JEL Classification: E47; E58; F31
Keywords: monetary policy, forecast evaluation, directional accuracy

Interest Rate and Exchange Rate Forecasting in the Czech Republic: Do Analysts Know Better than a Random Walk?*

Hamid BAGHESTANI—Department of Economics, American University of Sharjah, Sharjah, UAE (hbaghestani@aus.edu), *corresponding author*
Liliana DANILA—Department of Economics, American University of Sharjah, Sharjah, UAE (ldanila@aus.edu)

Abstract
The Czech National Bank (CNB) conducts a monthly survey to collect domestic and foreign analysts' forecasts of several economic and financial variables. Among these are the 2-week repo rate (which is the monetary policy interest rate set by the CNB), the 1-year Prague interbank offer rate and the CZK/EUR exchange rate. We ask whether the one- and twelve-month-ahead analysts' forecasts of these indicators are accurate for 2005–2012. Our findings indicate that the one-month-ahead forecast of the repo rate and the twelve-month-ahead forecast of the exchange rate made by the domestic analysts are free of systematic bias, superior to the random walk and directionally accurate. The same is true for the one-month-ahead foreign analysts' forecasts of the repo rate and the exchange rate. Unlike the domestic analysts' forecasts, however, the foreign analysts' forecasts are not efficient.

1. Introduction

Numerous studies have investigated the accuracy of experts' forecasts of interest rates and exchange rates for developed economies. The general consensus is that these forecasts cannot beat a simple random walk forecast. In a recent study, for instance, Mitchell and Pearce (2007) examine the accuracy of economists' interest rate and exchange rate forecasts from *Wall Street Journal* surveys and reach a similar conclusion. A possible explanation is that experts have great difficulty understanding the complex market dynamics and thus rely on simple forecasting rules (heuristics). As such, their forecasts are backward- instead of forward-looking (Tversky and Kahneman, 1974). Another explanation, often cited, is that interest rates and exchange rates in efficient markets follow a random walk. Random walk behavior implies that such rates rapidly and fully reflect all relevant information so that future rate changes deviate from zero only in response to unanticipated events.

We extend this investigation to an emerging market economy, namely the Czech Republic, and find mixed (and yet interesting) results. In particular, we focus on the domestic and foreign analysts' forecasts of the interest rates and exchange rate derived from the monthly survey conducted by the Czech National Bank. As pointed out by Filáček and Saxa (2012, pp. 244–245), "The expectations of financial market participants are very important for any central bank. If private expectations are

* We are grateful to two anonymous referees and the editor of this journal for their helpful comments and suggestions. Also, we would like to thank the Communications Department at the Czech National Bank for assistance with our questions.

broadly in line with central bank expectations, the central bank has a check that its communication has been properly understood and that its vision has been conveyed properly to the financial markets. If, however, private expectations differ significantly from the central bank forecast, the vision of the central bank might have been communicated badly or might even have been disbelieved." This is consistent with the statements on the CNB website that the purpose of the survey is "to get analysts' views on the expected evolution of macroeconomic indicators and to compare their expectations with the CNB's forecast." It follows that, regardless of their accuracy, the survey forecasts are useful to the CNB for its conduct of monetary policy. One can argue that the survey forecasts can be even more useful when they differ from the CNB's forecasts, as they may contain some extra information or different expert views on future developments.

With such considerations in mind, we utilize comparable random walk benchmarks to see whether the one- and twelve-month-ahead analysts' forecasts of the 2-week repo rate, 1-year Prague interbank offer rate (PRIBOR) and CZK/EUR exchange rate are accurate. Given that the 2-week repo rate is the monetary policy interest rate set by the CNB, our study could provide the CNB with interesting information. The accuracy of the interest rate forecasts, in particular, reflects the clarity and transparency of the CNB's communication. It can also reveal useful information on how and to what degree economic surprises may have shifted the actual setting of interest rates from the previous forecasts.

Our findings indicate that the one-month-ahead forecast of the repo rate and the twelve-month-ahead forecast of the exchange rate made by the domestic analysts are free of systematic bias, superior to the random walk and directionally accurate. The same is true for the one-month-ahead foreign analysts' forecasts of the repo rate and the exchange rate. Unlike the domestic analysts' forecasts, however, those of the foreign analysts are not efficient.[1] Section 2 provides some background on the Czech economy in addition to a brief literature review. Section 3 describes the analysts' and random walk forecasts. Section 4 presents the methodology and empirical results. Section 5 concludes the study by putting the results into perspective.

2. Background and Related Literature

As a country in the region of Central and Eastern Europe (CEE), the Czech Republic is well integrated economically and financially with the European economy. The steady process of financial integration, started in the 1990s, has proven crucial since the Czech economy relies heavily on foreign trade.[2] Such integration, however, makes the Czech economy quite susceptible to shocks due to changes in the economic conditions of its trading partners. To minimize any potential contagion, the CNB carefully monitors economic and financial developments.[3] A study by

[1] The CNB survey also collects the one- and three-year-ahead analysts' forecasts of inflation. Baghestani and Danila (2014) show these forecasts are generally accurate. They also show that the domestic analysts' forecasts are more informative than the foreign analysts' forecasts.

