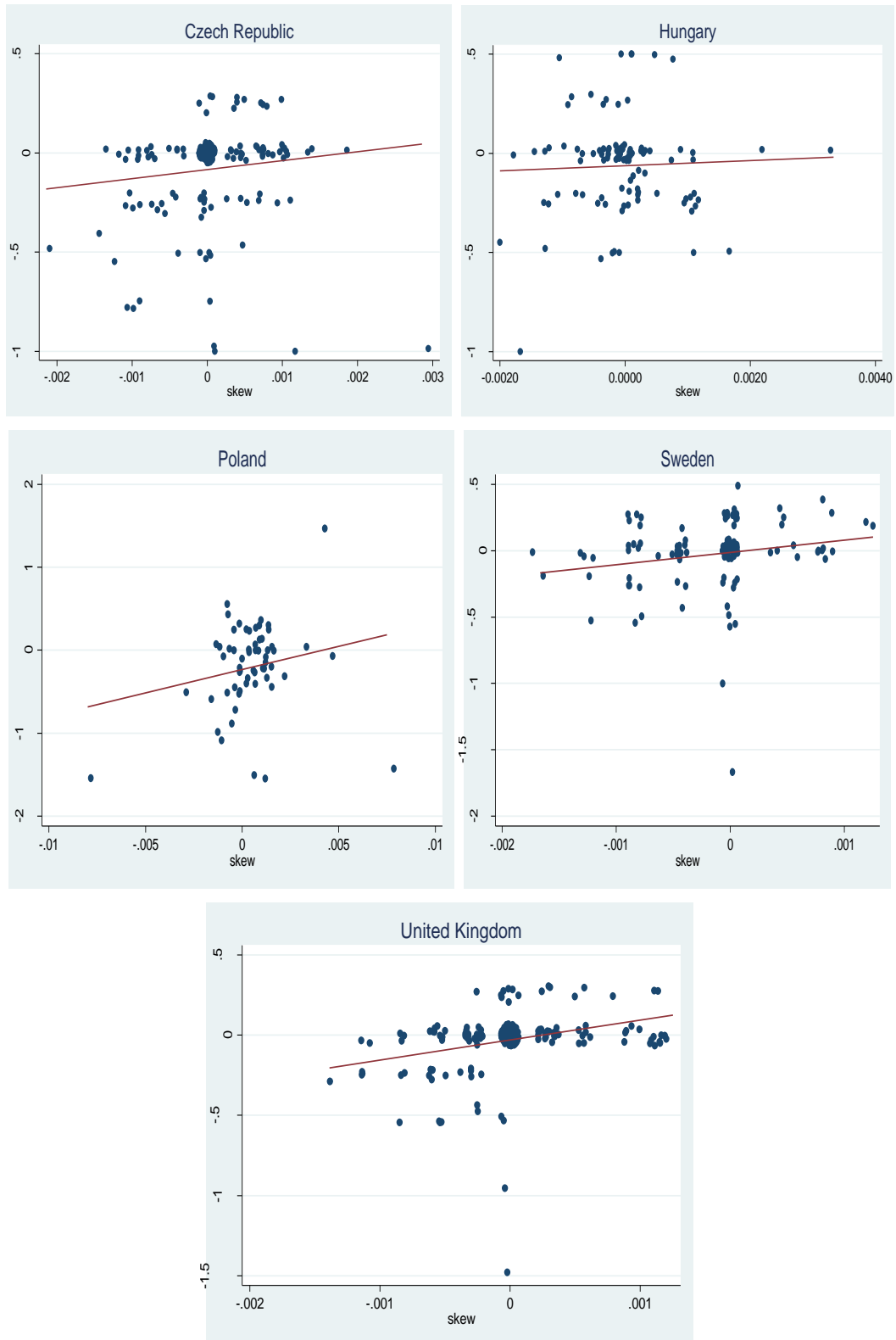
$$\Delta i_{t+2} = b_0 + b_1 \Delta i_t + b_2 skew_{\tau(t)} + b_3 (i_{\chi(t),L} - i_{\chi(t),S}) + u_{t+2} \quad (3)$$

$$\Delta i_{t+3} = b_0 + b_1 \Delta i_t + b_2 skew_{\tau(t)} + b_3 (i_{\chi(t),L} - i_{\chi(t),S}) + u_{t+3} \quad (4)$$

We estimate Eqs. (2)-(4) for both the full sample and the restricted sample – the period of the global financial crisis, which we define as the period from August 2007 onwards.

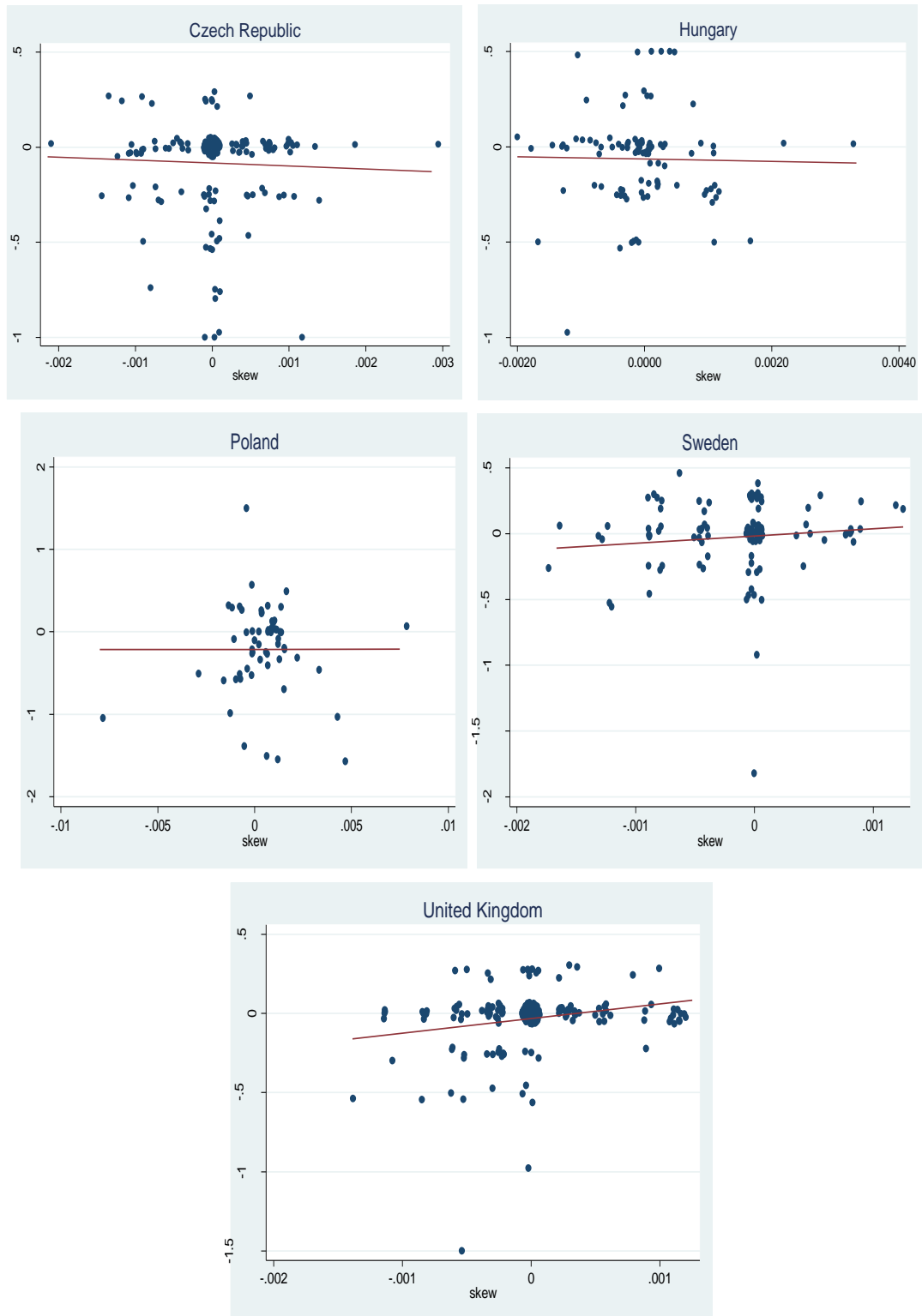
If we examine scatter plots between *skew* and future monetary policy, we observe, as expected, a positive relationship between *skew* and the monetary policy rate change at $t+1$. This is seen in Figure 2. The positive relationship is also observed for $t+2$ and $t+3$ but only for certain central banks (see Figures 3 and 4). Nevertheless, the scatter plots are merely indicative, as they do not control for financial market expectations. In addition, the regression framework reduces the importance of vertical outliers (e.g., rare but large interest rate hikes or cuts).

