

## Changing central bank transparency in Central and Eastern Europe during the financial crisis<sup>\*</sup>

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*There is ample empirical evidence in the literature for the positive effect of central bank transparency on the economy. The main channel is that transparency reduces the uncertainty regarding future monetary policy and thereby it helps agents to make better investment, and saving decisions. In this paper, we document how the degree of transparency of central banks in Central and Eastern Europe has changed during periods of financial stress, and we argue that during the recent financial crisis central banks became less transparent. We investigate also how these changes affected the uncertainty in these economies, measured by the degree of disagreement across professional forecasters over the future short-term and long-term interest rates and also by their forecast accuracy.*

**Keywords:** central banking, transparency, financial crises, survey expectations, forecasting.

### 1. Introduction

Recently, the literature has provided some empirical evidence for the favorable effect of central bank transparency on the economic outcomes. The main channel is that transparency reduces the uncertainty regarding future monetary policy and thereby it helps agents to make better investment, savings and other decisions. By testing the first step of the channel, Swanson (2004), Ehrmann et al. (2010), and Csávás et al. (2012) find that the interest rate is forecasted with a higher level of precision by professional analysts when the central bank is more transparent. By testing the effect of transparency directly on macro variables, Chortareas et al. (2002) find that greater transparency about forward looking analysis of central banks is associated with lower inflation rate, and unchanged output volatility.

Preceding the recent financial crisis, central banks have become more and more transparent all over the world. They implemented considerable changes in monetary policy communication, and many aspects of the central banks' operational and monetary policy targets and modeling practice became unveiled. The increasing degree of central bank transparency has been clarified by Eijffinger and Geraats (2006) inter alia, who published a transparency index for nine industrial countries covering the period between 1998 and 2002. Dincer and Eichengreen (2007) expanded the number of countries and years covered by Eijffinger and Geraats (2006). By using an even more comprehensive sample of 100 countries for the period between 1998 and 2005, they confirmed that central bank transparency had an increasing tendency even until the mid 2000's.

In this paper, we examine whether financial stress in 2007, 2008 and 2009 has inclined central banks to become even more transparent. This question has already been investigated in the empirical

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<sup>\*</sup> The views expressed in this paper are those of the authors and do not necessarily reflect the official view of the Magyar Nemzeti Bank.

literature by using the transparency index of Eijffinger and Geraats (2006). Siklos (2010) has updated the index for the period between 2006 and 2009. By studying the updated index, he found the following. First, transparency continued to improve gradually on average even after 2005 although at a slower rate than before. Second, there are some obvious differences across country groups. The transparency index of developed countries stopped increasing in 2006. From then on, it remained unchanged. In contrast, transparency has risen steadily in the rest of the world with the most impressive developments taking place among the countries in Central and Eastern Europe (CEE). These findings are apparent from Table 1.

**Table 1: The transparency index across country groups.**

	Level			
	Developed	Developing	Emerging	CEE - 4
1998	7.27	2.28	3.81	4.63
1999	7.97	2.37	4.08	5.38
2000	8.20	2.45	4.82	6.00
2001	8.60	2.85	5.19	6.38
2002	8.97	3.15	5.98	7.63
2003	9.17	3.28	6.48	8.00
2004	9.40	3.61	6.71	8.38
2005	9.47	3.75	6.89	9.25
2006	9.63	3.80	7.00	9.38
2007	9.63	3.86	7.11	9.75
2008	9.63	3.88	7.16	9.88
2009	9.63	3.88	7.32	11.00

Source of data: Siklos (2010).

Notes: The data has been revised and modified by the authors of this paper. See Section 4.2.2 about the modifications.

The categorization of countries into the group of developed, developing, and emerging is according to the IMF classification, published in the World Economic Outlook.

CEE 4 countries are the Czech Republic, Hungary, Poland, and Slovakia.

The potential explanations for these tendencies are as follows. First, the transparency index is constructed in a way that it has a maximum.<sup>1</sup> Therefore, it cannot increase continuously forever. By the mid 2000's, transparency might have already reached its limit in the developed countries and got close to it in many other countries. Second, the transparency index might have some limitations at measuring the exact degree of transparency and this limitation can be more apparent during periods of financial stress. (See Section 3 for the detailed analysis). Third, the global financial crisis of 2007-2009 enforced changes in the monetary policies that might make it impossible for central banks to enhance transparency. Siklos (2010) has left the judgment of these explanations to future research.

We contribute to the literature by analyzing the links between central bank transparency and financial system stability in many different ways. First, we document that the standard measure of transparency has hardly changed in some CEE countries during periods of financial stress.<sup>2</sup> Second, we review the

<sup>1</sup> See Section 4.2.2 about the details on the transparency index.

<sup>2</sup> The analyzed countries are the CEE-4 countries. Although their transparency indices have increased even in the recent years as it is reported in the last column of Table 1, it can be attributed mostly to one outlier. This is

dimensions of transparency that might have changed during the recent financial crisis but cannot be measured by the standard transparency index. Third, we investigate how the unconventional monetary policy has influenced central bank transparency in the recent years. Finally, we estimate the link between transparency and accuracy of survey forecasts by applying a methodology similar to that of Ehrmann et al. (2010), and Csavas et al. (2010). By using this link, we aim to provide indirect empirical evidence for the hypothesized reduction of transparency during periods of financial stress.

## 2. Stylized facts on financial stress and transparency

In this Section, we examine how transparency evolved in four CEE countries. The analyzed countries are the Czech Republic, Hungary, Poland, and Slovakia. This group of countries provides us with a special opportunity to explore the link between transparency and financial stress for two reasons. First, these countries have been hit not only by the global financial crisis, but they had experienced episodes of severe financial stress even before 2005. Second, central bank transparency has not reached its limit by the early 2000's in these countries.

In this analysis, we use the financial stress index (FSI) that has been constructed by Balakrishnan et al. (2009). This index is similar to the index of Cardarelli et al. (2009) as both consists of the sub-indices measuring the stress in the banking sector, security markets, and the foreign exchange market. The main difference between these two indices is that while the index of Cardarelli et al. (2009) has been developed for the advanced economies, the one of Balakrishnan et al. (2009) suits the emerging countries better.<sup>3</sup>

Figure 1 plots the time series of the financial stress index together with one of its sub-indices, the stock market volatility index for the analyzed 4 countries. According to the indices, these countries have been hit by as large shocks before 2005 as during the recent global financial crisis. Apparently, Poland's financial stability was as much at risk in 1998 as in 2008. Although the financial stress index is not available for the other three countries for the year 1998, we know that these countries were affected just as much by the default of Russia on its external obligations in 1998 and the collapse of Long Term Capital Management in the same year as Poland. This is also reflected by the stock market volatility index in Figure 1. Another episode of financial stress was the dot-com crash that distressed mostly the Czech market at the end of 2000 and at the beginning of 2001.

