Evaluation of the Ministry of Finance's Forecast History

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Abstract

This paper evaluates the accuracy of macroeconomic economic forecasts of the Ministry of Finance of the Czech Republic using the average forecasting error, the mean absolute error and Theil's inequality coefficient. The paper analyses the forecast accuracy of the main macroeconomic indicators – real GDP growth, nominal GDP growth, GDP deflator growth, real private consumption growth, average inflation rate, average unemployment rate and current account balance to GDP Ratio. The forecast accuracy is also assessed using the modified Diebold and Mariano test, which compares the accuracy of two forecasts under the null hypothesis that assumes no differences in accuracy. Last but not least, the paper compares the accuracy of the forecasts of the Ministry of Finance to those of the European Commission, Organization for Economic Co-operation and Development and International Monetary Fund.

Keywords

The accuracy of macroeconomic forecasts, the average forecasting error, the mean absolute error, Theil's inequality coefficient, the naïve forecast, modified Diebold-Mariano test

JEL code

C82

INTRODUCTION

This analysis evaluates the forecast accuracy of the macroeconomic forecasts of the Ministry of Finance of the Czech Republic. The first experimental publication summarizing the past and expected future development of basic economic indicators was published by the Ministry of Finance in November 1995. Today, an 18-year history of regular quarterly forecasts provides a high-quality source with which to evaluate their success rate. This can help forecast users to get an idea of how precisely the Ministry of Finance is able to predict the future development of basic macroeconomic indicators across various time horizons.

It is necessary to note that all macroeconomic forecasts are inherently conditioned by adopted assumptions regarding the development of exogenous factors, of which some, for example natural disasters, the development of financial markets, including commodity prices or changes in the political environment outside and inside the Czech Republic, are inherently unpredictable. Other assumptions, for example the impact of structural policy measures, can only be quantified with great difficulty. Another important source of uncertainty is revisions of databases for past periods, concerning in particular those most important indicators of the national accounting system (GDP and its components).

Last but not least, it is necessary to point out the fact that at a time of economic turbulence and financial crises the forecasting of future economic development is considerably more difficult than in a period of stable economic growth.

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Identifying the impacts of those factors emanating externally and which are completely beyond the control of the forecasting team is, however, difficult (if not impossible) and therefore in accordance with literature I have abstracted away from these facts.

1 DATA

The estimates of the future development of main economic indicators are published in the macroeconomic forecasts of the Ministry of Finance, which has been released quarterly since November 1995. This survey analyses the forecast accuracy for several macroeconomic indicators (real GDP growth, nominal GDP growth, GDP deflator growth, real private consumption growth, average inflation rate, average unemployment rate and current account balance to GDP Ratio).

I have divided the period 1995–2012 into three six-year periods of identical length (1995–2000, 2001–2006 and 2007–2012)[2] in order to be able to evaluate the success rate of forecasts over time. It is necessary to point out that during the evaluated period some major changes have occurred in the Czech economy, which was gradually changing from a volatile transition economy to a more or less stabilized market economy in the EU. Since 2008, the Czech economy has been affected by the global recession and the consequences of the subsequent debt crisis in the euro zone, which have manifested themselves in a repeated increase in volatility of macroeconomic indicators.

Last but not least, all statistics and tests were calculated against the first estimates published by the Czech Statistical Office or Czech National Bank, since it is not possible to estimate the extent of changes in past development through subsequent revisions of time series which cannot usually be divided into components of factual specification of the given ratio and methodological change.

2 FORECAST ERROR MEASUREMENT STATISTICS

The success rate of macroeconomic forecasts is usually evaluated by means of several basic statistics – the average forecasting error, the mean absolute error and Theil's inequality coefficient.[3]

Forecast error (e) or deviation is generally defined as:

$$e_t = F_t - A_t, \tag{1}$$

where F_t is the forecast for the period t and A_t is the real value over time t.