Figure 2 - Voting Record skew in t and Policy Rate Change in $t+1$



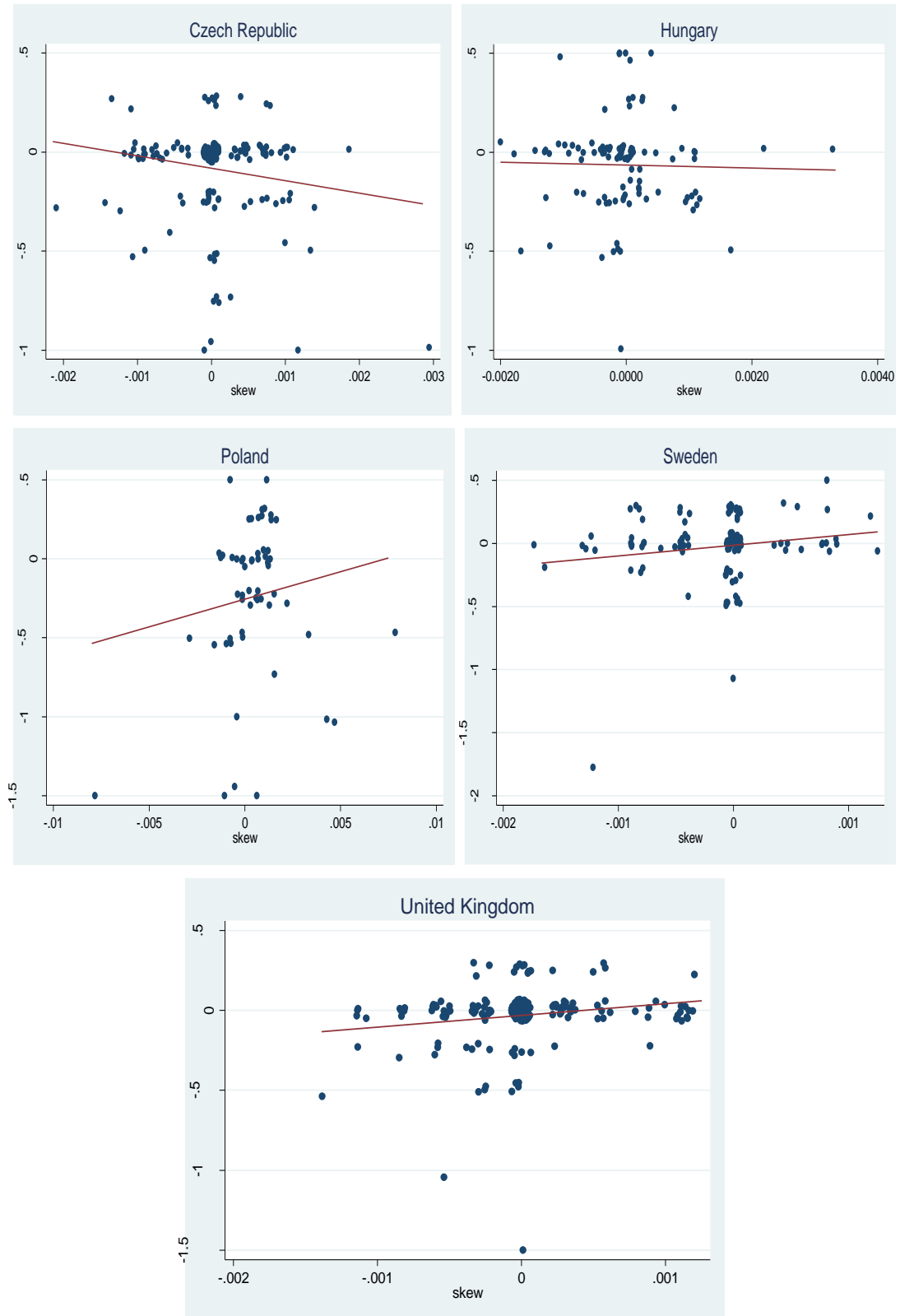
Notes: Skew (in%), plotted on the x-axis, is calculated as the difference between the average rate voted for by individual board members and the actually-implemented rate at policy meetings at time t . Monetary policy rate changes at policy meetings at $t+1$ are plotted on the y-axis. For expositional purposes, jitter is used for overlapping observations.

Figure 3 - Voting Record skew in t and Policy Rate Change in $t+2$



Notes: Skew (in%), plotted on the x-axis, is calculated as the difference between the average rate voted for by individual board members and the actually-implemented rate at policy meetings at time t . Monetary policy rate changes at policy meetings at $t+2$ are plotted on the y-axis. For expositional purposes, jitter is used for overlapping observations.

Figure 4 - Voting Record *skew* in *t* and Policy Rate Change in *t*+3



Notes: Skew (in%), plotted on the x-axis, is calculated as the difference between the average rate voted for by individual board members and the actually-implemented rate at policy meetings at time *t*. Monetary policy rate changes at policy meetings at

$t+3$ are plotted on the y-axis. For expositional purposes, jitter is used for overlapping observations.

IV. Results

In this section, we present the results of estimations of our empirical model of the importance of voting records for future monetary policy. First, we provide the results for the full sample. Second, we provide the results for the restricted sample – the period of the global financial crisis (starting in August 2007).

IV.I Results for the Full Sample

We present our results on the extent to which voting records matter for the monetary policy rate set at the next meeting (in $t+1$) in Table 1. The results suggest that voting records, proxied by our measure *skew*, are relevant to an understanding of future monetary policy. *Skew* is found to be significant even if we control for financial market expectations from one day before.³ This result suggests that voting records add information about monetary policy for financial markets. This finding is in line with Gerlach-Kristen (2004) and Horvath et al. (2012a).

One possible criticism of this analysis is that minutes and voting records are typically released together and that our results may therefore shed light on the importance of minutes rather than voting records. One way of thinking about this is that voting records represent quantitative summaries of the minutes of committee meetings. Nevertheless, it is important to recognize that voting records are released separately from minutes in Poland (at least during our sample period). As a result, our findings for Poland suggest that voting records indeed contain new information for financial markets.⁴

³ Note that the minutes with voting records are typically released in the morning at approximately 9AM, so that it should be sufficient to control for financial market expectations one day before.

⁴ In this regard, the results for the Czech Republic should be interpreted with caution, as, from 2006:8 onwards, voting ratios have been released at the press conference that occurs approximately two hours after the announcement of monetary policy decisions. On the other hand, *skew* remains significant, regardless the sample period.

Table 1 - Do Voting Records Predict Monetary Policy at the Next Meeting?

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

	Czech Rep. 1998:2–2014:6		Hungary 2005:10–2014:5		Poland 2000:2–2009:12		Sweden 1999:1–2014:7		UK 1997:7–2014:6	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Rate Change b_1	0.74*** (0.15)	0.57*** (0.16)	1.33*** (0.20)	1.28*** (0.20)	0.35** (0.18)	0.12 (0.22)	0.86*** (0.16)	0.77*** (0.16)	1.19*** (0.18)	1.10*** (0.18)
Skew b_2	0.88*** (0.17)	0.84*** (0.17)	0.19 (0.16)	0.18 (0.16)	0.40*** (0.14)	0.45*** (0.13)	0.98*** (0.22)	0.80*** (0.23)	1.49*** (0.24)	1.37*** (0.25)
Term Structure b_3	1.88*** (0.61)	1.68*** (0.37)	3.31** (1.34)	1.79*** (0.68)	4.19*** (0.93)	3.60*** (0.70)	2.28** (0.91)	2.07*** (0.55)	0.51 (0.59)	0.72* (0.37)
Adj. Pseudo R-sqr.	0.16	0.20	0.40	0.40	0.36	0.41	0.20	0.24	0.29	0.30
Observations	178	178	104	104	60	57	122	115	204	204

Notes: *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between three-month and one-month interbank rates, and even columns represent estimations of the difference between one-year and three-month rates. Twelve-month interbank rates in Poland have been published since 2001. Therefore, the number of observations in column (5) is larger than in column (6). Data on the twelve-month interbank rate in Sweden are available through March 2013. Thus, the number of observations in column (8) is smaller than in column (7). Voting records for Poland run only through 2009:12 because subsequent data on whether individual board members dissented do not include the specific interest rates they voted for.

It is noteworthy that *skew* is significant at the 1% level for all countries except Hungary. Why do the results for Hungary indicate that voting records do not contain new information for financial markets? Our supposition is that, because, in contrast to the other five central banks in our sample, *de facto* central bank independence in Hungary has decreased in recent years, financial markets do not view the votes of individual board members as relevant to the formation of expectations regarding future policy.

More broadly, the results for Hungary correspond to Tillmann (2011) and Horvath et al. (2012b) on strategic deliberations of the US Federal Reserve's Federal Open Market Committee (FOMC) members. Their results indicate that alternate members, who actively participate in debates at monetary policy meetings but do not vote, may respond to different incentives. Tillmann (2011) finds that such members exaggerate their views on policy to influence policy deliberations. Horvath et al. (2012b) find that their voting behavior is more in line with that of the chairman and that their votes do not forecast future monetary policy.

The independence of the Hungarian central bank has been extensively discussed in the media (see, for example, Reuters, 2014), by the monetary authorities (ECB,

2014) and in academic research (Eijffinger et al., 2013a). The ECB, in its legal opinion released on January, 31, 2014, warned that: “*The ECB would like to underline that Governors and other members of a decision-making body of a national central bank ... may not be dismissed for reasons other than those laid down in article 14.2 of the Statute of the ESCB*” (ECB, 2014). This view, which is shared by Eijffinger et al. (2013a), shows how central bank transparency and independence are interconnected. The appointment rules of new board members changed often (see Jung and Kiss, 2012) and the central bank law changed many times (nearly 25 times since 2008 according to the information provided on the website of the Hungarian central bank).

The results in Table 1 also suggest a certain amount of interest rate smoothing (the lagged rate change is statistically significant), i.e., that central banks typically prefer not to change their monetary policy rates abruptly. In addition, our results indicate that financial markets correctly predict the directions of monetary policy rate changes.⁵ The regression fit, as proxied by the adjusted pseudo R-squared, varies between 0.2 and 0.4.

⁵ Note that the liquidity of some interbank rates during the financial crisis was not high, but our data are at the monthly frequency (or approximately a month and a-half frequency for some central banks).

Table 2 - Do Voting Records Predict Monetary Policy Two Meetings Ahead?

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

	Czech Rep. 1998:2–2014:6		Hungary 2005:10–2014:5		Poland 2000:2–2009:12		Sweden 1999:1–2014:7		United Kingdom 1997:7–2014:6	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Rate Change 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-sqr.	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 significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between three-month and one-month interbank rates, and even columns represent estimations of the difference between one-year and three-month rates. Twelve-month interbank rates in Poland have been published since 2001. Therefore, the number of observations in column (5) is larger than in column (6). Data on the twelve-month interbank rate in Sweden are available through March 2013. Thus, the number of observations in column (8) is smaller than in column (7). Voting records for Poland run only through 2009:12 because subsequent data on whether individual board members dissented do not include the specific interest rates they voted for.

In Table 2, we provide results regarding whether voting records are informative about monetary policy rates two meetings ahead. The results largely confirm the findings presented in Table 1, although the significance of *skew* for the Czech and Polish central banks varies somewhat. The regression fit is accordingly lower.

The results regarding the relevance of voting records to an understanding of monetary policy three meetings ahead are presented in Table 3. *Skew* is no longer significant for central banks in Central Europe, and the predictability of monetary policy is thus highest for the central banks of Sweden and the UK. However, it is important to note that the difference in the frequency of monetary policy meetings in Sweden and UK. While the meetings are held at the monthly frequency in the UK, the frequency is bimonthly (the meetings are held six times per year) in Sweden. Therefore, according to our results, the predictability of Swedish monetary policy goes well beyond three months.