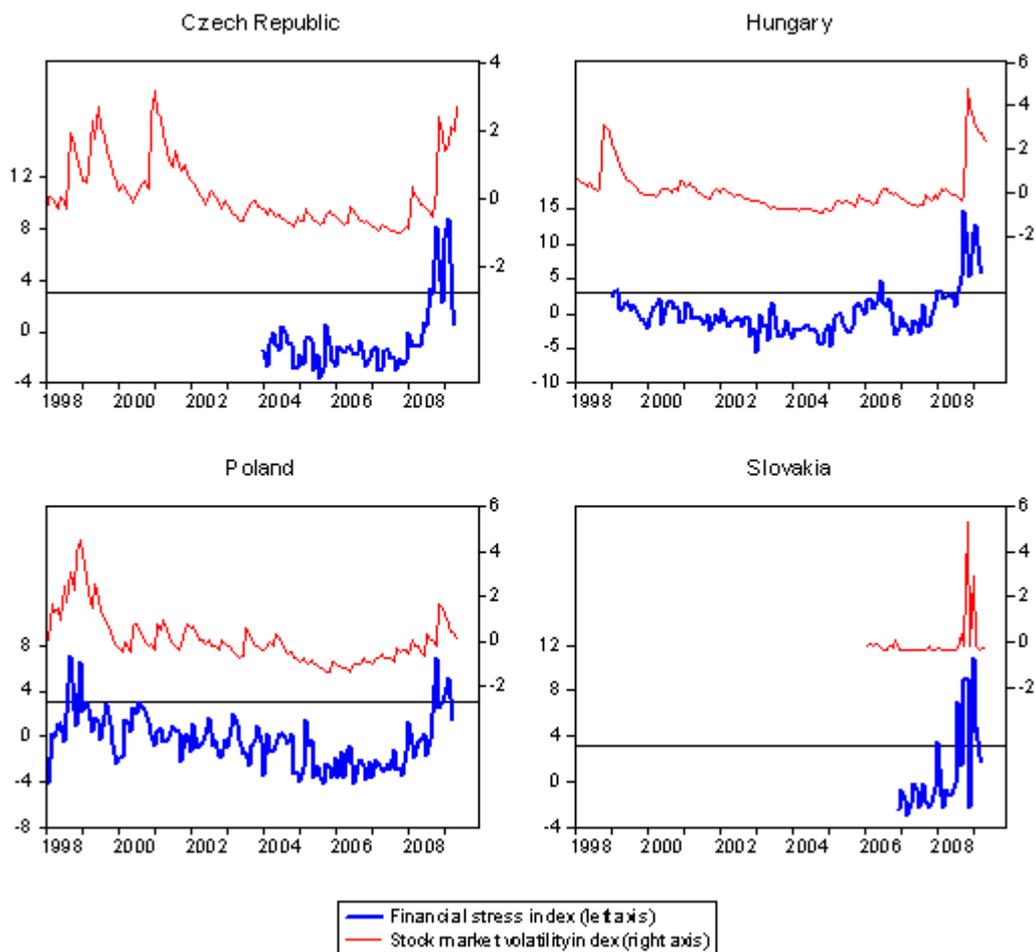
In order to get some idea on how transparency changes in periods of financial stress, we plotted the annual changes of the transparency index against the financial stress index in Figure 2. It clearly shows that the relationship is non-linear and negative. In relatively calm periods, when the stress index was below 3, central banks either increased the degree of transparency or maintained the previous level. During periods of financial stress (higher values of the financial stress index), the transparency of central banks in the CEE region has hardly changed. This finding is not an artificial consequence of the lack of data for the stress index for certain periods and countries. The relationship between financial stress and transparency is qualitatively the same, if we measure the stress with the stock market volatility index that is available for almost the entire sample.

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Slovakia that joined the Euro zone in 2009 and imported a much higher degree of transparency from the ECB than they had before.

<sup>3</sup> See Section 4.2.3 about the details of the financial stress index.

**Figure 1: The financial stress index and the stock market volatility index between January 1998 and April 2009.**

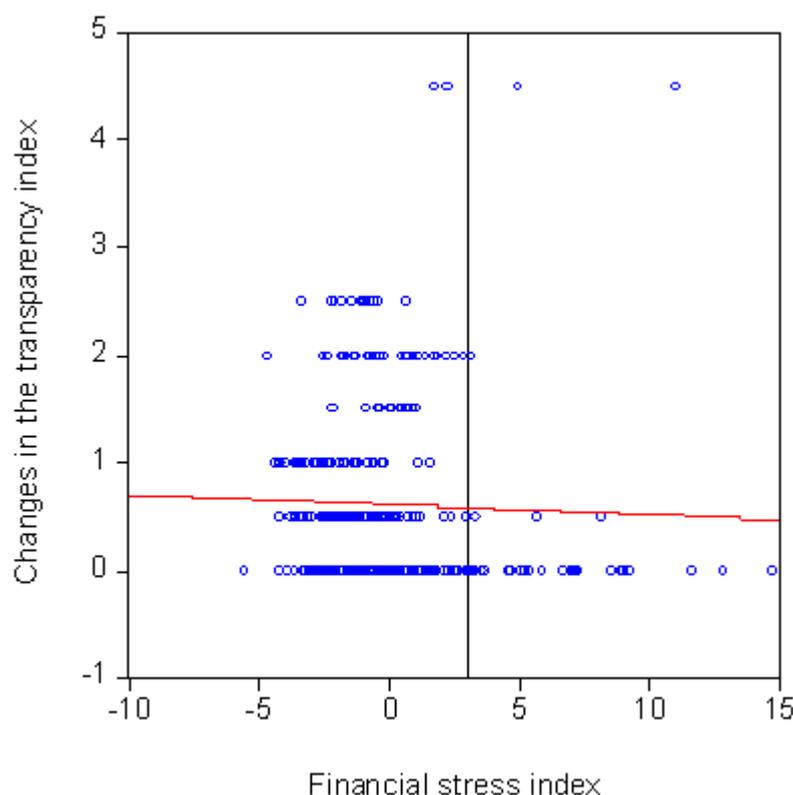


Source of data: Cardarelli et al. (2009).

Note: The horizontal line is at value 3 of the left axis.

Fortunately, our data on the 4 CEE countries makes it possible to judge some explanations for the lack of changes in the transparency index. Since transparency was not at its peak in the major part of the investigated period, and there were plenty of opportunities for central banks to become more transparent, it would not be fair to blame the transparency index for being bounded. It is more plausible that it is the financial stress that limits transparency.

**Figure 2: Annual changes in the transparency index plotted against the financial stress index.**  
**Sample: January 1998 – April 2009, countries: Czech Republic, Hungary, Poland, and Slovakia.**



Source of data: Cardarelli et al. (2009).