Average forecasting error (AFE) can be regarded as a measure of bias, as it indicates the deviations of forecasts. Positive AFE values indicate systematic or overwhelming overvaluation of forecasts, whereas negative AFE values indicate systematic or overwhelming undervaluation of forecasts. AFE is defined as the average of the forecast errors:

$$AFE = \frac{1}{T}\sum_{t=1}^{T} e_t, \tag{2}$$

with T representing the number of observations.

Mean absolute error (MAE) expresses the average absolute error of the forecast compared to reality. MAE is defined as:

$$MAE = \frac{1}{T}\sum_{t=1}^{T} |e_t|. \tag{3}$$

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[2] Some analysed indicators have not been included in the Macroeconomic Forecast since the start of publication.

[3] Sometimes also the mean percentage error (MPE) and the mean absolute percentage error (MAPE) are used. MPE is defined as an average of the percentage errors and MAPE is defined as an average of the percentage errors. Both statistics ignore the scale of the numbers, however, they can be very unstable and skewed by small values.

Theil's inequality coefficient (TIE) is used for evaluating the success rate of forecasts. The coefficient is defined as the proportion of the mean square variations of analysed forecasts and naïve forecasts, which is used as alternative model (a random walk model):

$$TIE = \frac{\sum_{t=1}^{T} (e_t)^2}{\sum_{t=1}^{T} (A_{t-1} - A_t)^2}. \quad (4)$$

If Theil's coefficient equals 0, the forecast is identical to reality. Value of the coefficient higher than 1 shows that the result of forecasting activities is worse than a naïve forecast. When interpreting the results, it is necessary to take into account the fact that this indicator greatly "penalizes" an isolated considerably worse result compared to the naïve forecast, and conversely, it awards a considerable "bonus" in the event of well-estimated sudden reversals in the development of forecast quantities.

The naïve forecast is a mechanically drawn up forecast where the value of the given indicator for the year of $t + 1$ equals a measured, estimated or forecasted value of this indicator for the year t.

The forecast horizon is understood as the time from publishing the forecast until the end of the forecast period. For any horizons above 15 and up to 24 months, it concerns evaluating an outlook (created by means of extrapolation techniques) whose forecasting information is very limited for understandable reasons.

3 TEST FOR FORECAST ACCURACY

In addition to the basic statistics mentioned above, a statistical test proposed by Diebold and Mariano (1995) for assessing forecast accuracy is used. Diebold-Mariano test compares the forecast accuracy of two forecast methods and it is applicable to non-quadratic loss functions, multi-period forecasts, and forecasts errors that are potentially non-Gaussian, non-zero-mean, serially correlated and contemporaneously correlated.

The asymptotic test introduced by Diebold and Mariano tests the null hypothesis of no difference in the accuracy of two competing forecasts. Suppose two different forecasts y_{1t}, y_{2t}, where t = (1,...n) and let e_{1t}, e_{2t} be the forecast errors of these forecasts. Then the economic loss functions $g(e_{1t})$ and $g(e_{2t})$ are arbitrary functions of the realization and prediction.[4] When denoting a loss differential as $d_t = g(e_{1t}) - g(e_{2t})$, the null hypothesis can be expressed as $H_0 : E(d_t) = 0$. If the expected value of the loss differential is zero, there is no statistical difference between the two forecasts. If the null hypothesis is rejected, the forecast with smaller loss will be chosen.

The Diebold-Mariano test statistic is defined as:

$$DM = \frac{\bar{d}}{\sqrt{\hat{V}(\bar{d})}}, \quad (5)$$

where $\bar{d} = \frac{\sum_{t=1}^{n} d_t}{n}$ is the sample mean loss differential.