[2] In 2012, Czech GDP (PPP) was USD 286.7 billion, with exports and imports accounting for 47% and 45% of GDP, respectively.

[3] According to the 2008 CNB Financial Stability Report, the CNB monitored 21 banks, 17 credit unions, 35 insurance companies, 10 pension funds, 142 open-end mutual funds and 27 non-bank investment institutions as well as 16 foreign banks and 17 EU insurance companies.

Babecky et al. (2013) shows that the impact of the recent global financial crisis on the Czech economy was relatively small due to the country's limited use of financial innovations and the prudent behavior of Czech financial market players such as the CNB and financial institutions.

The Czech economy's high degree of economic and financial integration with other European countries makes it vulnerable to contractions in those countries. In particular, the CNB worries about any turmoil in the international markets which would lead to instability in the Czech financial markets. Geršl and Hlaváček (2007) and Janáček et al. (2012) study potential foreign risks to the stability of the Czech financial sector. Geršl and Hlaváček (2007) discuss the risks posed by foreign direct investment (which accounted, on average, for 6.5% of the GDP during 1995–2006). Janáček et al. (2012) focus on the risks to financial stability by examining the co-movements between the Czech sovereign risk and the sovereign risk posed by other countries during calm times. They find (i) a decline in such co-movements between the Czech economy and developed economies like France and Germany, and (ii) an increase in such co-movements between the Czech economy and troubled economies' sovereign risk.

Although the Czech Republic is a member of the European Union, its currency is the Czech koruna (not the euro). The CNB manages the exchange rate float to help with inflation targeting adopted as the monetary policy framework in January 1998. Exchange rate management is particularly important since about 97% of the banking assets are directly or indirectly controlled by foreign entities. In general, however, the Czech koruna is perceived to pose lower risks than other CEE currencies. According to the 2005 CNB Financial Stability Report, the correlation between the koruna and other CEE currencies had declined, making the koruna a cheap financing currency for investment.

On the question of whether the CZK/EUR exchange rate is predictable, the literature contains a number of studies. Cuaresma and Hlouskova (2005) utilize several multivariate time-series models to forecast the CZK/EUR exchange rate in addition to four other exchange rates in CEE economies. For the period from 1993 to 2000, they conclude that their models for all exchange rates tend to beat the random walk for the 6-month horizon and beyond. Cuaresma and Hlouskova (2004) reach similar conclusions when excluding early transition data. Naszodi (2011) examines the accuracy of the survey forecasts of the exchange rate for the period from 2003 to 2009. She shows that, unlike Cuaresma and Hlouskova's (2005) time-series forecasts, the survey forecasts perform remarkably better than the random walk. Naszodi (2011) offers several reasons for the accuracy of the survey forecasts, including the notion that the survey participants may have employed more sophisticated models and/or used a broader set of quantitative/qualitative information. Naszodi (2011, p. 11) also recognizes the difference in her sample period and that of Cuaresma and Hlouskova (2005) and suggests that the exchange rates in Central and Eastern Europe may have become more predictable after the millennium. Using several time-series models including fractional random walk, Muck and Skrzypczynski (2012) generate weekly forecasts of the Polish zloty, the Czech koruna and the Hungarian forint exchange rates against the euro for 2005–2012 and conclude that it is very difficult to beat the random walk. Finally, Pierdzioc et al. (2012) utilize survey data to provide evidence in support of anti-herding behavior of exchange rate forecasters in eighteen

Asian, European and South American emerging market economies. They show that, in order to sell their forecasts, professional forecasters tend to differentiate themselves from others by providing exchange rate predictions that differ from the "no change" forecast.

Studies related to forecasting other indicators include Arnoštová et al. (2010) and Babecký and Podpiera (2011) who examine the accuracy of alternative forecasts of GDP and inflation including those of the CNB. Franta et al. (2014) take a different approach by generating Bayesian vector autoregression (BVAR) fan charts as benchmarks to evaluate the accuracy of the CNB's predictions. They show that BVAR fan charts for interest rate, exchange rate, inflation and GDP growth do not, in general, outperform those of the CNB. Havránek et al. (2012) find that several financial variables (including the share of liquid assets in the banking industry and the loan loss provision rate) have significant impact on Czech macroeconomic fluctuations. Their study also reveals that financial variables, in general, contain predictive information for GDP growth and inflation. Horváth et al. (2010) investigate the predictive information content of money for inflation in the Czech Republic, Hungary, Poland and Slovakia. They find in-sample evidence that money matters for inflation. Their out-of-sample evidence, however, indicates that, except for certain periods, money fails to accurately predict inflation. Using a structural time-varying parameter model, Horváth (2009) generates a policy-neutral interest rate in real-time for 2001–2006. He shows that the difference between the actual interest rate and the estimated policy-neutral rate is a useful predictor of future inflation in the Czech Republic.