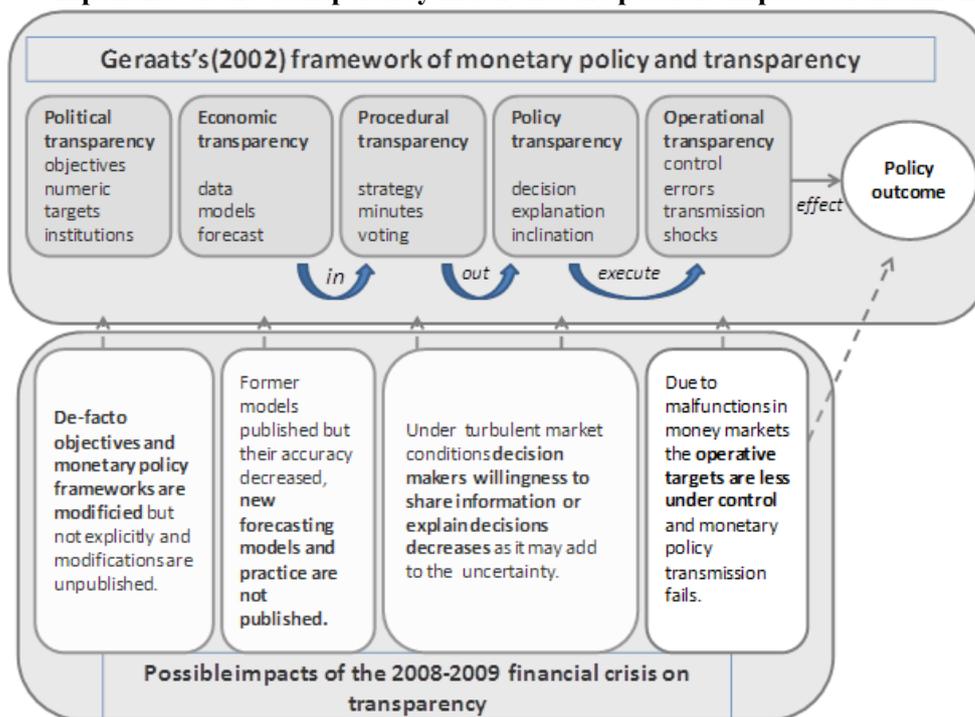
Notes: Higher values of the transparency and stress indices are associated with a higher degree of transparency and more stress respectively.

The red line is the regression line.

The vertical line is at value 3.

### 3. What dimensions of transparency have been affected by the financial crisis?

Geraats (2002) distinguishes 5 dimensions of transparency that are (1) political transparency, (2) economic transparency, (3) procedural transparency, (4) policy transparency, and (5) operational transparency. Each of these dimensions is measured separately by the sub-indices of the transparency index. And the transparency index is the simple sum of the sub-indices. We showed in the previous Sections that recent updates of the transparency index reflect almost unchanged circumstances on average. This is also true for the sub-indices, because central banks have not made significant changes to their practices that are measured by the index. For instance, they kept on publishing their economic models, strategies and decisions. In this Section, we examine how transparency changed in each of its 5 dimensions. We argue that all aspects of transparency have been affected by the financial crisis, and the impact was unfavorable. Figure 3 summarizes our arguments.

**Figure 3: Components of the transparency index and the possible impacts of the financial crisis.**

**Political transparency:** as the financial crisis highlighted vulnerabilities in the financial systems in many countries, central banks became already formally recognized as an important pillar in the systemic supervisory institutional framework. However, it is in the shroud of opacity how responsibility for financial stability influenced the priority of central bank objectives. For example, Fed governor Ben Bernanke noted that central bank independence is essential, but it cannot be unconditional. “We are committed to exploring new ways to enhance the Federal Reserve’s transparency without compromising our mandated monetary policy and financial stability objectives.” Borio (2009) claims that, stemming from informational gains the financial supervisory role of central banks can lead to synergies with the price stability objective. Nevertheless, the potential conflict of new goals with the price stability can affect transparency negatively.

In addition, central banks have not even had legal mandate to follow the new objectives, while most central banks updated their policy goals in practice. Many central banks have targeted lower interest rates than their announced key policy rates. The ECB, for example, tolerated that short-term money market rates have been tied to the overnight deposit rate of the ECB, which implies an unannounced monetary loosening.

In a recent study, Geraats (2008) also found that central banks across all monetary policy frameworks had become more transparent during the last decade, although there are significant differences in the degree of information disclosure across monetary policy frameworks. Central banks with inflation targeting have achieved the highest level of transparency, while monetary and exchange rate targeters have exhibited the lowest level in information disclosure. Although in terms of de-jure monetary frameworks central banks have not changed since the financial crisis in 2008, de-facto frameworks altered immensely, implying changes in communication practices, too.

**Economic transparency:** most central banks had to realize that old models and economic data no longer apply in the post-financial-crisis “new world order”. Furthermore, conceptual understanding of the new world will take many years, as the data shortage also represents an obstacle for statistical

analysis and forecasting. Under these circumstances central banks publish their usual reports, models and forecasts. So they seem transparent at first sight, while central bank economists and decision makers have lost their faith in these models and decision making is influenced more and more by expertise, judgment and gut feelings.

**Procedural and policy transparency:** while many central banks promptly announce monetary policy decisions, and the explanation of decisions in normal times, most central banks are reluctant to communicate severe systemic distress and extraordinary risks, because it may just add to the turmoil and become self-fulfilling.

**Operational transparency:** many central banks introduced unconventional monetary policy instruments in order to counteract the adverse effect of increased counterparty risk that led to the lack of liquidity in the markets and jumps in the prices. The markets have been supplied by much fewer information about these new instruments than about conventional instruments before. The next Section gives an overview on the unconventional instruments that were applied by the central banks in the CEE region in the crisis, and also on their impact on central bank transparency.

### 3.1. Transparency and new monetary policy instruments

The Eijffinger-Geraats transparency index was developed in an environment where central banks used almost exclusively the policy rates as an instrument to achieve their objectives, the primary objective being price stability in most cases. However, after the Lehman crisis, many central banks introduced unconventional monetary policy instruments (see a classification of these instruments in Yehoue et al., 2009) and objectives other than the price stability gained higher priority. Since the Eijffinger-Geraats index is not able to capture the transparency related to these new instruments, we provide a brief assessment about how the new measures could alter central bank transparency. In this Section we review the practice of the 4 CEE central banks and that of the ECB.

One of the new central bank measures introduced during the crisis provided liquidity for horizons longer than one day. Three CEE central banks in our sample (the Czech Republic, Hungary and Poland) applied these instruments with maturities ranging from 2 weeks to 6 months. In contrast, in Slovakia the domestic interbank market was sufficiently liquid given the imminent euro adoption, thus the SNB did not have to introduce new measures.<sup>4</sup> The ECB introduced long-term liquidity providing operations with maturities up to 1 year. (See ECB, 2009).