An optimal h-step forecast error will follow a moving average process of order $(h - 1)$:

$$e_t = \theta_0 \varepsilon_t + \theta_1 \varepsilon_{t-1} + ... + \theta_{h-1} \varepsilon_{t-h+1}, \quad (6)$$

[4] Some popular economic loss functions are squared error loss $g(e_{it}) = (e_{it})^2$ or absolute error loss $g(e_{it}) = |e_{it}|$, where $i = 1, 2$.

with zero autocovariances for all lags greater than $h-1$. Therefore, the consistent estimate of the asymptotic variance of $\bar{d}$ can be written as:

$$\hat{V}(\bar{d}) = \frac{\left[\hat{\gamma}_0 + 2\sum_{k=1}^{n-1}\hat{\gamma}_k\right]}{n}, \tag{7}$$

where γ_k is an estimate of the k th autocovariance of d_t that can be computed as:

$$\hat{\gamma}_k = \frac{\sum_{t=k+1}^{n}(d_t - \bar{d})(d_{t-k} - \bar{d})}{n} = \frac{\mathrm{cov}(d_t, d_{t-k})}{n}. \tag{8}$$

Under the null hypothesis, DM statistic has an asymptotic standard normal distribution. However, the major drawback of this test statistic is its small sample properties. Simulations showed that DM test statistic is seriously oversized, especially in small samples, so the null hypothesis is being rejected too often. Therefore Harvey, Leybourne and Newbold (1997) proposed modification, which reduces this oversizing:

$$mDM = \sqrt{\frac{n+1-2h+h(h-1)/n}{n}} * DM. \tag{9}$$

The modified DM statistic has a Student's t distribution with $n-1$ degrees of freedom.

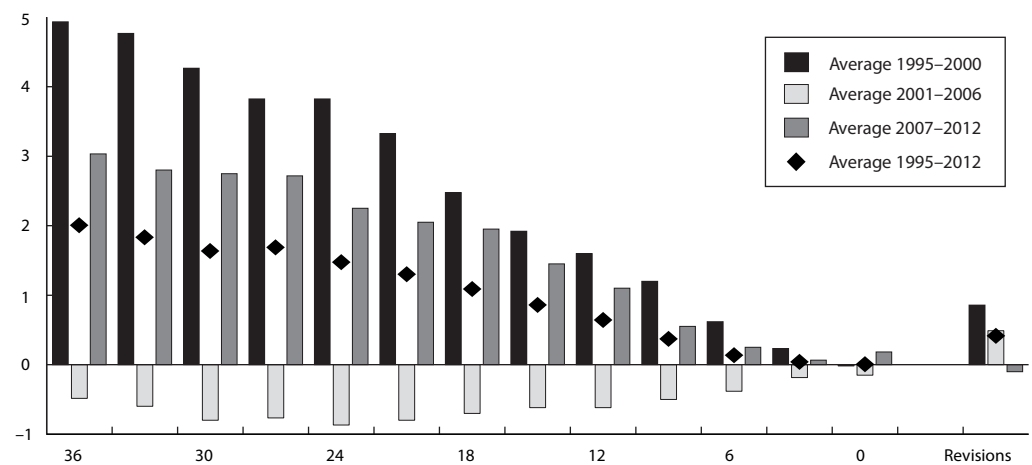
In this analysis, the macroeconomic forecasts are compared with the naïve forecast. Further, commonly used mean squared error loss function is applied and variance is estimated as the long-run variance using a Newey-West method.

4 EVALUATION OF THE MINISTRY OF FINANCE FORECASTS

4.1 Real GDP Growth

In 1995–2000 and 2007–2012 the Ministry of Finance's forecasts overvalued real GDP growth, with forecasts widest of the mark in 1998, 2009 and 2012, when the Czech Republic was in recession. Conversely, in 2001–2006 when the Czech Republic was going through a period of relatively strong and stable economic growth, GDP growth was slightly undervalued, although this undervaluation did not exceed –0.9 p.p.

Figure 1 Average Forecasting Error (in p.p.)