Table 3 - Do Voting Records Predict Monetary Policy Three Meetings Ahead?

$$\Delta i_{t+3} = b_0 + b_1 \Delta i_t + b_2 \text{skew}_{\tau(t)} + b_3 (i_{\chi(t),L} - i_{\chi(t),S}) + u_{t+3}$$

	Czech Rep. 1998:2–2014:6		Hungary 2005:10–2014:5		Poland 2000:2–2009:12		Sweden 1999:1–2014:7		United Kingdom 1997:7–2014:6	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Rate Change 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- sq.	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 significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between three-month and one-month interbank rates, and even columns represent the difference between one-year and three-month rates. Twelve-month interbank rates in Poland have been published since 2001. Therefore, the number of observations in column (5) is larger than in column (6). Data on the twelve-month interbank rate in Sweden are available through March 2013. Thus, the number of observations in column (8) is smaller than in column (7). Voting records for Poland run only through 2009:12 because subsequent data on whether individual board members dissented do not include the specific interest rates they voted for.

Next, we examine to what extent the *skew* is (or is not) a noisy indicator. We calculate the conditional probability of policy rate change depending on the magnitude of *skew*. Suppose we have a board with seven members. We calculate the conditional probability of policy rate change in case zero, one, two or three members votes to decrease the policy rate by 25 basis points. Clearly, low probabilities for policy rate change suggest that *skew* is a noisy indicator. We present the results in Table 4. The results are presented only for the case of policy meeting in $t+1$, the other two cases ($t+2$ and $t+3$) are largely similar and available upon request.

We observe that the probability of monetary policy rate change increases with the number of dissenting members. The probabilities seem to be adequate. For example, if one of the board members vote for lower rate of 25 basis points, while remaining eight members vote for the status quo, the conditional probability that the rates will be lowered at the next meeting is 0.1 in the case of the Bank of England. Once four members out of nine vote for lower policy rate, the conditional probability that the rates will be indeed reduced at the next meeting is of 0.45 for the Bank England.

Figure 4 – The Number of Dissenting Members and the Conditional Probability of Policy Rate Change in t+1

Czech Republic					
Dissent	Large decrease	Decrease	No change	Hike	
0	0.06	0.14	0.77	0.03	
1	0.1	0.19	0.69	0.02	
2	0.17	0.24	0.59	0	
3	0.25	0.27	0.47	0.01	

Hungary					
Dissent	Large decrease	Decrease	No change	Hike	Large hike
0	0	0.23	0.75	0.02	0
1	0.01	0.25	0.73	0.01	0
2	0.01	0.26	0.72	0.01	0
3	0.01	0.28	0.7	0.01	0
4	0.01	0.29	0.69	0.01	0

Poland					
Dissent	Large decrease	Decrease	No change	Hike	Large hike
0	0.17	0.44	0.39	0	0
1	0.2	0.45	0.35	0	0
2	0.23	0.46	0.31	0	0
3	0.26	0.47	0.27	0	0
4	0.3	0.46	0.24	0	0
5	0.34	0.45	0.21	0	0

Sweden					
Dissent	Large decrease	Decrease	No change	Hike	Large hike
0	0.01	0.06	0.78	0.15	0
1	0.03	0.1	0.78	0.09	0
2	0.07	0.16	0.73	0.04	0
3	0.12	0.21	0.65	0.02	0

United Kingdom					
Dissent	Large decrease	Decrease	No change	Hike	
0	0	0.04	0.92	0.03	
1	0.01	0.09	0.89	0.01	
2	0.03	0.15	0.81	0.01	
3	0.07	0.23	0.7	0	
4	0.14	0.31	0.55	0	

Note: Dissent represents the number of dissenting board members. Large decrease/large hike represents the decrease/increase of policy rate greater than 0.25. Decrease/hike represents the decrease/increase of policy rate of 0.25. No change represent the no change in the level of policy rate.

Note that the probability of 0.45 in the case of the Bank of England is no so low, as it may seem at the first sight. The high value of *skew* may persist for the next meeting (thus, without a change in the policy rate in $t+1$) and the rates may be decreased only at the meeting after the next meeting (in $t+2$).

Nevertheless, it is worth mentioning that the conditional probabilities somewhat differ in different central banks. While we observe the conditional probability of 0.45 for the Bank England, the corresponding probability is 0.52 for the Czech National Bank, 0.79 for the National Bank of Poland, 0.33 for Riksbank and 0.30 for the Hungarian central bank.

To summarize, our results show that the *skew* provides a correct prediction of the sign of future change in the policy rates but the skew indicator is somewhat noisy in the sense that its non-zero value does not automatically imply the policy rate change at the next monetary policy meeting. Nevertheless, if more board members dissent, the policy rate is likely to be changed soon.

IV.II Results for the Period of the Financial Crisis

In this subsection, we specifically examine the period of the global financial crisis. The crisis was characterized by a high level of uncertainty, and conventional monetary policy (i.e., setting the short-term interest rate) was accompanied by various non-standard measures primarily intended to inject additional liquidity into banks and stabilize financial markets.

Interestingly, voting records remain relevant to an understanding of monetary policy at the next meeting, as the results in Table 5 suggest. *Skew* is again significant for all countries, except Hungary (the results for Poland should be interpreted with caution, given the small number of observations).

**Table 5 - Do Voting Records Predict Monetary Policy at the Next Meeting?
The Period of the Global Financial Crisis**

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

	Czech Rep. 2007:8–2014:6		Hungary 2007:8–2014:5		Sweden 2007:8–2014:7		United Kingdom 2007:8–2014:6	
	(1)	(2)	(3)	(4)	(7)	(8)	(9)	(10)
Lagged Rate Change b_1	1.04*** (0.39)	1.20*** (0.36)	1.22*** (0.23)	1.18*** (0.25)	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)	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)	1.83 (2.14)	6.72*** (2.18)	2.91 (2.5)	0.31 (1.34)
Adj. Pseudo R-sqr.	0.36	0.29	0.37	0.36	0.28	0.55	0.74	0.72
Observations	56	56	82	82	42	35	82	82

Notes: *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between three-month and one-month interbank rates, and even columns represent estimations of the difference between one-year and three-month rates. Twelve-month interbank rates in Poland have been published since 2001. Therefore, the number of observations in column (5) is larger than in column (6). Data on the twelve-month interbank rate in Sweden are available through March 2013. Thus, the number of observations in column (8) is smaller than in column (7). Voting records for Poland run only through 2009:12 because subsequent data on whether individual board members dissented do not include the specific interest rates they voted for. The results for Poland not presented because of the low number of observations.

On the other hand, the results in Tables 6 and 7 show that voting records cannot predict monetary policy at more distant time horizons during the financial crisis. With one exception, *skew* is not significant at conventional levels. This result is likely a consequence of increased economic uncertainty. In such situations, financial markets recognize that monetary policy making may differ from policy making in the tranquil periods preceding the crisis and that the signaling role of voting records is more limited.

**Table 6 - Do Voting Records Predict Monetary Policy Two Meetings Ahead?
The Period of the Global Financial Crisis**

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

	Czech Rep. 2007:8–2014:6		Hungary 2007:8–2014:5		Sweden 2007:8–2014:7		United Kingdom 2007:8–2014:6	
	(1)	(2)	(3)	(4)	(7)	(8)	(9)	(10)
Lagged Rate Change b_1	0.72** (0.30)	0.90*** (0.29)	0.74*** (0.21)	0.62*** (0.23)	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)	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)	-0.42 (1.96)	1.00 (1.17)	0.56 (1.28)	1.30* (0.72)
Adj. Pseudo R-sqr.	0.17	0.13	0.16	0.17	0.10	0.13	0.34	0.39
Observations	55	55	81	81	41	35	82	82

Notes: *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between the three-month and one-month interbank rate, and even columns represent the difference between one-year and three-month rates. Twelve-month interbank rates in Poland have been published since 2001. Therefore, the number of observations in column (5) is larger than in column (6). Data on the twelve-month interbank rate in Sweden are available through March 2013. Thus, the number of observations in column (8) is smaller than in column (7). Voting records for Poland runs only through 2009:12 because subsequent data on whether individual board members dissented do not include the specific interest rates they voted for. The results for Poland not presented because of the low number of observations.

**Table 7 - Do Voting Records Predict Monetary Policy Three Meetings Ahead?
The Period of the Global Financial Crisis**

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

	Czech Rep. 2007:8–2014:6		Hungary 2007:8–2014:5		Sweden 2007:8–2014:7		United Kingdom 2007:8–2014:6	
	(1)	(2)	(3)	(4)	(7)	(8)	(9)	(10)
Lagged Rate Change b_1	0.44 (0.31)	0.63** (0.28)	0.45** (0.21)	0.42* (0.22)	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)	0.15 (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)	-2.88 (2.00)	1.07 (1.16)	-1.24 (1.18)	1.60** (0.65)
Adj. Pseudo R-sqr.	0.10	0.08	0.07	0.07	0.08	0.07	0.17	0.24
Observations	54	54	80	80	40	35	81	81

Notes: *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between three-month and one-month interbank rates, and even column represent the difference between one-year and three-month rates. Twelve-month interbank rates in Poland are published through 2001. Therefore, the number of observations in column (5) is larger than in column (6). Data on the twelve-month interbank rate in Sweden are available through March 2013. Thus, the number of observations in column (8) is smaller than in column (7). Voting records for Poland run only through 2009:12 because subsequent data on whether individual board members dissented do not include the specific interest rates they voted for. The results for Poland not presented because of the low number of observations.

IV.III Further Robustness Checks

Finally, we carry out a series of additional robustness checks. First, we re-estimate the baseline regressions for the Czech National Bank and the Bank of England. The policy rates remained unchanged for extended time period during the financial crisis. Therefore, our restricted sample for the Czech National Bank is 1998:2–2010:5 and 1997:7–2009:3, respectively. The regression results based on the restricted sample remain largely unchanged and are available upon request.

Second, the error terms in the regressions can be correlated, as we try to explain the effect of *skew* on the monetary policy rate change in $t+1$, $t+2$ and $t+3$. As a result, we estimate the seemingly unrelated regressions for ordered probit model (therefore, accounting for the nature of our dependent variable). If error terms are correlated, this additional piece of information may decrease the estimated standard errors and eventually influence our conclusions whether (or not) *skew* is informative at more distant policy horizons.