3. Analysts' and Random Walk Forecasts

Two of the questions on the CNB's survey questionnaire are: "what is the expected level of interest rate in 1 month and in 1 year?", and "what is the expected level of nominal exchange CZK/EUR in 1 month and in 1 year?" The survey is carried out after the publication of the CPI and the deadline for analysts to submit their forecasts is usually between the 13th and 17th day of the month. Using the individual responses, the survey calculates and reports the consensus (mean) forecasts on the CNB website.[4] In evaluating the one- and twelve-month-ahead consensus forecasts of the repo rate, PRIBOR and CZK/EUR exchange rate, we utilize the forecasts made in January 2004 through March 2012 (2004.01–2012.03).[5] As such, the sample periods for the one- and twelve-month-ahead forecasts are, respectively, 2004.02––2012.04 and 2005.01–2013.03. For both the one- and twelve-month-ahead forecast horizons, however, we focus on a single period (2005.01–2012.04) with 88 observations. Since the foreign analysts did not report forecasts in some months, the number of observations (n) for the foreign analysts' forecasts of the repo rate and exchange rate varies from 65 to 87 (as reported in column 1 of *Table 1*).[6] We do not examine

[4] The survey questionnaire is also available on the CNB website. The individual analyst's forecasts are not available and we thus examine only the consensus forecast. In 2013, 11 domestic and 4 foreign analysts were surveyed. The number of domestic analysts over the forecast period varied from 10 to 13 and the number of foreign analysts varied between 3 and 4.

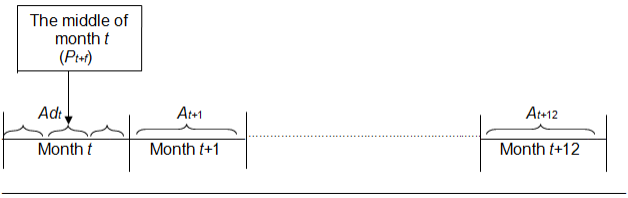
[5] For the period up to December 2003, the analysts were asked to provide the forecasts of the 1-week PRIBOR. Since January 2004, the survey has asked for the forecasts of the 2-week repo rate (which is the monetary policy interest rate set by the CNB). For consistency, we focus on the forecasts made since January 2004 for all series examined here.

Table 1 Forecast Accuracy Test Results

Row no.	Analysts	*n* (1)	ME (2)	ME (3)
2-week repo rate forecasts: 2005.01–2012.04 (*n* = 88) Actual mean = 1.89%; high = 3.75%; low = 0.75%				
One-month-ahead forecasts				
1	Domestic	88	-0.008 (0.009)	0.048
2	Foreign	84	0.008 (0.016)	0.059
3	All	88	-0.008 (0.009)	0.048
Twelve-month-ahead forecasts				
4	Domestic	88	-0.611[a] (0.224)	0.750
5	Foreign	87	-0.590[a] (0.242)	0.802
6	All	88	-0.607[a] (0.223)	0.750
1-year PRIBOR forecasts: 2005.01–2012.04 (*n* = 88) Actual mean = 2.62%; high = 4.42%; low = 1.70%				
One-month-ahead forecasts				
7	Domestic	88	0.018 (0.024)	0.131
8	All	88	0.022 (0.024)	0.131
Twelve-month-ahead forecasts				
9	Domestic	88	-0.426[a] (0.221)	0.709
10	All	88	-0.410[a] (0.223)	0.711
CZK/EUR exchange rate forecasts: 2005.01-2012.04 (*n* = 88) Actual mean = 26.659; high = 30.375; low = 23.375				
One-month-ahead forecasts				
11	Domestic	88	-0.140[a] (0.067)	0.422
12	Foreign	65	0.046 (0.050)	0.277
13	All	88	-0.128[a] (0.067)	0.417
Twelve-month-ahead forecasts				
14	Domestic	88	-0.268 (0.336)	1.018
15	Foreign	81	-0.841[a] (0.388)	1.379
16	All	88	-0.341 (0.338)	1.041

Notes: *n* is the number of observations, ME is the mean forecast error and MAE is the mean absolute forecast error. The forecast error is e_{t+f} (= $A_{t+f} - P_{t+f}$), where A_{t+f} is the actual rate in month $t+f$, and P_{t+f} is the analysts' forecast of A_{t+f} made in the middle of survey month t (f is the forecast horizon). Numbers in parentheses are the Newey-West standard errors. Superscript "a" indicates significance at the 10% or lower level of significance.