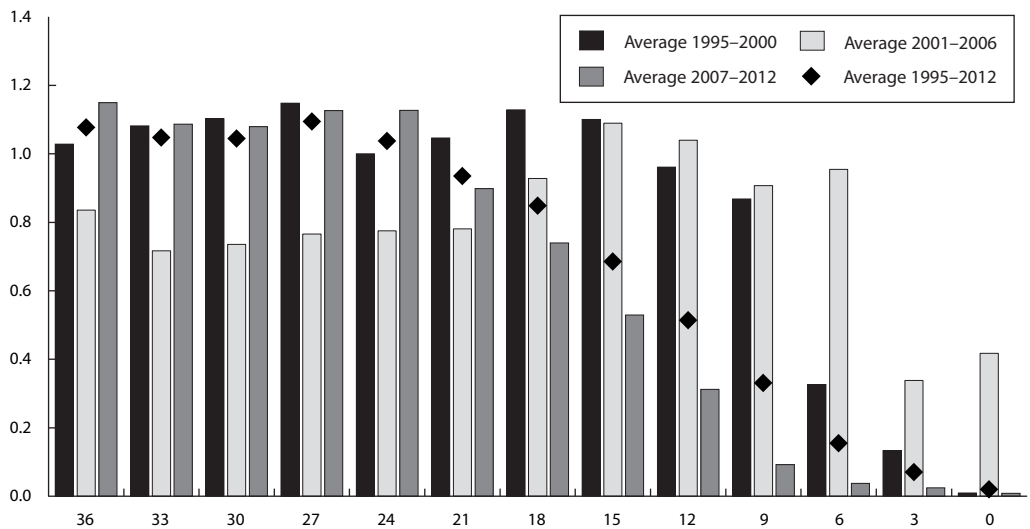
Source: Czech Statistical Office, own calculation

In accordance with results published in the literature and based on the experience of forecasters, it has been proved very difficult, even impossible, to identify the onset of recession in time. In the first and third monitored periods, the mean absolute error exceeded in the horizon over 18 months the limit of 3 p.p., which was caused in particular by the failure to identify recessions in 1998, 2009 and 2012. In the successful period of 2001–2006, the mean absolute error fluctuated below 1.7 p.p. throughout the horizon.

In connection with the so-called great recession at the turn of 2008 and 2009, it is necessary to emphasize, however, that the decline in the domestic economy was caused exclusively by unfavourable development in the external environment. Comparison with the forecasts of other institutions at that time confirms how difficult it was to predict future development.

Theil's coefficient in the forecast horizon beyond 24 months exceeds 1 on average. However, this gradually decreases with a shortening horizon. The analysis proves that the recognisability of future development in an 18-month horizon exceeds only slightly the possibilities of the naïve forecast. It is in this very horizon that the macroeconomic framework of the draft state budget is usually drawn up. This knowledge can also be related to many of the following indicators.

Figure 2 Theil's Coefficient



Source: Czech Statistical Office, own calculation

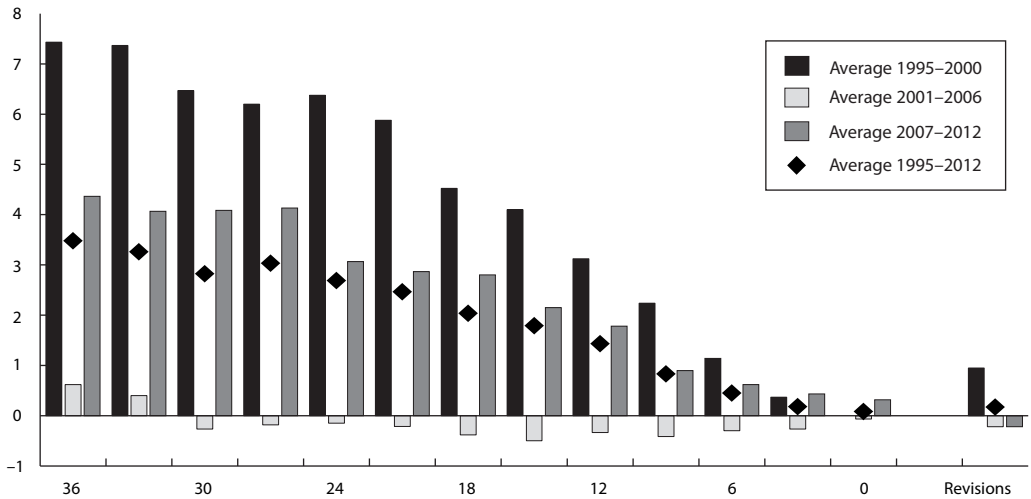
Modified Diebold-Mariano test is even stricter than Theil's coefficient. As can be seen in the Table 8, Modified Diebold-Mariano test showed that there are no the differences between forecast and naïve forecast for 15-month and longer time horizon at 5% level of significance.