**Table 8 - Do Voting Records Predict Monetary Policy?
Seemingly Unrelated Regressions, Policy Meetings - $t+1$ and $t+2$**

	Czech Rep.	Hungary	Poland	Sweden	UK
Meeting at $t+1$					
Lagged rate change	0.56*** (0.16)	1.25*** (0.20)	0.07 (0.22)	0.80*** (0.17)	1.11*** (0.18)
Skew	0.83*** (0.17)	0.20 (0.16)	0.45*** (0.13)	0.82*** (0.23)	13.77*** (2.48)
Term structure	1.68*** (0.37)	2.20*** (0.71)	3.94*** (0.75)	2.13*** (0.56)	0.72* (0.37)
Meeting at $t+2$					
Lagged rate change	0.69*** (0.15)	0.58*** (0.18)	0.17 (0.20)	0.49*** (0.15)	1.06*** (0.17)
Skew	0.21 (0.16)	-0.06 (0.15)	0.22** (0.11)	0.42** (0.21)	7.51*** (2.35)
Term structure	1.21*** (0.36)	1.72*** (0.62)	1.62*** (0.49)	0.96* (0.50)	0.71* (0.37)
chi 2 (1)	0.72	53.68***	0.04	10.73***	2.23

Note: chi 2 (1) is LR test of independent equations with a null hypothesis that the equations are independent.

The available code is able to estimate the bivariate regressions for the ordered dependent variables. We present the results in Tables 8-10 and find that the errors are indeed correlated but not in all cases. The robustness check largely confirms our

baseline results. The *skew* indicator remains significant for more distant monetary policy meetings only in the case of the Bank of England and Sveriges Riksbank.

**Table 9 - Do Voting Records Predict Monetary Policy?
Seemingly Unrelated Regressions, Policy Meetings - t+1 and t+3**

	Czech Rep.	Hungary	Poland	Sweden	UK
Meeting at t+1					
Lagged rate change	0.56*** (0.16)	1.24*** (0.20)	0.13 (0.23)	0.78*** (0.16)	1.13*** (0.18)
Skew	0.82*** (0.18)	0.20 (0.16)	0.50*** (0.14)	0.80*** (0.23)	1.39*** (0.24)
Term structure	1.61*** (0.37)	2.08*** (0.71)	4.15*** (0.84)	2.07*** (0.55)	0.77** (0.38)
Meeting at t+3					
Lagged rate change	0.47*** (0.15)	0.33* (0.17)	0.01 (0.18)	0.36** (0.15)	0.65*** (0.16)
Skew	0.01 (0.16)	-0.03 (0.15)	0.12 (0.10)	0.34 (0.21)	0.53** (0.22)
Term structure	1.05*** (0.35)	1.38** (0.58)	0.97*** (0.35)	0.77 (0.49)	0.77** (0.34)
chi 2 (1)	22.16***	26.31***	0.34	3.83*	19.89***

Note: chi 2 (1) is LR test of independent equations with a null hypothesis that the equations are independent.

**Table 10 - Do Voting Records Predict Monetary Policy?
Seemingly Unrelated Regressions, Policy Meetings - t+2 and t+3**

	Czech Rep.	Hungary	Poland	Sweden	UK
Meeting at t+2					
Lagged rate change	0.68*** (0.15)	0.62*** (0.18)	0.27 (0.19)	0.51*** (0.15)	1.08*** (0.17)
Skew	0.21 (0.16)	-0.05 (0.15)	0.26** (0.11)	0.45** (0.21)	0.80*** (0.23)
Term structure	1.21*** (0.36)	1.91*** (0.63)	1.40*** (0.45)	0.99** (0.50)	0.72** (0.36)
Meeting at t+3					
Lagged rate change	0.45*** (0.15)	0.31* (0.17)	-0.01 (0.18)	0.36** (0.15)	0.65*** (0.16)
Skew	0.03 (0.16)	-0.03 (0.15)	0.12 (0.10)	0.36* (0.21)	0.55** (0.22)
Term structure	1.04*** (0.35)	1.44** (0.58)	0.98*** (0.35)	0.78 (0.49)	0.80** (0.34)
chi 2 (1)	1.41	74.04***	7.81***	18.70***	10.77***

Note: chi 2 (1) is LR test of independent equations with a null hypothesis that the equations are independent.

Third, we also estimate Eqs. (2)-(4) for the restricted sample, i.e., based on data prior to the financial crisis. The results again largely confirm our baseline results for the full sample. The results are presented in Tables A.1-A.3 in the Appendix.

Forth, we assess our results on the conditional probabilities of policy rate change and how this probability depends on the size of *skew*. Instead of calculating the conditional probabilities of policy rate change, which are presented in Table 4, we provide a simple “early bird” indicator. We define the dissent as of the “early bird” type, if the policy rate is indeed changed within the next three monetary policy meetings in the direction of the dissenting vote relative to what the majority voted for. The results suggest that not all dissenting votes are followed by the policy rate change but we still observe relatively many central bankers, for which their voting record predicts the future course of policy well. For example, the Bank of England’s Monetary Policy Committee member Willem Buiter dissented 17 times during his term and in 13 cases the direction of his dissent predicted the direction of monetary policy rate change for at least one of the next three policy meetings. The results are available in the Appendix in Tables A.4-A.8.

We would like to emphasize that our early bird analysis is positive rather than normative. Being the early bird does not mean that this central banker votes for the policy rate closer to the (unobserved) optimal policy rate. It merely signals the future policy rate changes. Interestingly, there are much less early birds in Hungary, which corresponds to our regression findings that *skew* does not matter for Hungarian central bank. Overall, this is in line with our analysis of the effect of the magnitude of *skew* on the conditional probability of policy rate change.

Fifth, we additionally include the “crisis” dummy into our regressions and re-estimate our ordered probit model. The dummy takes the value of one from 2007:8 onwards, zero otherwise. The dummy is statistically significant in many cases but the significance of *skew* remains unchanged. These results are also available upon request.

V. Conclusions

We examine the voting records of five central banks (the Czech Republic, Hungary, Poland, Sweden and the UK) and analyze whether information conveyed by voting records helps predict future monetary policy. Following Gerlach-Kristen (2004), we

construct the variable *skew*, defined as the difference between the average voted-for and actually-implemented policy rate and examine whether *skew* helps predict future changes in the monetary policy rate, controlling for current policy and financial market expectations. Put differently, we examine whether, when the minority votes for lower rates than the majority, there is an increased likelihood of a rate cut at subsequent meetings. Unlike previous research, we focus not only on predicting monetary policy at the next policy meeting but also at more distant time horizons (two and three monetary policy meetings ahead). Our sample includes the period of the global financial crisis; thus, we contribute to previous research by empirically examining the predictive power of voting records under conditions of high economic uncertainty.

Our results confirm findings of previous literature (see Gerlach-Kristen, 2004, and Horvath et al., 2012a) in showing that voting records are indeed informative about policy rates set at the next monetary policy meeting. However, this result pertains only to central banks that are sufficiently independent. If the central bank is not independent, voting records of central bankers do not add new information that is relevant to financial markets. To our knowledge, this finding has not previously been observed in the literature.

Next, we extended the previous literature, as we find that voting records are informative about policy rates set even two or three policy meetings ahead, unless the macroeconomic environment is too volatile. The probability of policy rate change increases with the number of dissenting votes. *Skew* is somewhat noisy indicator. If one board members votes for lower rate, the probability that the rate is decreased at the next meeting is not high. Nevertheless, if there are more dissenting members, the probability may increase substantially. This result suggests that it may benefit market participants to closely monitor the voting patterns of individual board members, especially those ‘early birds’ who propose changes in policy rates ahead of the majority.

More generally, our results show that enhancing the transparency of independent central banks through the release of (attributed or non-attributed) voting records is likely to increase monetary policy predictability.

References

- Angeletos, G.-M. and A. Pavan, 2007. Efficient Use of Information and Social Value of Information. *Econometrica*, 75(4), 1103-1142.
- Besley, T., N. Meads, and P. Surico, 2008. Insiders versus Outsiders in Monetary Policymaking. *American Economic Review*, 98 (2), 218–223.
- Bhattacharjee, A. and S. Holly, 2014. Influence, Interactions and Heterogeneity: Taking Personalities out of Monetary Policy Decision-making. *Manchester School*, forthcoming.
- Brooks, R., M. Harris, and C. Spencer, 2011. A decade of dissent: explaining the dissent voting behavior of Bank of England MPC members. *Public Choice*, 146(3-4), 413-442.
- Blinder, A. S., M. Ehrmann, M. Fratzscher, J. de Haan and D.-J. Jansen, 2009. Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence. *Journal of Economic Literature*, 46(4), 910–945.
- Chappell, H. W., R. R. McGregor and T. Vermilyea, 2005. Committee Decisions on Monetary Policy, Evidence from Historical Records of the Federal Open Market Committee. London: MIT Press.
- Cornand, C. and F. Heinemann, 2008. Optimal Degree of Public Information Dissemination. *Economic Journal*, 118, 718–742.
- Crowe, C., 2010. Testing the Transparency Benefits of Inflation Targeting: Evidence from Private Sector Forecasts. *Journal of Monetary Economics*, 57, 226-232.
- Dale, S., A. Orphanides, and P. Österholm, 2011. Imperfect Central Bank Communication - Information versus Distraction. *International Journal of Central Banking*, 7(2), 3-39.
- Dincer, N. and B. Eichengreen, 2014. Central Bank Transparency and Independence: Updates and New Measures. *International Journal of Central Banking*, 10, 189-253.
- Eijffinger, S. C. W., R.J. Mahieu, and L. Raes, 2013a. Estimating the Preferences of Central Bankers: An Analysis of Four Voting Records. Center Discussion Paper Series No. 2013-047.
- Eijffinger, S. C. W., R.J. Mahieu, and L. Raes, 2013b. Inferring Hawks and Doves from Voting Records. Discussion Paper 2013-024, Center for Economic Research, Tilburg University
- Farvaque, E., N. Matsueda, and P.-G. Meon, 2009. How Monetary Policy Committees Impact the Volatility of Policy Rates. *Journal of Macroeconomics*, 31(4), 534-546.
- Geraats, P. M., 2002. Central Bank Transparency. *The Economic Journal*, 112(483), F532–F565, 35.