Figure 1 Timeline of the Forecasts



Notes: A_{t+1} and A_{t+12} are the actual rates observed in the middle of the month. With the forecast horizon f = 1 and 12, P_{t+f} is the analysts' (consensus) forecast of A_{t+f} made in the middle of month t. The random walk forecast (denoted as Ad_t) is the rate observed around the 10th day of month t.

the foreign analysts' forecasts of the PRIBOR due to unavailability of such forecasts for 2006–2011.

Figure 1 presents the timeline of the forecasts. As noted, A_{t+f} is the actual rate related to month $t+f$, and P_{t+f} is the analysts' (consensus) forecast of A_{t+f} made in the middle of month t (the forecast horizon f = 1 and 12 months). We let A_{t+f} be the actual rate in the middle of month $t+f$.[7] This is because the survey questionnaire notes that "Expected interest rates and exchange rate are understood as an expected level in 1M horizon (e.g. when reporting in the middle of November 2006, the expected level of interest and exchange rates for 1M mean level in the middle of December 2006 and the expected rates for 1 year horizon mean level in the middle of November 2007)." With the survey forecasts made in the middle of month t, we let the random walk forecasts (denoted as Ad_t) be the rate observed around the 10th day of month t.[8] This random walk forecast (Ad_t) is comparable to the analysts' forecasts since, as shown in *Figure 1*, the rate is available at the time of the survey.

4. Methodology and Empirical Results

Our analysis focuses on answering the following four questions:

1. Are analysts' forecasts free of systematic bias?
2. Are analysts' forecasts superior to the random walk benchmark?
3. Are analysts' forecasts directionally accurate?
4. Are analysts' forecasts efficient?

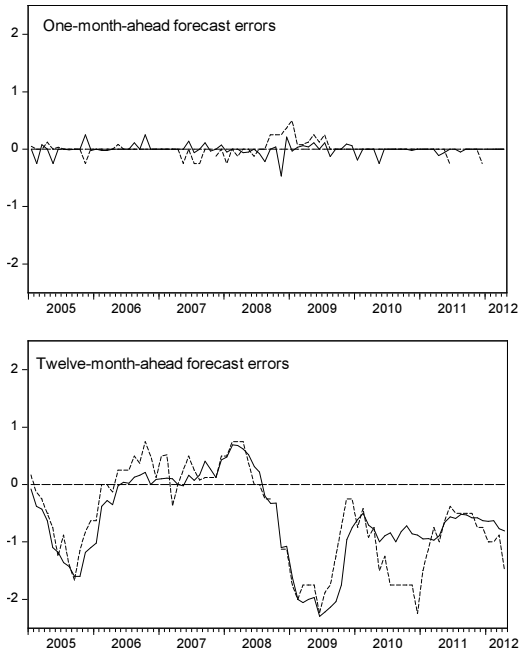
In answering these questions, we let A_{t+f} be the actual rate in month $t+f$ and P_{t+f} be the forecast of A_{t+f} made in the middle of survey month t (the forecast horizon f = 1 and 12 months). Threfore, with Ad_t denoting the actual rate known at the time of the survey, the actual change is $(A_{t+f} - Ad_t)$ and the predicted change is $(P_{t+f} - Ad_t)$.

[6] Regarding the repo rate, foreign analysts reported the one-month-ahead forecasts in 84 months and the twelve-month-ahead forecasts in 87 months. As for the exchange rate, the foreign analysts reported the one-month-ahead forecasts in 65 months and the twelve-month-ahead forecasts in 81 months. As can be seen in *Figures 2* and *4*, the time plots of the foreign analysts' forecasts are not continuous throughout due to the missing observations.

[7] A_{t+f} is the actual rate for the 16th day of month $t+f$. Where the rate for the 16th day of the month is not available, we use the rate for the 17th (or the 18th, if the rate for the 17th is not available).

[8] The random walk forecast (Ad_t) is the rate observed on the 10th day of month t. Where the rate for the 10th day of the month is not available, we use the rate for the 9th (or the 11th, if the rate for the 9th is not available).

Figure 2 2-week Repo Rate Forecast Errors: Actual-Forecast Domestic Analysts (Solid Line) vs. Foreign Analysts (Dotted Line)



4.1 Are Analysts' Forecasts Free of Systematic Bias?

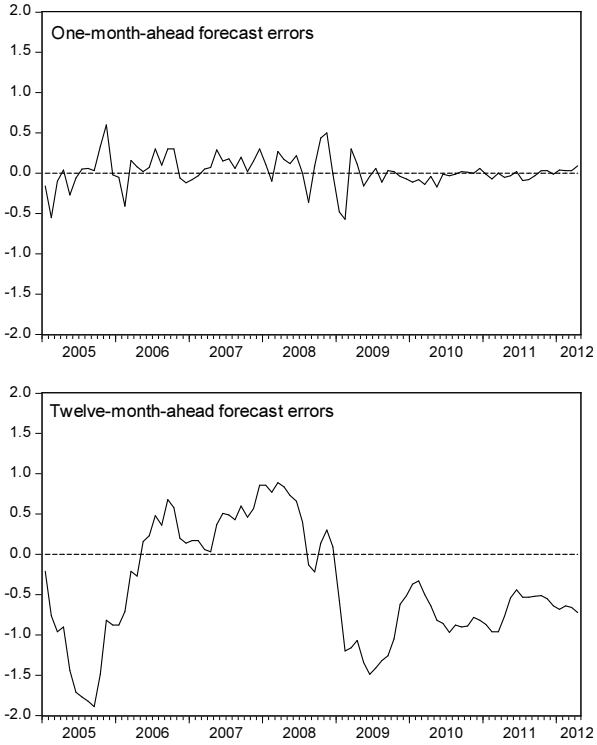
We start with estimating the following test equation