4.2 Nominal GDP Growth

From the perspective of the budget process, the most important macroeconomic indicator is nominal GDP. It is used as the denominator of important ratios (e.g. the government sector's balance or debt as a ratio to GDP) and budget revenue forecasts are derived from the size of its components.

As in the case of real GDP growth, nominal GDP growth was overvalued by forecasts in the first and third periods, although the overvaluation in 2007–2012 was likewise considerably lower. Undervaluation of nominal GDP growth in 2001–2006 was only minimal.

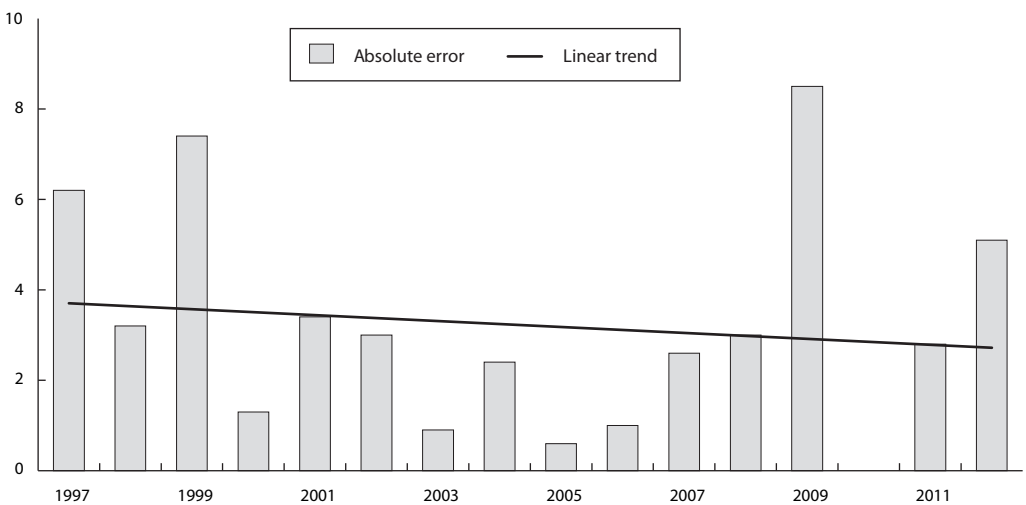
Figure 3 Average Forecasting Error (in p.p.)



Source: Czech Statistical Office, own calculation

In the 18-month horizon representing the starting point for drafting the state budget, the mean absolute error for the whole period reached approximately 3 p.p., although it shows a decreasing tendency during the whole period. Its high values in 1997, 2009 and 2012 were recorded for periods of economic recession, the year 1999 relates to a period of disinflation. The average value of Theil's coefficient in the forecast horizon up to 27 months is lower than 1, while it reaches its lowest values in 2001–2006.

Figure 4 Mean Absolute Error in the 18-Month Horizon (in p.p.)