- Geraats, P. M., 2009. Trends in Monetary Policy Transparency. *International Finance*, 12, 235–268.
- Gerlach-Kristen, P., 2004. Is the MPC's Voting Record Informative about Future UK Monetary Policy?. *Scandinavian Journal of Economics*, 106, 299–313.
- Gerlach-Kristen, P. and E. Meade, 2010. Is There a Limit on FOMC Dissents? Evidence from the Greenspan Era. American University economics working papers, No. 16/2010.
- Hayo, B. and Neuenkirch, M. (2010), Do Federal Reserve Communications Help Predict Federal Funds Target Rate Decisions?. *Journal of Macroeconomics*, 32, 1014–1024.
- Hahn, V., 2012. Should Central Banks Remain Silent about their Private Information on Cost-Push Shocks?. *Oxford Economic Papers*, 64(4), 593-615.
- Horváth, R., K. Šmídková, and J. Zápal, 2010. Central Banks' Voting Records and Future Policy. *Czech National Bank Working Paper Series, No.10/2010*.
- Horváth, R., K. Šmídková, and J. Zápal, 2012a. Central Banks' Voting Records and Future Policy. *International Journal of Central Banking*, 8(4), 1–19.
- Horváth, R., K. Šmídková, and J. Zápal, 2012b. Is the U.S. Fed Voting Record Informative about Future Monetary Policy?. *Czech Journal of Economics and Finance*, 62(6), 478–484.
- Horváth, R., M. Rusnák, K. Šmídková, and J. Zápal, 2014. The Dissent Voting Behavior of Central Bankers: What Do We Really Know?. *Applied Economics*, 46 (4), 450-461.
- Jung, A. and G. Kiss, 2012. Preference Heterogeneity in the CEE Inflation-Targeting Countries. *European Journal of Political Economy*, 2894, 445-460.
- Meade, E. E. and D. Stasavage, 2008. Publicity of Debate and the Incentive to Dissent: Evidence from the US Federal Reserve. *Economic Journal*, 118(528), 695–717.
- Morris, S. and H. S. Shin, 2002. Social Value of Public Information. *American Economic Review*, 92(5), 1521–1534.
- Neuenkirch, M., 2013. Predicting Bank of England's Asset Purchase Decisions with MPC Voting Records. *Applied Economics Letters*, 20(13), 1275-1278.
- Neuenkirch, M. and P. Siklos, 2013. What's in a second opinion? Shadowing the ECB and the Bank of England. *European Journal of Political Economy*, 32, 135-148.
- Neuenkirch, M. and P. Siklos, 2014. How Monetary Policy is Made: Two Canadian Tales. *International Journal of Central Banking*, forthcoming.

Reis, R., 2013. Central Bank Design. *Journal of Economic Perspectives*, 27(4): 17-44.

Riboni, A. and F. Ruge-Murcia, 2014. Dissent in monetary policy decisions. *Journal of Monetary Economics*, 66, 137-154.

Sturm, J.-E. and J. de Haan, 2011. Does Central Bank Communication Really Lead to Better Forecasts of Policy Decisions?. *Review of World Economics*, 147(1), 41–58.

Tillman, P., 2011. Strategic Forecasting on the FOMC. *European Journal of Political Economy*, 27, 547-553.

Other sources

ECB, 2014. Opinion of the European Central Bank of 31 January 2014 on the Magyar Nemzeti Bank, downloaded from https://www.ecb.europa.eu/ecb/legal/pdf/en_con_2014_08_f_sign.pdf on August 26, 2014

Reuters, 2014. ECB warns Hungary yet again to honor its central bank's independence, downloaded from <http://www.reuters.com/article/2014/02/06/us-ecb-hungary-centralbank-idUSBREA151KE20140206> on August 26, 2014

APPENDIX

Data Description

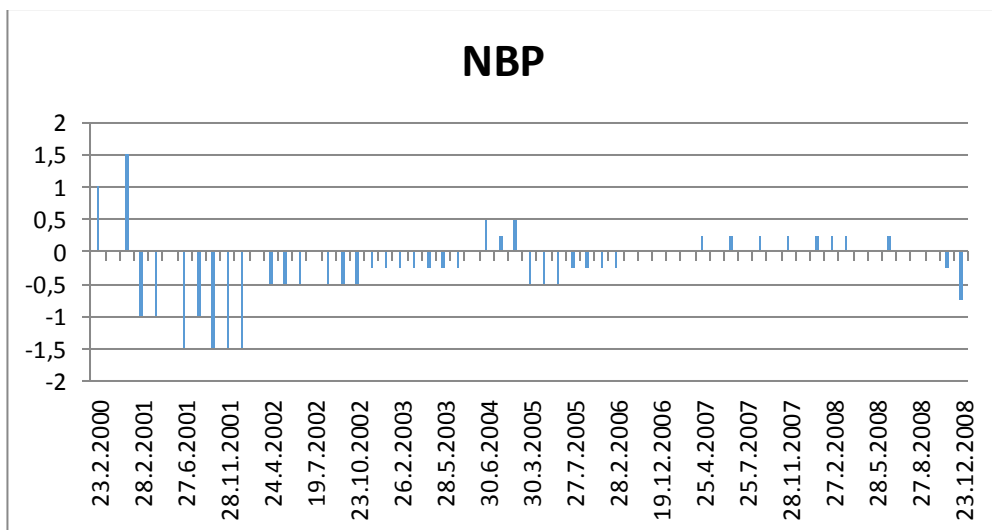
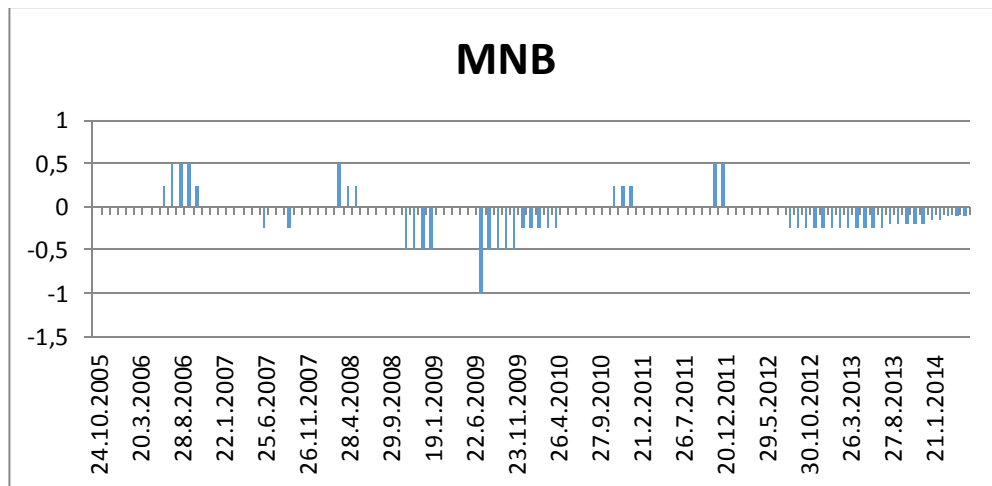
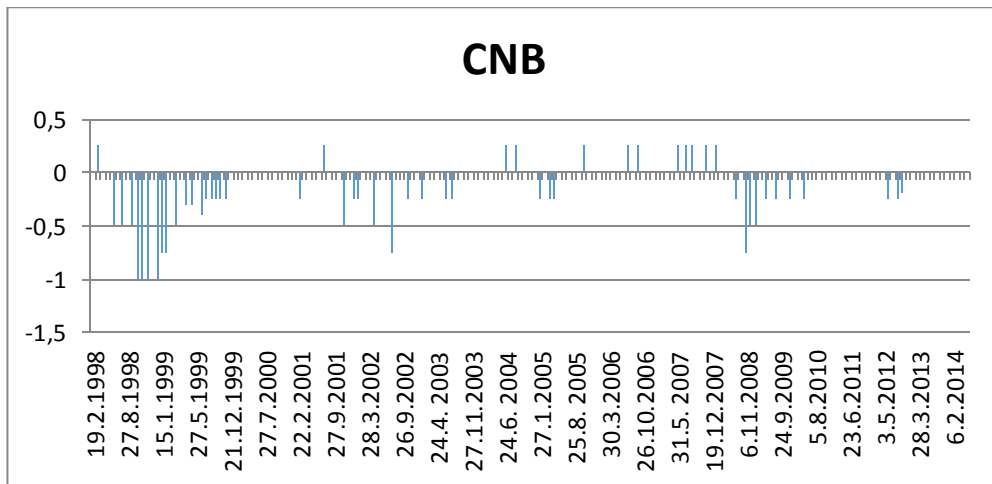
Voting record