$$e_{t+f} = \alpha + u_{t+f} \tag{1}$$

where e_{t+f} ($= A_{t+f} - P_{t+f}$) is the analysts' forecast error and α is the population mean error (ME). Since the forecasts are made in month t, the error term u_{t+f} follows an f^{th}-order moving-average process under the null hypothesis of rationality. With the forecast errors generally heteroscedastic, we use the Newey-West (1987) procedure to correct for the inherent f^{th}-order serial correlation and heteroscedasticity.

Column 2 of *Table 1* reports the OLS estimates of the mean error (ME) along with the Newey-West standard errors for the one- and twelve-month-ahead forecasts of the repo rate in rows 1–6, PRIBOR in rows 7–10 and CZK/EUR exchange rate in rows 11–16. As shown by superscript "a", we reject the null hypothesis that the population ME is zero for the forecasts in rows 4–6, 9–11, 13 and 15. This means that the one-month-ahead analysts' forecasts of the repo rate, the one-month-ahead analysts' forecasts of the PRIBOR, the one-month-ahead foreign analysts' forecast of the exchange rate, and the twelve-month-ahead domestic analysts' and all analysts' forecasts of the exchange rate are the only ones that do not, on average, under- or over-predict. Consistent with these findings, the ME estimates of these forecasts are small relative to their corresponding mean absolute error (MAE) reported in column 3. By the same token, the ME estimates of the remaining forecasts (in rows 4–6, 9–11, 13 and 15) are large relative to their corresponding MAE. *Figures 2–4* plot the ana-

Figure 3 1-year PRIBOR (All Analysts) Forecast Errors: Actual-Forecast

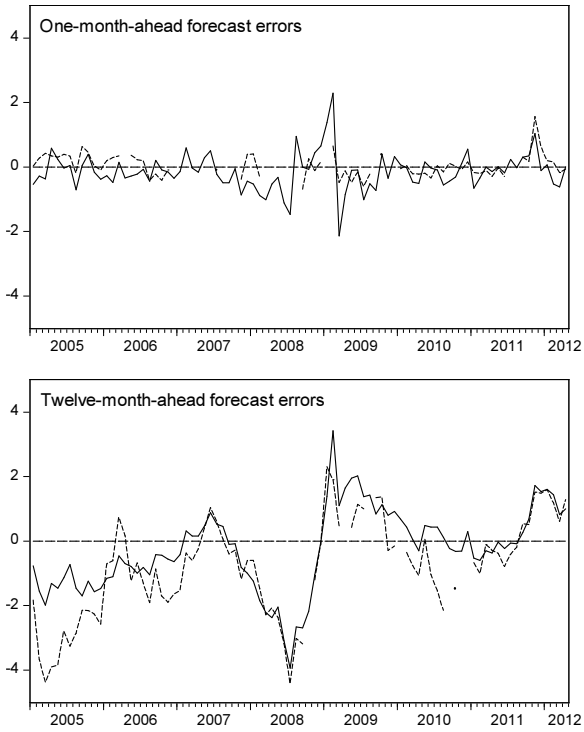


lysts' forecast errors of the repo rate, PRIBOR and exchange rate to provide further information particularly on the impact of the recent economic and financial crisis. A visual inspection of the twelve-month-ahead forecast errors, for instance, suggests that such crisis may have resulted in a break in the series around 2008–2009.

4.2 Are Analysts' Forecasts Superior to the Random Walk Benchmark?

For many economic and financial indicators, a simple random walk forecast is not necessarily a poor competitor (Diebold and Lopez, 1996). In examining whether the analysts' forecasts are superior to the random walk, we calculate Theil's *U* coefficient as the mean squared error (MSE) of the analysts' forecast divided by the MSE of the random walk forecast. Column 1 of *Table 2* reports Theil's *U* coefficients. The analysts' forecasts with *U* coefficients greater than one (in rows 4–6, 11 and 13) produce larger MSEs and thus cannot be superior to the random walk forecasts. For the forecasts with *U* coefficients lower than one (in rows 1–3, 7–10, 12 and 14–16), we use the Diebold-Mariano (1995) procedure to test the null hypothesis of equal forecast accuracy against the alternative that the MSE of the analysts' forecast is less than the MSE of the random walk forecast. Column 2 of *Table 2* reports the test *p*-values. With the *p*-values below 0.10 in rows 1–3, 12, 14 and 15, we reject the null hypothesis of equal forecast accuracy for the one-month-ahead analysts' forecasts of the repo rate, the one-month-ahead foreign analysts' forecast of the ex-