Source: Czech Statistical Office, own calculation

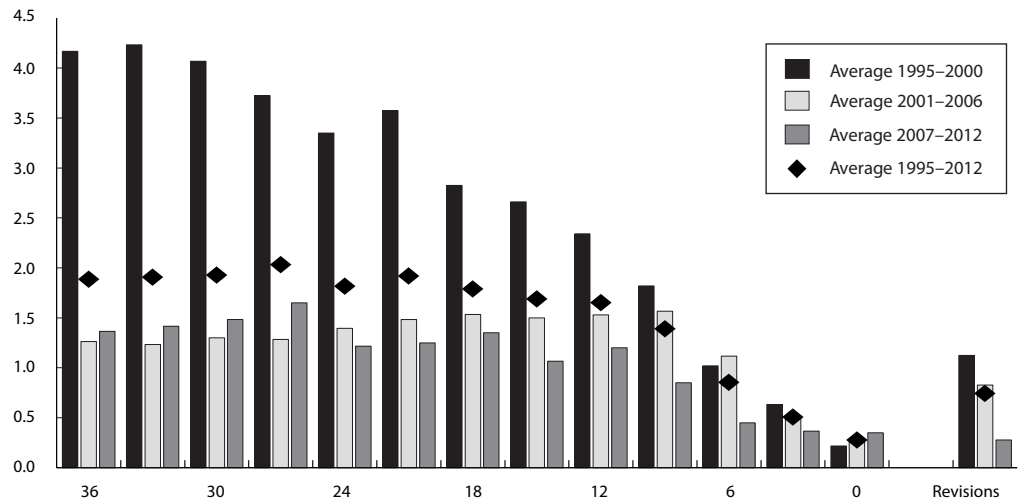
According to the modified Diebold-Mariano test, there are no the differences between forecast and naïve forecast for 15-month and longer time horizon at 5% level of significance.

4.3 GDP Deflator Growth

GDP deflator growth was overvalued in every single monitored period; nevertheless, the average mean error against the actual facts did not exceed 1.4 p.p. throughout the horizon.

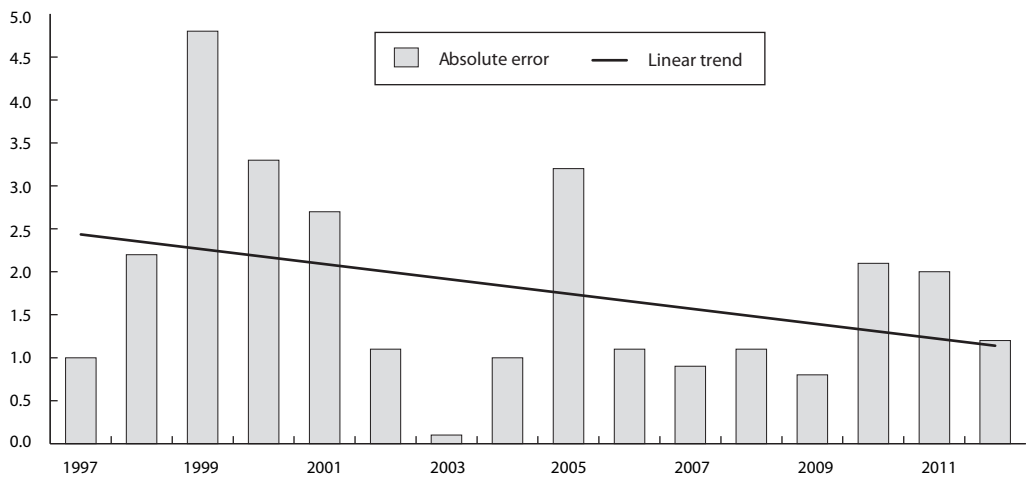
The average mean absolute error did not exceed 2 p.p., and reached its highest values in 1995–2000. The decreasing trend is also confirmed by the graph showing absolute error in the 18-month horizon. The error for 1999 relates to the period of disinflation, when GDP deflator growth decreased from 10.7% in 1998 to 2.4% in 1999. Although a decrease was expected and identified correctly in time, its extent exceeded all expectations.

Figure 5 Mean Absolute Error (in p.p.)



Source: Czech Statistical Office, own calculation

Figure 6 Mean Absolute Error in the 18-Month Horizon (in p.p.)