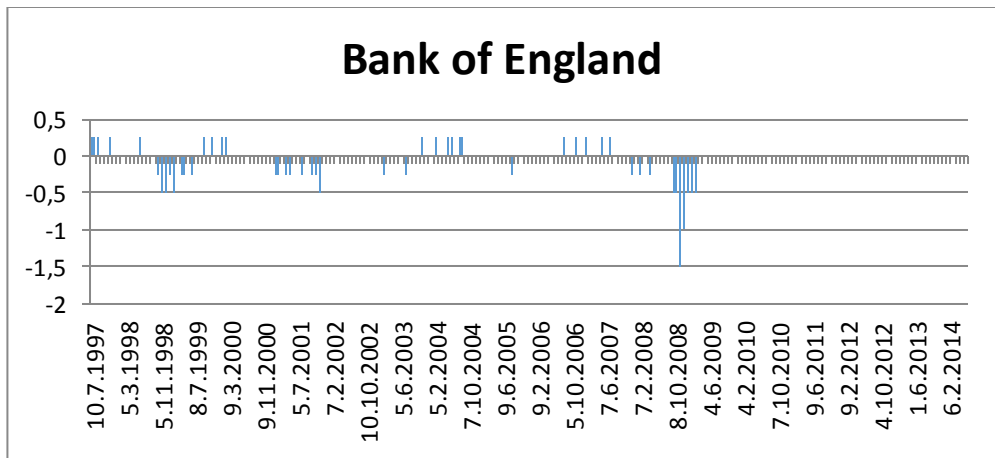
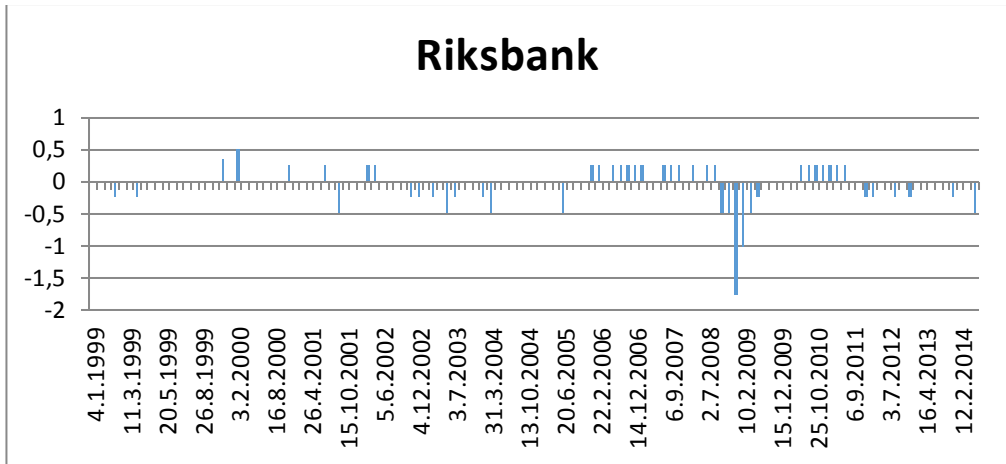
We collected voting records of five central banks: the Czech Republic, Hungary, Poland, Sweden and the United Kingdom. We updated the publicly available dataset of Horvath et al. (2012a) (see <http://www.central-bank-communication.net/>). The original dataset contains data through the beginning of 2009; we updated the dataset through mid-2014. As a result, we have voting records for the Czech Republic (1998:1-2014:6), Hungary (2005:9-2014:5), Poland (2000:1-2009:12), Sweden (1999:1-2014:6) and the United Kingdom (1997:7-2014:6). Voting data are typically monthly, although not always so, as central banks such as the Czech National Bank have met 8 times per year from 2008 onwards. The procedure by which the Czech National Bank releases voting records changed several times during our sample period (see Horvath et al., 2012a, for details). We use voting records for Poland only through 2009:12 because subsequent data on whether individual board members dissented do not include the specific interest rates they voted for. The sources of voting record data are central bank websites.

Monetary policy rates and interbank rates

Policy rates are obtained from central bank websites. Interbank data are from Datastream. We use PRIBOR for the Czech Republic, BUBOR for Hungary, WIBOR for Poland, STIBOR for Sweden and LIBOR for the United Kingdom for one-month, three-month and twelve-month maturities. Because 12M STIBOR closed on March 1, 2013, regressions using this variable are restricted to the period preceding this date (see <http://www.riksbank.se/en/Interest-and-exchange-rates/Explanation-of-the-series/Swedish-market-rates/>).

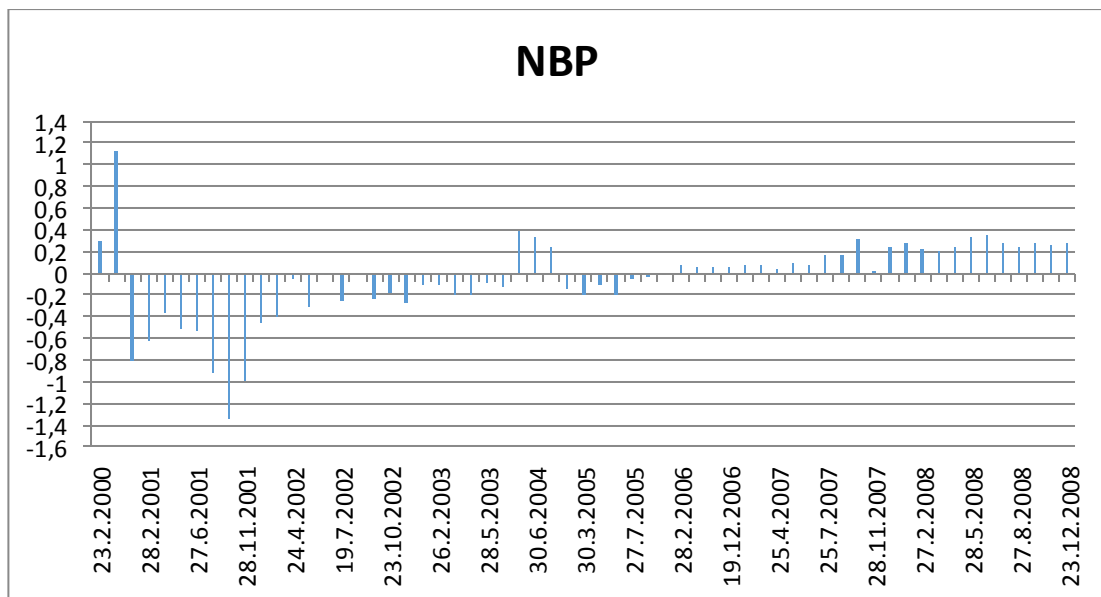
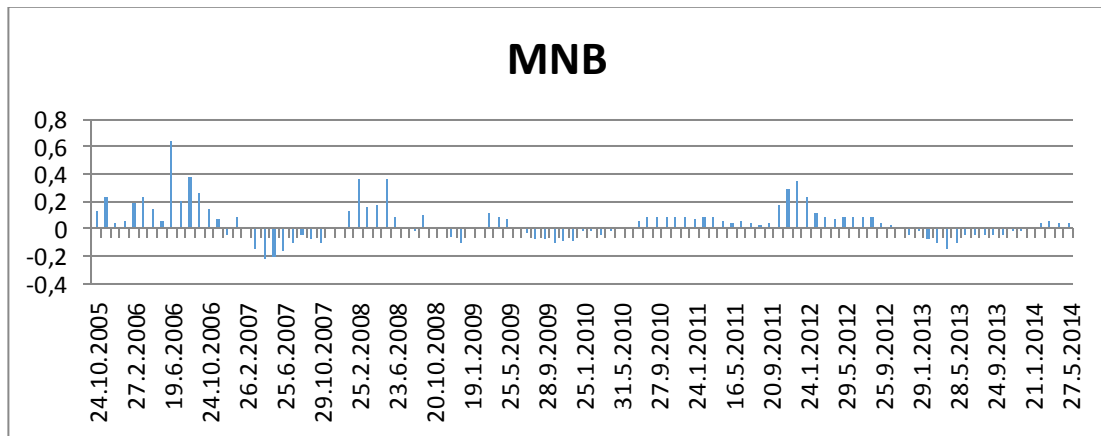
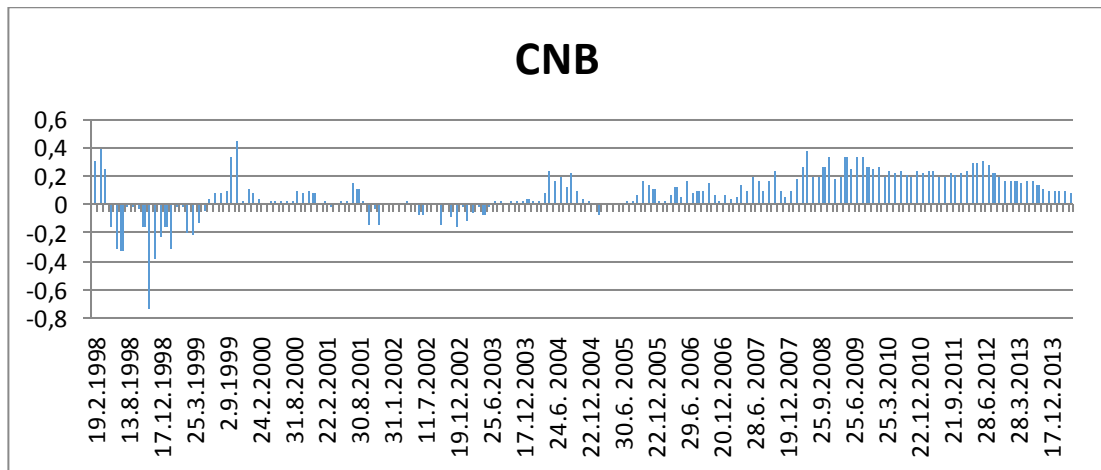
Figure A.1- Monetary policy rate changes





Note: The figure depicts our dependent variable. Time is on the x axis.