Figure 4 CZK/EUR Exchange Rate Forecast Errors: Actual-Forecast Domestic Analysts (Solid Line) vs. Foreign Analysts (Dotted Line)



change rate and the twelve-month-ahead domestic analysts' and all analysts' forecasts of the exchange rate. We thus conclude that these analysts' forecasts are all significantly superior to the random walk benchmarks. [9]

4.3 Are Analysts' Forecasts Directionally Accurate?

Column 3 of *Table 2* reports the directional accuracy rate (π). With Ad_t known at the time of the survey, π is the number of observations for which the actual change ($A_{t+f} - Ad_t$) and predicted change ($P_{t+f} - Ad_t$) have the same sign divided by the sample size.[10] We test the null hypothesis of no (directional) association between the actual and predicted changes using Fisher's exact test and the chi-square tests with and without Yate's continuity correction (Sinclair et al., 2010). These tests are based on a two-by-two contingency table whose elements are the numbers of correct and incorrect sign forecasts. As shown by superscript "b", we reject the null hypothesis of no (directional) association for the forecasts in rows 1–3, 12, 14 and 16. As such, we conclude that the one-month-ahead analysts' forecasts of the repo rate, the one-

[9] It is important to note that the one-month-ahead domestic and all analysts' forecasts of the exchange rate fail to be superior to the random walk forecasts for the shorter period with $n = 65$.

[10] For some months, the actual change or the predicted change is zero. We include these no-change observations with the downward predictions.

Table 2 Additional Forecast Accuracy Test Results

Row no.	Analysts	*U* (1)	DM *p*-value (2)	π (3)	*F-test p-value* (4)
2-week repo rate forecasts					
One-month-ahead forecasts					
1	Domestic	0.38	0.007	0.80[b]	0.237
2	Foreign	0.59	0.045	0.90[b]	0.001
3	All	0.38	0.007	0.82[b]	0.183
Twelve-month-ahead forecasts					
4	Domestic	1.01	--	0.48	--
5	Foreign	1.12	--	0.44	--
6	All	1.02	--	0.51	--
1-year PRIBOR forecasts					
One-month-ahead forecasts					
7	Domestic	0.78	0.180	0.50	--
8	All	0.78	0.177	0.49	--
Twelve-month-ahead forecasts					
9	Domestic	0.84	0.317	0.60	--
10	All	0.83	0.299	0.60	--
CZK/EUR exchange rate forecasts					
One-month-ahead forecasts					
11	Domestic	1.08	--	0.58	--
12	Foreign	0.40	0.065	0.82[b]	0.061
13	All	1.06	--	0.53	--
Twelve-month-ahead forecasts					
14	Domestic	0.51	0.001	0.85[b]	0.174
15	Foreign	0.91	0.362	0.60	--
16	All	0.53	0.001	0.84[b]	0.176

Notes: U is Theil's *U*-coefficient. The Diebold-Mariano (DM) test *p*-values in column 2 are for testing the null hypothesis of equal forecast accuracy. π is the directional accuracy rate. Superscript "b" indicates that the null hypothesis of no (directional) association is rejected at the 10% or lower level of significance. The F-test *p*-values in column 4 are for testing the null hypothesis that the forecast is efficient.

month-ahead foreign analysts' forecast of the exchange rate, and the twelve-month-ahead domestic analysts' and all analysts' forecasts of the exchange rate are all directionally accurate. Consistent with this conclusion, the overall directional accuracy rates (π), ranging from 0.80 to 0.90, are quite high for these forecasts.

4.4 Are Analysts' Forecasts Efficient?

Put together, our findings so far indicate that the one-month-ahead analysts' forecasts of the repo rate (in rows 1–3), the one-month-ahead foreign analysts' forecasts of the exchange rate (in row 12) and the twelve-month-ahead domestic analysts' and all analysts' forecasts of the exchange rate (in rows 14 and 16) are free of systematic bias, superior to the random walk and directionally accurate. The question

then is whether these forecasts are efficient. A forecast is efficient if it contains the past information in the target variable known at the time of the forecast. In testing for efficiency, we thus regress the forecast error (e_{t+f}) on the past forecast errors (e_{t-f-1} and e_{t-f-2}) and the difference between the analysts' and the random walk forecasts ($P_{t+f} - Ad_t$). Using the Newey-West covariance estimates, we test the null hypothesis of efficiency that e_{t-f-1}, e_{t-f-2}, and ($P_{t+f} - Ad_t$) are not jointly correlated with the forecast error e_{t+f}. Column 4 of *Table 2* reports the corresponding F-test *p*-values. With the *p*-values in rows 2 and 12 below 0.10, we conclude that the one-month-ahead foreign analysts' forecasts of the repo rate and the exchange rate are not efficient. With the *p*-values in rows 1, 3, 14 and 16 above 0.10, we further conclude that the one-month-ahead forecasts of the repo rate and the twelve-month-ahead forecasts of the exchange rate made by the domestic analysts and by all analysts are efficient.