A common feature of the CEE countries is that their banking systems operate with a liquidity surplus. Therefore, there is no need for the monetary authorities to act as a liquidity provider in normal times. It was the malfunctioning of interbank money markets during the crisis that forced commercial banks to hoard liquid assets and necessitated the active assistance of the central bank.

It is evident from Figure 4 that the 3-month interbank rates were above the policy rates on the Czech and Polish markets for several months after the Lehman crisis. This wedge has not reflected interest rate hike expectations, but the reluctance of banks to provide credit to each other on the interbank market due to higher counterparty risk.<sup>5</sup> In other words, the wedge was a premium for the extra risk. One of the objectives for liquidity providing measures was to reduce this premium. The premium not only makes loans expensive, but distorts the transmission mechanism as well, *i.e.*, the transmission

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<sup>4</sup> [http://www.nbs.sk/\\_img/Documents/ZAKLNBS/PUBLIK/SFS/SFS2008A.pdf](http://www.nbs.sk/_img/Documents/ZAKLNBS/PUBLIK/SFS/SFS2008A.pdf)

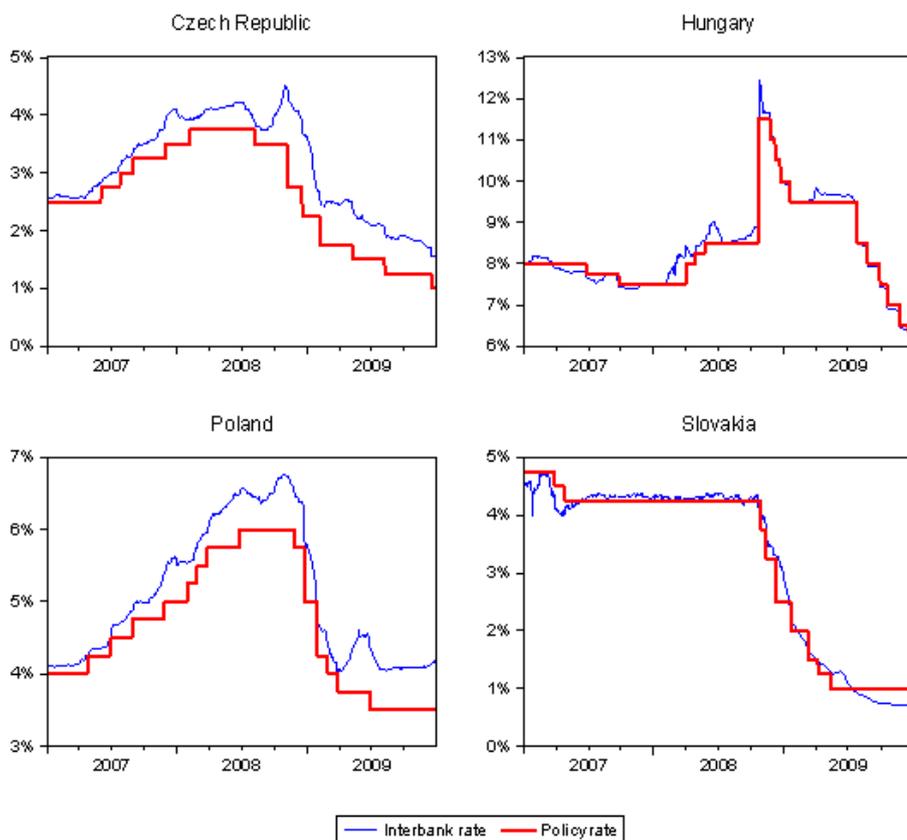
<sup>5</sup> See the minutes of the CNB and NBP in the period between 2008 and 2009.

[http://www.cnb.cz/en/monetary\\_policy/bank\\_board\\_minutes/;](http://www.cnb.cz/en/monetary_policy/bank_board_minutes/)

<http://www.nbp.pl/homen.aspx?f=/en/onbp/organizacja/minutes.html>

from policy rate to market rates. The CNB explained their measure with the aim of fostering the functioning of the government bond market. Similar considerations prompted MNB to provide liquidity to primary dealers of the Hungarian government bond. The ECB had a further motivation to reduce long-term yield in a situation where the zero bound to the policy rate became effective.

**Figure 4: Central bank policy rates and 3-month interbank money market rates between 2007 and 2009.**



Source: CNB, MNB, NBP, NBS, ECB.

Notes: The interbank rates are the PRIBOR (Czech Republic), the BUBOR (Hungary), the WIBOR (Poland) and the BRIBOR (Slovakia).

For Slovakia, the policy rate is replaced by that of the ECB and interbank rate is replaced by the EURIBOR since January 2009.

Since central banks shifted from influencing market rates by setting the policy rate to directly intervening on the market, the overall transparency of the central bank can only be assessed by judging how much information has been revealed on these new instruments. Central banks disclosed the pricing and the quantity of these instruments. However, they were less transparent regarding the decision making about these instruments relative to the transparency of setting the policy rate.<sup>6</sup> It is worth mentioning that even with perfect transparency, the effect of these on money markets would have been uncertain. For market participants to know what will be the market interest rates in the future, it is not enough to have information about the decision making of the central banks but also about how liquidity situation will be changed in the interbank market.

<sup>6</sup> For example, the ECB disclosed the following information related to the pricing of its long-term instrument: “In subsequent longer-term refinancing operations the interest rate applied may include a spread in addition to the rate on the main refinancing operations, depending on the circumstances at the time.”

In both Poland and the Czech Republic, some of the interest rate cuts at the end of 2008 as well as in 2009 were explained by the above mentioned distortion of the transparency mechanism: the aim was to bring the market interest rates in line with the interest rate which is considered optimal by the central bank.<sup>7</sup> For market participants, this again could make it difficult to understand how exactly the central bank wanted to perform its monetary policy: by using new instruments to reduce market interest rates or by reducing the policy rate which can contribute to lower market interest rates if the premium on this latter remains unchanged. On the other hand, rate cuts were partly explained by arguments related to financial stability in which case it does not necessarily went against the logic of inflation targeting since the risks of undershooting the inflation goals were more pronounced.

The MNB began to purchase government bonds in autumn 2008. The motivation was to restore the smooth functioning of the market and reduce the liquidity premium.<sup>8</sup> Though the purchases were performed in a transparent way, via a tender procedure, the market did not have a clear idea of the level of long-term interest rates that the central bank intended to reach. Possibly, neither could the central bank specify how much of the increase in the government bond yields was due to liquidity premium, and not caused by fundamentals; thus, it was more difficult for market participants to forecast long-term interest rates. The covered bond purchase program of the ECB since June 2009 (ECB, 2009) can be assessed in a similar way; the targeted long-term interest rate was not revealed.