Figure A.2 - The difference between 3M and 1M interbank rates



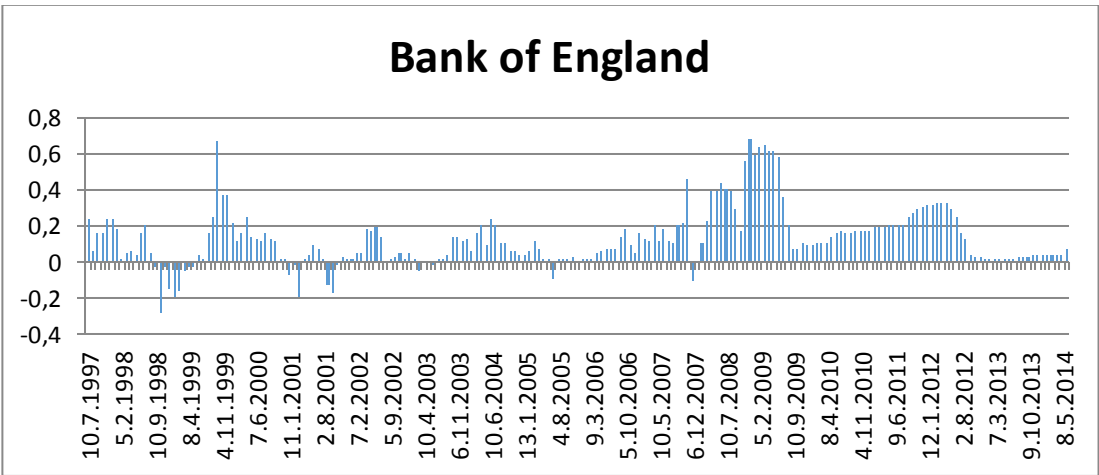
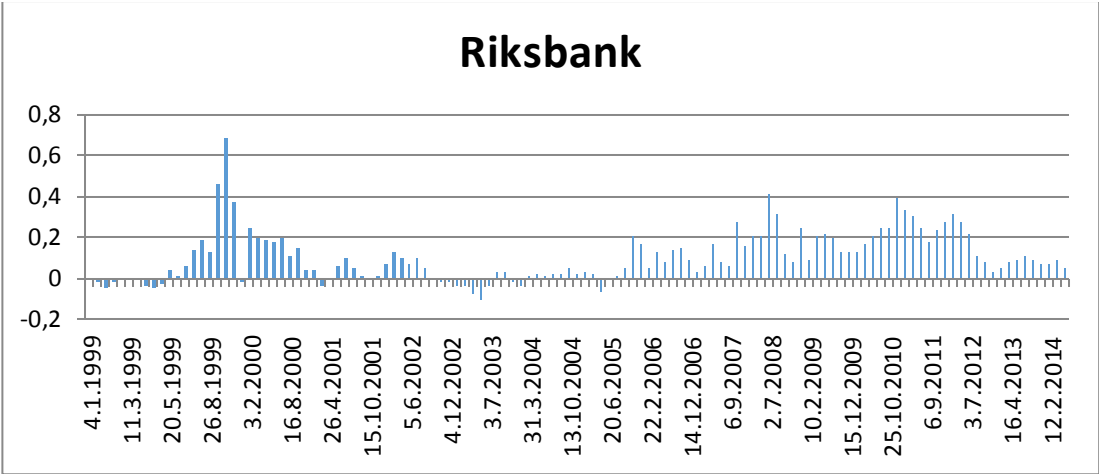
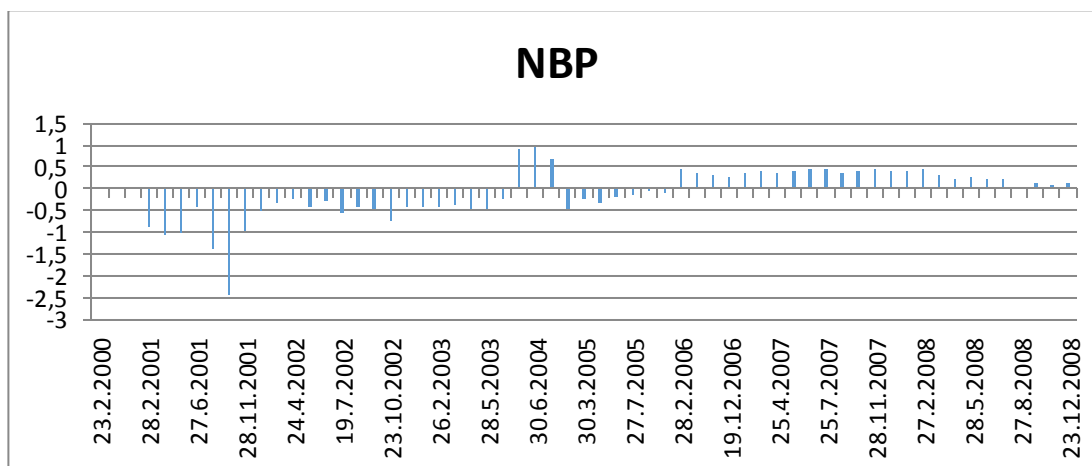
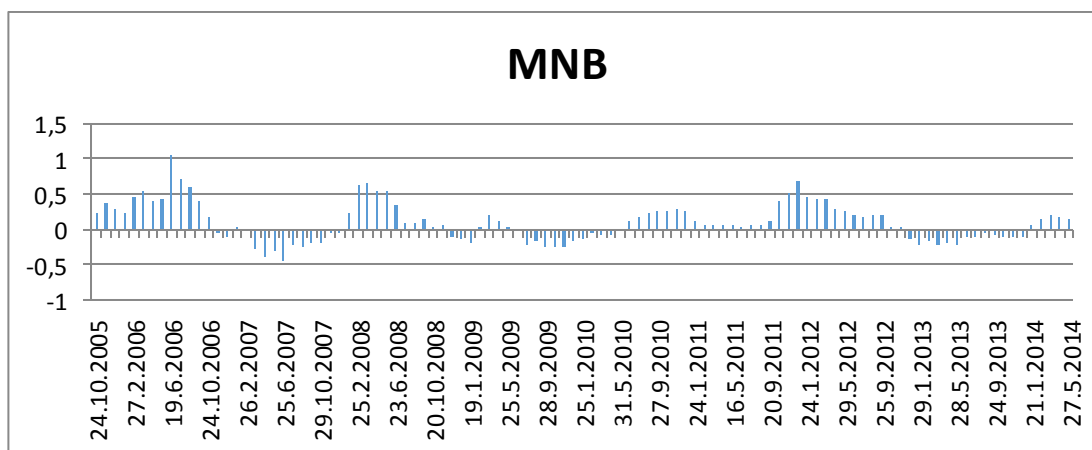
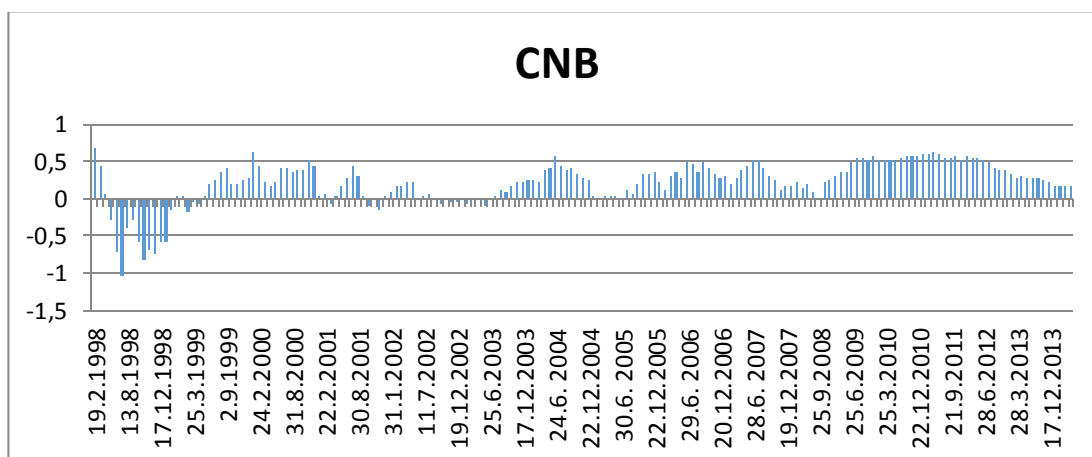
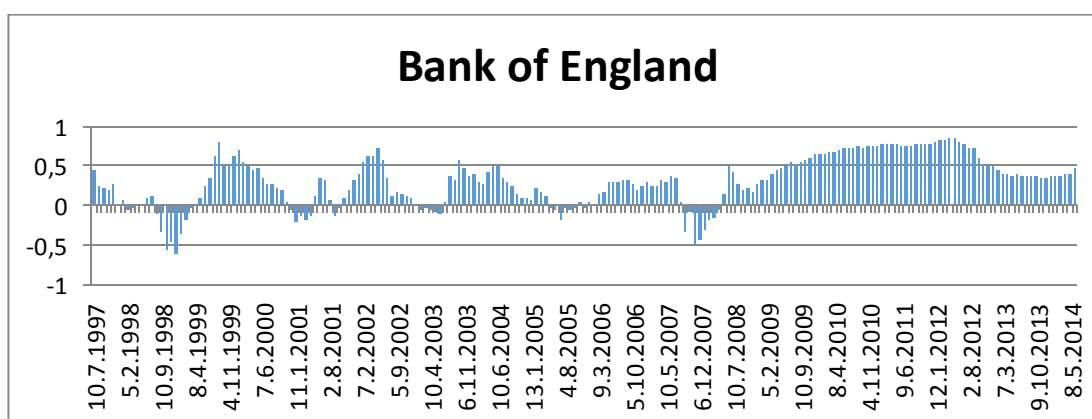
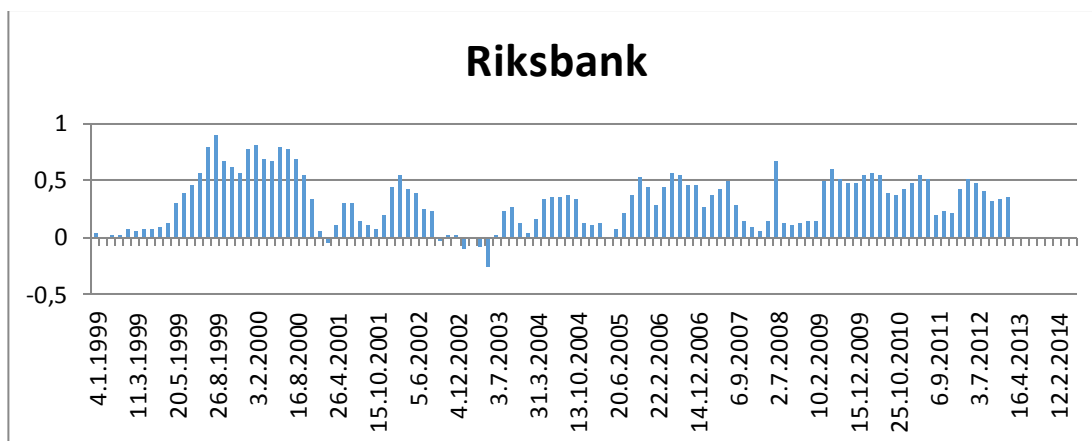


Figure A.3 - The difference between 12M and 3M interbank rates





**Table A.1 - Do Voting Records Predict Monetary Policy at the Next Meeting?
The Period until the Global Financial Crisis**

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

Country Sample	Czech Rep. 2000:7–2007:7		Hungary 2005:10–2007:7		Poland 1998:2–2007:7		Sweden 1999:1–2007:7		United Kingdom 1997:6–2007:7	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Rate Change 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-sqr.	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 significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between three-month and one-month interbank rates, and even columns represent the difference between one-year and three-month rates. Twelve-month interbank rates in Poland have been published since 2001. Therefore, the number of observations in column (5) is larger than in column (6). These results replicate those in Horvath et al. (2012a).