Finally, the time plots of the one-month-ahead forecast errors of the repo rate in *Figure 2* reveal that the domestic and foreign analysts produce similar forecast errors for most of the period. For 2007–2009, however, the foreign analysts' forecast errors are larger. This may explain why the one-month-ahead foreign analysts' forecast of the repo rate fails to be efficient. In addition, consistent with our conclusion for the exchange rate forecasts, *Figure 4* demonstrates that the foreign analysts produce smaller one-month-ahead forecast errors, while the domestic analysts produce smaller twelve-month-ahead forecast errors.

5. Concluding Remarks

The CNB conducts a monthly survey to collect domestic and foreign analysts' forecasts of several economic and financial variables. Among these are the 2-week repo rate (which is the monetary policy interest rate set by the CNB), 1-year PRIBOR and CZK/EUR exchange rate. We ask whether the one- and twelve-month-ahead domestic and foreign analysts' forecasts of these indicators are accurate. This question is important, given the CNB's statement on its website that "This [survey] information serves primarily for the CNB's monetary policy purposes."

Under the hypothesis of market efficiency coupled with the time-invariant term premiums assumption, the theory of term structure suggests that long-term interest rates approximately follow a random walk (Pesando, 1979; Reichenstein, 2006). Consistent with this theory, Brooks and Gray (2004) and Mitchell and Pearce (2007), among others, show that experts' forecasts of either the 10-year or 30-year US Treasury rates are inferior to the random walk benchmark. However, as noted by Pesando (1979, p. 460), the theory of term structure does not necessarily imply a random walk behavior in short-term interest rates. As such, whether alternative forecasts of short-term interest rates are inferior to the random walk benchmarks is an empirical question. For 2005.01–2012.04, we have mixed results. That is, the twelve-month-ahead analysts' forecast of the repo rate and the one- and twelve-month-ahead analysts' forecasts of the PRIBOR are all inferior to the random walk. However, the one-month-ahead analysts' forecasts of the repo rate are free of systematic bias, directionally accurate, superior to the random walk forecast and generally efficient. Perhaps, due to its importance as the monetary policy interest rate, analysts closely monitor the CNB's behavior and are thus able to accurately predict the repo rate short-horizon movements.

As for the exchange rate, many studies, beginning with Meese and Rogoff (1983), have shown that the exchange rate forecasts from structural and time-series models are generally inferior to a simple random walk forecast. A similar conclusion follows for the survey forecasts examined by Dominguez (1986), Frankel and Froot (1987), Elliott and Ito (1999), and Harrison and Mogford (2004). Mark (1995), however, finds evidence of long-horizon predictability. In a more recent study, Novotný and Raková (2011) show that the consensus forecast of the USD/EUR exchange rate is more accurate than the naive forecast and the forecast implied by the forward rate for 2002–2009. With regard to the predictability of the CZK/EUR exchange rate, existing studies offer mixed results. Cuaresma and Hlouskova (2005) show the forecasts from multivariate time-series models beat the random walk only for the 6-month horizon and beyond. Muck and Skrzypczynski (2012), who examine the accuracy of the time-series forecasts for a more recent period, conclude that it is very difficult to beat the random walk. In contrast, Naszodi (2011) shows the survey forecasts perform remarkably better than the random walk. According to our findings, the one-month-ahead foreign analysts' forecast of the CZK/EUR exchange rate as well as the twelve-month-ahead domestic analysts' and all analysts' forecasts are free of systematic bias, superior to the random walk and directionally accurate; unlike the foreign analysts' forecasts, the domestic analysts' forecasts are efficient.

Our evidence that the foreign analysts are able to produce accurate forecasts of the repo rate and exchange rate is not surprising. As noted already, the Czech economy has a liberalized trade policy and is highly integrated with international markets (especially with the Eurozone markets). A large share of domestic production is aimed at foreign markets and a major share of both intermediate and final products is imported. Therefore, it makes sense for the foreign analysts to closely monitor the Czech economy and produce accurate forecasts of the repo rate and exchange rate.

REFERENCES

Arnoštová K, Havrlant D, Růžička L, Tóth P (2010): Short-Term Forecasting of Czech Quarterly GDP Using Monthly Indicators. *Finance a úvěr-Czech Journal of Economics and Finance*, 61: 566–583.

Babecký J, Podpiera J (2011): Inflation forecast errors in the Czech Republic: Evidence from a panel of institutions. *Eastern European Economics*, 49:72–83.

Babecký J, Komarek L, Komarkova Z (2013): Financial integration at times of financial instability. *Finance a úvěr-Czech Journal of Economics and Finance*, 63:25–45.