The MNB, the NBP and the ECB introduced currency swap instruments (Yehoue et al., 2009). The CEE countries supplied EUR and USD against domestic currencies as well as CHF against EUR, while the ECB provided USD and CHF. The aim was to provide foreign currency liquidity to the banking system and also to reduce the stress in financial markets (Moessner and Allen, 2010). Banai et al. (2009) describes central banks acting as 'FX lender of last resort'. Regarding swap operations, the market didn't have a clear idea on how decisions about the pricing of these instruments were made. E.g. the NBP communicated only that its price (the swap point) would be close to market prices.<sup>9</sup> Nevertheless, the lower transparency of the swap instruments possibly affected the uncertainty related to future interest rates denominated in domestic currency less.

To conclude, the use of unconventional monetary policy instruments in the CEE region possibly lowered the central bank transparency regarding the objectives of the instruments, the explanation of decisions, or the achievement of operating goals, which are all important dimensions of transparency.

#### **4. Empirical analysis of the effect of transparency on economic uncertainty**

Some theoretical considerations and some stylized facts reviewed in Section 3 suggest that central banks become less transparent during periods of financial stress and this drop of transparency is not captured by the transparency index. In this Section, we use regression analysis to examine both the observed and the unobserved component of transparency and their affect on economic uncertainty. Following the practice of Swanson (2004), and Ehrmann et al. (2010), we measure uncertainty by the forecast accuracy of survey expectations and also by the dispersion of views of survey participants.

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<sup>7</sup> E.g. according to the Minutes of the CNB on 17 December 2008, "... the imperfect transmission of monetary policy rates had to be compensated for by making larger changes to monetary policy rates." [http://www.cnb.cz/en/monetary\\_policy/bank\\_board\\_minutes/2008/amom\\_081217.html](http://www.cnb.cz/en/monetary_policy/bank_board_minutes/2008/amom_081217.html)

<sup>8</sup> [http://english.mnb.hu/engine.aspx?page=mnben\\_pressreleases\\_2008&ContentID=11643](http://english.mnb.hu/engine.aspx?page=mnben_pressreleases_2008&ContentID=11643)

<sup>9</sup> <http://www.nbp.pl/Homen.aspx?f=/en/aktualnosci/2009/swap270409en.html>

#### 4.1. Econometric model and the hypotheses to be tested

Our benchmark econometric model is given by

$$y_{i,t} = \beta_{0,i} + \beta_1 TR_{i,t} + \beta_2 FSI_{i,t} + \beta_3 \sigma_{i,t} + \epsilon_{i,t}, \quad (1)$$

where  $y_{i,t}$  denotes the dependent variable characterizing the forecasts in country  $i$  formed at time  $t$ . More precisely, it measures either the degree of disagreement across individual forecasters, or the forecast accuracy. On the right-hand-side of the equation,  $TR_{i,t}$  and  $FSI_{i,t}$  denote the transparency index and the financial stress index respectively. The transparency index is either the total index, *i.e.*, the sum of the sub-indices measuring different aspects of transparency, or one of the sub-indices. The volatility of the variable to be forecasted is  $\sigma_{i,t}$ , and  $\epsilon_{i,t}$  is the error term.

The *hypothesis* that is usually tested in the literature is that the quality of forecasts depends negatively on central bank transparency ( $\beta_1 < 0$ ), *i.e.*, forecasters disagree less and make smaller forecast errors if the central bank is more transparent. As a first step, we also test the above hypothesis, however, our main focus is on the coefficient of the financial stress index  $FSI_{i,t}$ . Some theoretical considerations and some stylized facts reviewed in Section 3 suggest that central banks became less transparent during periods of financial stress and this decline of transparency could not be measured by the transparency index. Our aim is to provide empirical evidence for the presence of the unobserved reduction of transparency. The idea is to detect the unobserved component through its effect on the forecasts. The unobserved decline of transparency is likely to have the same effect on the forecasts as the observed component. The latter is that lower degree of transparency is associated with larger forecast errors and higher dispersion of views under our first hypothesis. Suppose that the first hypothesis is true, moreover, financial stress influences the forecasts dominantly through the changing transparency of the central bank. Under these two assumptions a positive coefficient of the financial stress index ( $\beta_2 > 0$ ) implies that there is a positive measurement error in the transparency index during financial stress.

It is important to note that the above interpretation depends highly on its assumptions. While we can easily test the first assumption, we cannot test the second one. The reason is that we can hardly distinguish empirically between the direct and the indirect effect of financial stress on the forecasts, where the latter works through the changing transparency of the central bank. Therefore, if the coefficient of the financial stress is positive, then all we can say is that either the unobserved component of transparency declines during periods of financial stress, or that financial stress has a direct effect on the forecasts.

We control for the country fixed effect by  $\beta_{0,i}$  that captures some country specific characteristics. These characteristics are, for instance, the following: how difficult it is in general to forecast the interest rate of the country; what the general level of skills of the forecasters is in the country, and also whether the dispersion of views is shaped by the interactions between the forecasters, *i.e.*, whether there is a dominant forecaster in the country who is followed by some others.

In addition to the country fixed effects, we control for the volatility of the variable to be forecasted  $\sigma_{i,t}$ . We expect that the higher the volatility is, the more difficult the task of forecasting becomes. Hence, both the degree of disagreement and the absolute forecast error ( $\beta_3 > 0$ ) increase.

## 4.2. Data

In our empirical exercise, we use survey data on forecasts of short interest rates and long interest rates. In addition, we use historical data of these rates, in order to evaluate the performance of these forecasts. Finally, we apply some measures of transparency and a financial stress index. This section provides a detailed description of these data. Moreover, it discusses how the control variables are constructed.

### 4.2.1 Data for the dependent variable

We use the survey data of the Consensus Economics for both of the dependent variables in Equation (1), *i.e.*, the degree of disagreement across individual forecasters, and the forecast accuracy. Consensus Economics surveys the views of a large group of professional forecasters on the future short and long-term interest rates. It reports forecasts for a broad set of countries, including emerging countries in the CEE region. For the countries we analyze, the forecasted short-term interest rate is the 3-month interbank rate,<sup>10</sup> while the long-term rate is 10-year government bond yield.<sup>11</sup> The forecasts cover both short (3-months) and long (1-year) horizon predictions. The sample is spanned by *January 2003 and December 2009*. The *frequency* is bimonthly prior to May 2007, afterwards it is monthly. Therefore, we have 58 forecast periods in our sample. Consensus Economics started to survey long-term forecasts only in 2006, therefore the sample of these forecasts is shorter. See Table 2 on some summary statistics of our measures of the degree of disagreement and the forecast accuracy.