**Table A.2 - Do Voting Records Predict Monetary Policy Two Meetings Ahead?
The Period until the Global Financial Crisis**

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

	Czech Rep. 1998:2–2007:7		Hungary 2005:10–2007:7		Poland 2000:2–2007:7		Sweden 1999:1–2007:7		United Kingdom 1997:7–2007:7	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Rate Change 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-sqr.	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 significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between three-month and one-month interbank rates, and even columns represent the difference between one-year and three-month rates. Twelve-month interbank rates in Poland have been published since 2001. Therefore, the number of observations in column (5) is larger than in column (6).

Table A.3 - Do Voting Records Predict Monetary Policy Three Meetings Ahead?

The Period until the Global Financial Crisis

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

	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)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Rate Change 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-sqr.	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 significance at the 10 percent, 5 percent and 1 percent levels, respectively. Robust standard errors are reported in parentheses. Odd columns represent estimations of the difference between three-month and one-month interbank rates, and even columns represent the difference between one-year and three-month rates. Twelve-month interbank rates in Poland have been published since 2001. Therefore, the number of observations in column (5) is larger than in column (6).

Table A.4 – Early Bird Analysis, Sweden

	Early bird vote	dissent	%
V. Bergström	3	4	75%
U. Bäckström	0	0	
K. Ekholm	9	12	75%
M. Flodén	3	3	100%
L. Heikensten	0	1	0%
K. Hessius	1	2	50%
S. Ingves	0	0	
P. Jansson	0	0	
K. Jochnick	0	0	
L. Nyberg	0	1	0%
B. Wickman-Parak	0	0	
K. Persson	5	7	71%
I. Rosenberg	1	1	100%
C. Skingsley	0	0	
E. Srejber	6	12	50%
L. E.O. Svensson	6	11	55%
S. Öberg	3	3	100%

Table A.5 – Early Bird Analysis, UK

	Early bird vote	dissent	%
C. Bean	3	5	60%
B. Broadbent	0	0	
M. Carney	0	0	
J. Cunliffe	0	0	
S. Dale	0	6	0%
P. Fisher	0	0	
I. McCafferty	0	0	
D. Miles	0	0	
M. Weale	0	7	0%
C. Allsopp	7	11	64%
K. Barker	4	5	80%
M. Bell	4	4	100%
T. Besley	4	7	57%
D. Blanchflower	8	12	75%
A. Budd	2	4	50%
W. Buitter	13	17	76%
D. Clementi	1	3	33%
H. Davies	0	0	
E. George	0	0	
J. Gieve	3	3	100%
C. Goodhart	1	3	33%
D. Julius	9	13	69%
M. King	3	10	33%
R. Lambert	0	0	
A. Large	4	8	50%
R. Lomax	0	1	0%
S. Nickell	7	17	41%
I. Plenderleith	2	4	50%
A. Posen	0	0	
A. Sentance	4	17	23%
P. Tucker	1	6	17%
J. Vickers	1	5	20%
S. Wadhvani	10	13	77%
D. Walton	3	3	100%

Table A.6 – Early Bird Analysis, Hungary

	Early bird vote	dissent	%
P. Adamecz	0	4	0%
H. Auth	0	5	0%
Á. Balog	0	0	
T. Bánfi	1	39	3%
A. Bártfai Máger	0	0	
P. Bihari	5	11	55%
V. Bihari	7	9	78%
J. Cinkotai	3	12	25%
C. Csáki	3	5	60%
F. Gerhardt	0	0	
I. Hardy	2	3	67%
Z. Jári	0	4	0%
B. Kádár	0	2	0%
C. Kandrás	0	0	
F. Karvalits	0	4	0%
J. Király	0	10	0%
G. Kocziszy	1	2	50%
G. Kopits	2	5	40%
G. Matolcsy	0	0	
J. Neményi	7	13	54%
G. Oblath	1	4	25%
G. Pleschinger	0	8	0%
A. Simor	1	4	25%
G. Szapáry	0	1	0%
L. Windisch	0	0	

Table A.7 – Early Bird Analysis, Poland

	Early bird vote	dissent	%
H.Gronkiewicz-Waltz	0	0	
M. Dabrowski	1	18	6%
B. Grabowski	0	8	0%
C. Józefiak	1	11	9%
J. <u>Krzyżewski</u>	7	7	100%
W. <u>Łączkowski</u>	0	7	0%
J. Pruski	1	15	7%
D. Rosati	13	13	100%
G. Wójtowicz	15	15	100%
W. <u>Ziółkowska</u>	14	14	100%
L. Balzerowicz	3	6	50%
J. Czekaj	1	2	50%
D. Filar	11	20	55%
S. Niekarz	1	5	20%
M. Noga	11	17	65%
S. Owsiak	0	3	0%
M. Pietrewicz	3	5	60%
A. Sławinski	1	1	100%
H. Wasilewska-Trenkner	11	18	61%
A. Wojtyna	5	5	100%
S. Skrzypek	1	4	25%

Table A.8 – Early Bird Analysis, Czech Republic

	Early bird vote	dissent	%
M.Singer	7	8	88%
M.Hampl	3	9	33%
V.Tomšík	4	5	80%
K.Janáček	0	4	0%
L.Lízal	1	1	100%
J.Rusnok	0	0	
P.Řežábek	3	14	21%
E.Zamrazilová	0	11	0%
R.Holman	0	11	0%
Z.Tůma	5	7	71%
L.Niedermayer	4	23	17%
M.Erbenová	2	3	67%
J.Frait	7	13	54%
O.Dědek	5	11	46%
P.Racocha	1	4	25%
P.Štěpánek	3	6	50%
J.Tošovský	2	2	100%
M.Hrnčíř	2	2	100%
P.Kysilka	0	0	
J.Vít	0	1	0%
O.Kaftan	0	1	0%
J.Pospíšil	0	1	0%

IES Working Paper Series

2014

1. Diana Zigraiova, Petr Jakubik: *Systemic Event Prediction by Early Warning System*
2. Pavla Blahova, Karel Janda, Ladislav Kristoufek: *The Perspectives for Genetically Modified Cellulosic Ethanol in the Czech Republic*
3. Oxana Babecká Kucharčuková: *The impact of exchange rate volatility on trade: Evidence for the Czech Republic*
4. Oliver Polyák: *The Impact of Euro Adoption on Export Performance: Comparison of the Czech Republic and Slovakia*
5. Lucie Davidová, Vladimír Benáček: *Determinants of Austrian International Trade: Analysis Based on the Gravity Model*
6. Julie Chytilová, Václav Korbel: *Individual and Group Cheating Behavior: A Field Experiment with Adolescents*
7. Petr Janský: *Consumer Demand System Estimation and Value Added Tax Reforms in the Czech Republic*
8. Pavel Hait, Petr Janský: *Inflation Differentials among Czech Households*
9. Hana Džmuráňová, Petr Teplý: *Risk management of savings accounts*
10. Tomáš Fiala, Tomáš Havránek: *Ailing Mothers, Healthy Daughters? Contagion in the Central European Banking Sector*
11. Petra Andrlíková: *Is Barrier version of Merton model more realistic? Evidence from Europe*
12. Martin Pospíšil, Jiří Schwarz: *Bankruptcy, Investment, and Financial Constraints: Evidence from a Post-Transition Economy*
13. Matt Hunt, Goran Serdarević, Tom Ovington, Clive Kenny: *Evidence for a ladder of investment in Central and Eastern European countries*
14. Petra Andrlíková: *Bayesian default probability models*
15. Petra Buzková: *Has the Relationship Between Market and Model CDS Price Changed during the EMU Debt Crisis?*
16. Jakub Černý, Jiří Witzany: *Interest Rate Swap Credit Valuation Adjustment*
17. Martin Gregor: *Receiver's access fee for a single sender*
18. Pavel Ryska: *Deflation and Economic Growth in Long-Term Perspective*
19. Michal Paulus, Eva Michalíková, Vladimír Benáček: *German International Trade: Interpreting Export Flows According to the Gravity Model*
20. Michal Bauer, Nathan Fiala, Ian Lively: *Trusting Former Rebels: An Experimental Approach to Understanding Reintegration after Civil War*
21. Michal Skořepa: *Family Matters: Concurrent Capital Buffers in a Banking Group*
22. Martin Gregor: *Access Fees for Competing Lobbies*
23. Jozef Baruník, František Čech: *On the Modelling and Forecasting Multivariate Realized Volatility: Generalized Heterogeneous Autoregressive (G HAR) Model*
24. Roman Horváth, Ayaz Zeynalov: *The Natural Resource Curse and Institutions in Post-Soviet Countries*
25. Petr Janský: *Impact of Excise Duties on Households in the Czech Republic*
26. Petr Jakubík, Thomas Reininger: *What Are the Key Determinants of Nonperforming Loans in CESEE?*

27. Jaromír Baxa, Tomáš Olešňaník: *Current Accounts in the Eurozone Countries: The Role of Euro, Fiscal Policies and Financial Developments*
28. Petr Polák: *The Productivity Paradox: A Meta-analysis*
29. Tomáš Havránek, Zuzana Iršová, Karel Janda, David Zilberman: *Selective Reporting and the Social Cost of Carbon*
30. Jozef Baruník, Tomáš Křehlík: *Coupling High-Frequency Data with Nonlinear Models in Multiple-Step-ahead Forecasting of Energy Markets' Volatility*
31. Lenka Štaštná, Jana Votápková: *Efficiency of Hospitals in the Czech Republic: Conditional Efficiency Approach*
32. Eva Michalíková, Michal Paulus: *Gravity Model Analysis: Robust Evidence from the Czech Republic and Corruption Matching*
33. Jozef Baruník, Lucie Kraicová: *Estimation of Long Memory in Volatility Using Wavelets*
34. Daniel Benčík: *Range-based Volatility Estimation and Forecasting*
35. Roman Horváth, Júlia Jonášová: *Central Banks' Voting Records, Financial Crisis and Monetary Policy*

All papers can be downloaded at: <http://ies.fsv.cuni.cz>