Baghestani H, Danila L (2014): On the accuracy of analysts' forecasts of inflation in an emerging market economy. *Eastern European Economics*, 52, forthcoming.

Brooks R, Gray JB (2004): History of the forecasters: Naive forecasts are better than the consensus WSJ forecasts. *Journal of Portfolio Management*, 30:113–117.

Cuaresma JC, Hlouskova J (2004): Forecasting exchange rates in transition economies: a comparison of multivariate time series models. *Empirical Economics*, 29:787–801.

Cuaresma JC, Hlouskova J (2005): Beating the random walk in Central and Eastern Europe. *Journal of Forecasting*, 24:189–201.

Diebold FX, Lopez JA (1996): Forecast evaluation and combination. In: Maddala GS, Rao CR (Eds.): *Handbook of Statistics*, 14:241–268. (Amsterdam, North–Holland)

Diebold FX, Mariano RS (1995): Comparing predictive accuracy. *Journal of Business & Economic Statistics*, 13:253–263.

Dominguez KM (1986): Are foreign exchange forecasts rational? New evidence from survey data. *Economics Letters*, 21:277–281.

Elliott G, Ito T (1999): Heterogeneous expectations and tests of efficiency in the yen/dollar forward exchange rate market. *Journal of Monetary Economics*, 43:435–456.

Filáček J, Saxa B (2012): Central bank forecasts as a coordination device: Evidence from the Czech Republic. *Czech Economic Review*, 6:244–264.

Frankel JA, Froot KA (1987): Using survey data to test standard propositions regarding exchange rate expectations. *American Economic Review*, 77:133–153.

Franta M, Baruník J, Horváth R, Šmídková K (2014): Are Bayesian fan charts useful? The effect of zero lower bound and evaluation of financial stability stress tests. *International Journal of Central Banking*, 10:159–187.

Geršl A, Hlaváček M (2007): Foreign Direct Investment, Corporate Finance, and the Life Cycle of Investment. *Finance a úvěr-Czech Journal of Economics and Finance*, 57:448–464.

Harrison S, Mogford C (2004): Recent developments in surveys of exchange rate forecasts. *Bank of England Quarterly Bulletin*, 44:170–175.

Havránek T, Horváth R, Matějů J (2012): Monetary transmission and the financial sector in the Czech Republic. *Economic Change and Restructuring*, 45:135–155.

Horváth R (2009): The time-varying policy neutral rate in real time: A predictor for future inflation? *Economic Modelling*, 26:71–81.

Horváth R, Komárek L, Rozsypal F (2010): Does money help predict inflation? An empirical assessment for Central Europe. *Economic Systems*, 35:523–536.

Janáček K, Komárková Z, Hlaváček M, Komárek L (2012): Impacts of the sovereign default crisis on the Czech financial sector. *Czech National Bank Financial Stability Report*, 2011/2012:118–128.

Mark N (1995): Exchange rates and fundamentals: Evidence on long-horizon predictability. *American Economic Review*, 85:201–218.

Meese R, Rogoff K (1983): Empirical exchange rate models of the seventies: Do they fit out of sample? *Journal of International Economics*, 14:3–24.

Mitchell K, Pearce D (2007): Professional forecasts of interest rates and exchange rates: Evidence from the Wall Street Journal's panel of economists. *Journal of Macroeconomics*, 29:840–854.

Muck J, Skrzypczynski P (2012): *Can we beat the random walk in forecasting CEE exchange rates?* Available at SSRN: http://ssrn.com/abstract=2163518 or http://dx.doi.org/10.2139/ssrn.2163518.

Naszodi A (2011): Beating the random walk in Central and Eastern Europe by survey forecasts. *MNB Working Papers* (Magyar Nemzeti Bank). Available at: http://www.econstor.eu/handle/10419/83618

Newey WK, West KD (1987): A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55:703–708.

Novotný F, Raková M (2011): Assessment of consensus forecasts accuracy: the Czech National Bank perspective. *Finance a úvěr-Czech Journal of Economics and Finance*, 61:348–366.

Pesando JE (1979): On the random walk characteristics of short- and long-term interest rates in an efficient market. *Journal of Money, Credit, and Banking*, 11:457–466.

Pierdzioc C, Rülke JC, Stadtmann G (2012): A note on forecasting emerging market exchange rates: evidence of anti-herding. *Review of International Economics*, 20:974–984.

Reichenstein W (2006): Rationality of naive forecasts of long-term rates. *Journal of Portfolio Management*, 32:116–119.

Sinclair TM, Stekler HO, Kitzinger L (2010): Directional forecasts of GDP and inflation: a joint evaluation with an application to Federal Reserve predictions. *Applied Economics*, 42:2289–2297.

Tversky A, Kahneman D (1974): Judgment under uncertainty: heuristics and biases. *Science*, 185: 1124–1131.