We measure *the degree of disagreement of the individual forecasters* by the *standard deviation*. Our choice is motivated by the fact that this statistics is readily available for us, as it is reported by the Consensus Economics. An alternative measure would be the inter-quartile range. The latter has the advantage over the standard deviation of not being sensitive to outliers. Ehrmann et al. (2010) used both measures in an empirical exercise similar to ours, and they found all of their results robust to the choice of the dispersion measure. Their finding supports that it is sufficient to use only the standard deviation of the individual forecasts as a measure of cross-sectional dispersion.

We measure the *forecast accuracy* by the *absolute forecast error of the consensus forecast*, where the *consensus forecast* is the cross-sectional mean of the individual forecasts. This statistics, just like the standard deviation, is also reported by the Consensus Economics. In this respect we deviate again from the methodology of Ehrmann et al. (2010), since they used the *average absolute forecast error* and not the absolute error of the average forecasts. The average absolute forecast error depends not only on the forecast accuracy of the consensus forecast, but also on the dispersion of forecasts across individual forecasters. The latter is already captured by our previously introduced measure for the degree of disagreement. Since there is no point to measure the same effect twice, we decided to make our measure for forecast accuracy as much orthogonal to the degree of dispersion as possible. For this reason the absolute forecast error of the consensus forecast seemed to be a better choice than the average absolute forecast error.

The historical data of the end-of-month short-term and long-term interest rates are from the Bloomberg. We collected interest rate data not only for the Czech koruna, Hungarian forint, Polish zloty, and Slovakian koruna, but also for the euro. We used the short-term euro rate as the historical rate for Slovakia from January 2009 on, when Slovakia joined the euro zone.

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<sup>10</sup> The only exception is Hungary, where the forecasted short rate is the 3 month Treasury Bill rate.

<sup>11</sup> The interest rate is measured in percentage and so is its standard error and the forecast error.

**Table 2: Summary statistics for the cross-sectional dispersion and the forecast accuracy in the Consensus Economics dataset. Sample: 2003–2009, countries: Czech Republic, Hungary, Poland, and Slovakia.**

	Standard deviation of the individual forecasts				
	Num. obs.	Mean (%)	Std (%)	Min (%)	Max (%)
Short-term interest rates - in 3 months	232	0.29	0.17	0.10	1.10
Short-term interest rates - in 12 months	232	0.45	0.22	0.10	1.60
Long-term interest rates - in 3 months	160	0.31	0.17	0.10	1.30
Long-term interest rates - in 12 months	160	0.42	0.21	0.10	1.40
	Absolute forecast error of the consensus forecast				
	Num. obs.	Mean (%)	Std (%)	Min (%)	Max (%)
Short-term interest rates - in 3 months	217	0.54	0.62	0.000	3.51
Short-term interest rates - in 12 months	187	1.26	1.08	0.010	5.85
Long-term interest rates - in 3 months	160	0.55	0.59	0.001	4.45
Long-term interest rates - in 12 months	132	0.72	0.84	0.007	5.15

Source: Consensus Economics

#### 4.2.2 Measures of central bank transparency

We use the traditional measure of central bank transparency, the so-called transparency index developed by Geraats (2002). It distinguishes 5 dimensions (political, economic, procedural, policy, and operational) described in Section 3. Each of these dimensions is measured separately by 3 sub-indices. All the 15 sub-indices of the transparency index can take the value of 0,  $\frac{1}{2}$  or 1 according to the practice of the investigated central bank implying that the total index can take the minimum of 0 and the maximum of 15 (the higher value indicating a more transparent central banking practice).

Central bank communication practices have been surveyed by Eijffinger and Geraats (2006), Dincer and Eichengreen (2007), and Siklos (2010) using the same methodology. In our empirical analysis we used the latest update by Siklos (2010). We implemented, however, the following minor modifications in his dataset. The Czech National Bank and National Bank of Hungary have been publishing individual voting records since 2008 and 2005 respectively, hence the value of sub-index 3.c is changed to 1 from 0.5 for both countries. Furthermore, Slovakia introduced the euro in January 2009, therefore, we assigned the values of the transparency index of ECB to Slovakia since then.

#### 4.2.3 Measures of financial stress

We use the financial stress index (FSI) that has been constructed by Balakrishnan et al. (2009).<sup>12</sup> This index is a modified version of the comprehensive index of Cardarelli et al. (2009). Both indices have three subcomponents: (i) banking sector (the slope of the yield curve, TED spread, beta of banking sector stock), (ii) securities markets (corporate bonds spread, stock market returns and time-varying volatility of stock return) and (iii) exchange rate (time varying volatility of NEER change). In contrast to the index of Cardarelli et al. (2009), the index of Balakrishnan et al. (2009) has been developed for emerging economies. For instance, it consists of measures for exchange rate pressures and sovereign debt spread that are more relevant for emerging economies than to developed ones.

<sup>12</sup> The series of the financial stress index can be downloaded from <http://www.imf.org/external/pubs/cat/longres.cfm?sk=23039.0>

#### 4.2.4 Volatility of the variables to be forecasted

In order to judge how transparency and financial stress affect the quality of forecasts, we control for the overall difficulty of forecasting. In the model specification of Equation (1), the control variable is the annualized volatility of the variable to be forecasted. It is calculated from the daily interest rate data of 20 days preceding the survey date. The daily historical data are from Bloomberg.

### 4.3. Estimation results

This Section summarizes the estimation results of Equation (1). In order to see which aspects of transparency can be the most important in terms of coordinating individual expectations, not only the total index of transparency is used as explanatory variable but also some of the sub-indices measuring different aspects of transparency. In certain dimensions, there is only moderate variation in the data, or the sub-index correlates highly with some other explanatory variables disabling us to run the regression. These dimensions are the political transparency, the policy transparency, and the operational transparency. The low variation in the political transparency is due to the fact that all central banks have already complied with most of the criteria of this aspect of transparency in the sample.

Tables 3 and 4 report the estimates for the forecasted short rate and long rate respectively. The left panels of Table 3 show our results on the *dispersion of individual short rate forecasts*. Whenever the parameter of the transparency index or sub-index is significant, it is negative. Therefore, we can say that central bank transparency coordinates survey expectations in the sense of reducing the degree of disagreement over the 3-month-ahead and 1-year-ahead short rates. Moreover, the procedural aspects of transparency seem important as they have parameter estimates significant at 1% for both the short horizon and the long horizon forecasts. Its effect is significant also in economic terms. For instance, if a central bank starts to provide an explicit policy rule or strategy that describes its monetary policy framework, then its transparency index increases by 1. Our estimates suggest that this measure decreases the standard deviation of the individual forecasts of the 3-months-ahead short rate by 8 basis points given everything else remains unchanged. This effect is not negligible, because the standard deviation of these forecasts is between 10 and 110 basis points as it is reported in Table 2.

Our results on the *forecast accuracy* reported by the panels on the right-hand-side in Table 3, are in line with those on the dispersion of forecasts. Higher transparency is associated with significantly better forecasts. For instance, if the sub-index of the procedural transparency increases by 1, like in our previous example, then the absolute forecast error of the 3-months-ahead short rate decreases by 40 basis points *ceteris paribus*. This effect is comparable in magnitude to the sample mean of the absolute forecast errors, which is 54 basis points. (See Table 2.)

Table 4 reports the estimates for the *long rate*. Surprisingly, central bank transparency has the opposite effect on the long-term rate forecasts than on the short rate forecasts. Higher degree of transparency mostly comes with significantly bigger absolute forecast errors and more disperse views on the future 10 year government bond yields. One potential explanation of this finding is provided by Morris and Shin (2002). They demonstrate that when central banks have noisy private information on the long-term interest rate and market participants rely too much on public information then higher central bank transparency can lower social welfare and increase uncertainty.

**Table 3: The effect of central bank transparency and financial stress on dispersion of the individual forecasts and forecast accuracy, where the forecasted variable is the short rate.**  
**Sample: 2003-2009, countries: Czech Republic, Hungary, Poland, and Slovakia.**

Transparency is measured by index or sub-index	2	3	4	5	Total	2	3	4	5	Total
Dependent variable	Standard deviation of the individual forecasts for the short-term interest rates with forecast horizon 3 months					Absolute forecast error of the consensus forecast for the short-term interest rates with forecast horizon 3 months				
Transparency	-0.00	-0.08***	0.15	0.08	-0.02*	-0.31***	-0.4***	-	-	-0.24***
(t-stat)	(-0.2)	(-3.44)	(0.86)	(0.86)	(-1.37)	(-5.03)	(-2.94)	-	-	(-4.22)
Financial Stress	0.01***	0.02***	0.01***	0.01***	0.02***	0.01	0.04***	-	-	0.03**
(t-stat)	(3.01)	(4.72)	(2.91)	(2.91)	(3.4)	(0.44)	(2.63)	-	-	(1.82)
Volatility	3.26***	2.66***	3.26***	3.26***	3.09***	1.28	-0.59	-	-	-0.35
(t-stat)	(3.48)	(3.28)	(3.63)	(3.63)	(3.43)	(0.36)	(-0.19)	-	-	(-0.11)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	Yes
Observations	169	169	169	169	169	162	162	-	-	162
R2	45.23%	49.28%	45.56%	45.56%	45.92%	21.75%	26.19%	-	-	26.08%
Dependent variable	Standard deviation of the individual forecasts for the short-term interest rates with forecast horizon 1 year					Absolute forecast error of the consensus forecast for the short-term interest rates with forecast horizon 1 year				
Transparency	-0.05**	-0.11***	0.03	0.01	-0.04***	-0.51***	-0.28*	-	-	-0.25***
(t-stat)	(-2.33)	(-3.26)	(0.14)	(0.14)	(-2.39)	(-4.13)	(-1.51)	-	-	(-2.8)
Financial Stress	0.02***	0.02***	0.01***	0.01***	0.02***	-0.04	-0.02	-	-	-0.02
(t-stat)	(2.76)	(3.75)	(2.44)	(2.44)	(3.29)	(-1.17)	(-0.71)	-	-	(-0.62)
Volatility	1.6	0.95	1.82	1.82	1.38	4.79	4.7	-	-	3.76
(t-stat)	(0.97)	(0.61)	(1.08)	(1.08)	(0.86)	(0.66)	(0.65)	-	-	(0.53)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	Yes
Observations	169	169	169	169	169	153	153	-	-	153
R2	44.61%	48.39%	43.47%	43.47%	45.96%	35.97%	33.39%	-	-	35.28%

Source: author's calculations

Notes: \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10% respectively.

**Table 4: The effect of central bank transparency and financial stress on dispersion of the individual forecasts and forecast accuracy, where the forecasted variable is the long rate.**  
**Sample: 2006-2009, countries: Czech Republic, Hungary, Poland, and Slovakia.**

Transparency is measured by index or sub-index	2	3	4	5	Total	2	3	4	5	Total
Dependent variable	Standard deviation of the individual forecasts for the long-term interest rates with forecast horizon 3 months					Absolute forecast error of the consensus forecast for the long-term interest rates with forecast horizon 3 months				
Transparency	0.12***	0.1***	0.35***	0.18***	0.04***	0.28***	-0.01	0.84***	0.42***	0.08**
(t-stat)	(4.62)	(2.53)	(4.62)	(4.62)	(4.72)	(2.76)	(-0.11)	(2.76)	(2.76)	(2.23)
Financial Stress	0.02***	0.02***	0.02***	0.02***	0.02***	0.05**	0.06**	0.05**	0.05**	0.05**
(t-stat)	(6.71)	(5.1)	(6.71)	(6.71)	(5.88)	(1.79)	(1.81)	(1.79)	(1.79)	(1.68)
Volatility	1	1.02	1	1	1.13	4.7	3.99	4.7	4.7	4.77
(t-stat)	(1.01)	(0.99)	(1.01)	(1.01)	(1.13)	(0.84)	(0.69)	(0.84)	(0.84)	(0.85)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	121	121	121	121	121	121	121	121	121	121
R2	39.86%	38.72%	39.86%	39.86%	40.59%	34.57%	33.43%	34.57%	34.57%	34.26%
Dependent variable	Standard deviation of the individual forecasts for the long-term interest rates with forecast horizon 1 year					Absolute forecast error of the consensus forecast for the long-term interest rates with forecast horizon 1 year				
Transparency	0.09**	-0.05	0.28**	0.14**	0.02*	0.04	0.24**	0.13	0.06	0.04
(t-stat)	(2.06)	(-0.89)	(2.06)	(2.06)	(1.37)	(0.46)	(1.78)	(0.46)	(0.46)	(0.94)
Financial Stress	0.01**	0.02**	0.01**	0.01**	0.01*	-0.02	-0.03	-0.02	-0.02	-0.03
(t-stat)	(1.74)	(1.95)	(1.74)	(1.74)	(1.64)	(-0.8)	(-0.98)	(-0.8)	(-0.8)	(-0.85)
Volatility	0.02	-0.34	0.02	0.02	0.01	-3.47	-2.82	-3.47	-3.47	-3.23
(t-stat)	(0.02)	(-0.36)	(0.02)	(0.02)	(0.01)	(-0.49)	(-0.4)	(-0.49)	(-0.49)	(-0.45)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	121	121	121	121	121	121	121	121	121	121
R2	55.02%	54.14%	55.02%	55.02%	54.45%	41.81%	42.23%	41.81%	41.81%	41.89%

Source: author's calculations

Notes: \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10% respectively.

An alternative explanation is that our sample for the long rate forecasts is not representative and we cannot generalize the results obtained from the period between 2006 and 2009. Obviously, we do a false generalization, if the relationship between the transparency index and the forecasts is time-varying and atypical during the years of financial stress. Unfortunately, we cannot check the stability of this relationship for the long rate forecasts, since these data are available only from 2006 on. However, we can do it for the short rate forecasts. To see whether the relationship between the transparency index and the short rate forecasts is time-varying, we re-estimate Equation (1). However, this time the sample period is the same as that of the long rate forecasts, *i.e.*, spanned by 2006 and 2009. Table 5 shows the results for the regressions, whenever estimation is possible. Unlike the estimates for the short rate obtained on the long sample (Table 3), but similar to the estimates for the long rate obtained on the short sample (Table 4), the estimates in Table 5 suggest that higher transparency is associated with higher degree of disagreement and less precise forecasts.

**Table 5: The effect of central bank transparency and financial stress on dispersion of the individual forecasts and forecast accuracy, where the forecasted variable is the short rate.**  
**Sample: 2006-2009, countries: Czech Republic, Hungary, Poland, and Slovakia.**

Transparency is measured by index or sub-index	2	3	4	5	Total	2	3	4	5	Total
Dependent variable	Standard deviation of the individual forecasts for the short-term interest rates with forecast horizon 3 months					Absolute forecast error of the consensus forecast for the short-term interest rates with forecast horizon 3 months				
Transparency	0.033	0.04***	0.1	0.05	0.01	-	0.14*	-	-	0.14*
(t-stat)	(0.5)	(1.19)	(0.5)	(0.5)	(0.67)	-	(1.35)	-	-	(1.35)
Financial Stress	0.02***	0.02***	0.02***	0.02***	0.02***	-	0.04	-	-	0.04
(t-stat)	(4.17)	(4.35)	(4.17)	(4.17)	(4.07)	-	(2.87)	-	-	(2.87)
Volatility	3.01***	3.04***	3.01***	3.01***	3.02***	-	-2.42	-	-	-2.42
(t-stat)	(3.01)	(3.04)	(3.01)	(3.01)	(3.01)	-	(-0.79)	-	-	(-0.79)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	-	Yes	-	-	Yes
Observations	121	121	121	121	121	-	114	-	-	114
R2	52.83%	52.86%	52.83%	52.83%	52.92%	-	20.12%	-	-	20.12%
Dependent variable	Standard deviation of the individual forecasts for the short-term interest rates with forecast horizon 1 year					Absolute forecast error of the consensus forecast for the short-term interest rates with forecast horizon 1 year				
Transparency	-0.02	0.05**	-0.05	-0.02	0	-	1.16***	-	-	1.16***
(t-stat)	(-0.23)	(1.23)	(-0.23)	(-0.23)	(0.02)	-	(6.65)	-	-	(6.65)
Financial Stress	0.02*	0.02*	0.02*	0.02*	0.02*	-	-0.02	-	-	-0.02
(t-stat)	(3.41)	(3.19)	(3.41)	(3.41)	(3.39)	-	(-0.93)	-	-	(-0.93)
Volatility	1.35	1.39	1.35	1.35	1.35	-	-2.63	-	-	-2.63
(t-stat)	(0.64)	(0.66)	(0.64)	(0.64)	(0.64)	-	(-0.88)	-	-	(-0.88)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	-	Yes	-	-	Yes
Observations	121	121	121	121	121	-	105	-	-	105
R2	44.50%	44.74%	44.50%	44.50%	44.47%	-	39.10%	-	-	39.10%

Source: author's calculations

Notes: \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10% respectively.

Although central banks may know less about the long rate than the market, it is unlikely to be true for the short rate given that its most important determinant is the policy rate. Therefore, we think that the explanation of Morris and Shin (2002) has only limited relevance at rationalizing the estimated relationship between transparency and forecasts. However, it is still an open question why the forecasts became relatively less precise in countries with more transparent central banks in the recent years.

Turning to our second hypothesis, the coefficient of the financial stress index is either insignificant or significantly positive in Tables 3 and 4. The most probable explanation for this is that financial stress has a strong direct effect on the forecasts, and the tenser is the situation, the higher is the forecast error and the dispersion of views. However, if we think that all the direct effect of financial stress on uncertainty is controlled by the volatility of the variable to be forecasted, then the financial stress index accounts only for the effect that works through the central bank transparency. By assuming that in periods of financial stress the unobserved component of transparency declines and affects the forecasts the same way as the observed component, then the parameter of the stress index should have

the opposite sign as that of the transparency index. This is true for the estimates for the short rate obtained on the long sample.<sup>13</sup> Therefore, this finding supports the presence of unobserved decline of transparency during the financial turmoil.

Finally, we interpret the estimates for the coefficient of the volatility. The sign of the estimates are in line with our previous expectations. Higher historical volatility of forecasted interest rates is associated with higher forecast error and dispersion of views most of the times. Moreover, the estimates are significantly different from zero when the dependent variable is the standard deviation of the 3-month-ahead short rate forecasts. (See the upper left panel in Table 3).

## 5. Conclusions

In the past, financial crises have always triggered important changes in the operation of central banks. The recent financial crisis has also played a pivotal role in forming central bank practices; however, recent updates of the transparency index reflect unchanged circumstances. Almost all the measurable aspects of transparency are the same in 2008 as in 2006, since central banks have kept on publishing their economic models, strategies and decisions.

In this paper we have argued that during the recent financial crisis central banks indeed had become less transparent as an obvious consequence of applying unconventional measures. This decline of transparency has not been captured by the standard measure of transparency developed by Geraats (2002). In order to provide empirical evidence for the presence of measurement error in the transparency index, we have investigated the effect of transparency on the quality of survey forecasts.

By examining the forecasts for the *short rate* of a sample covering the period between 2003 and 2006 and 4 CEE countries, we found the following. First, the more transparent the central banks are, the smaller the absolute forecast errors are and the smaller the degree of disagreement across individual forecasters is after controlling for the overall difficulty of forecasting. This finding is in line with the literature. (See Swanson 2004, and Ehrmann et al. 2010). Second, forecasts for the short rate are less precise and more diverse in periods of financial stress even after controlling for the transparency index, the volatility of the variable to be forecasted and some country specific effects. This second finding can be explained either by the direct or the indirect effect of financial stress on economic uncertainty. If the dominant effect is the indirect one, which works through the central bank transparency, then we can think of the financial stress index as a proxy for the unobserved component of transparency and the second finding can be interpreted as an indirect evidence for the measurement error in the transparency index.

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<sup>13</sup> In contrast to the estimates for the short rate forecasts obtained on the long sample, the estimates obtained on the short sample are such that the parameter of the stress index has the same sign as that of the transparency index in most of the cases. (See Tables 4 and 5.) Given that the short sample is not representative, we cannot rely much on these results.

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