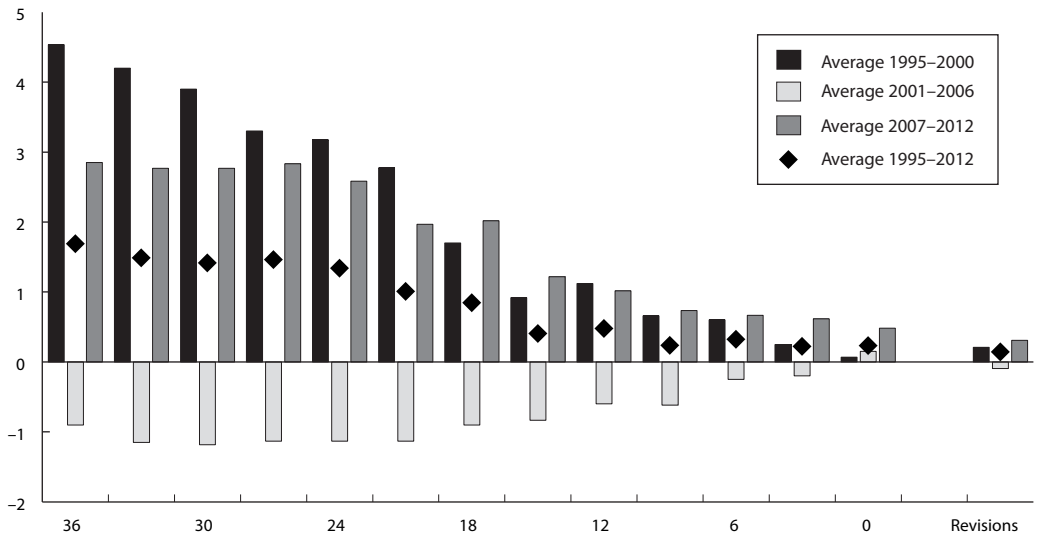
Source: Czech Statistical Office, own calculation

The average Theil's coefficient did not exceed the value of 1.0 throughout the horizon. In the horizon up to 21 months its values decreased gradually in individual periods, thereby highlighting the improvement of forecasts. On the other hand, modified Diebold-Mariano test showed that there are no the differences between forecast and naïve forecast for 18-month and longer time horizon at 5% level of significance, as shown in Table 10.

4.4 Real Private Consumption Growth

While in the first and third monitored periods the growth in household consumption was overvalued, in the second period forecasts were slightly tilted to the downside.

Figure 7 Average Forecasting Error (in p.p.)



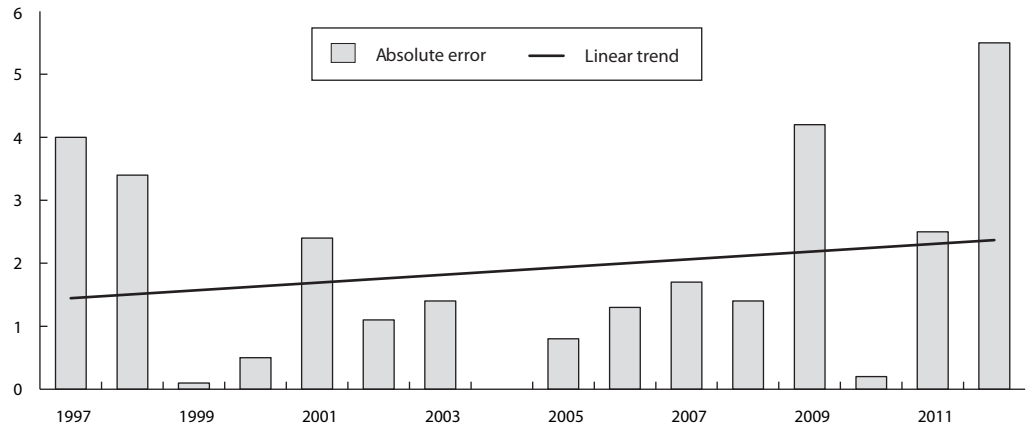
Source: Czech Statistical Office, own calculation

The mean absolute error in individual periods reaches approximately the same values as in case of forecasts of real GDP growth. In the horizon of 2–3 years, it is approximately 3 p.p. on average, whereupon it gradually decreases and drops below 1.5 p.p. within a short period of up to one year.

The absolute error in the 18-month horizon shows an increasing tendency. However, this result is strongly influenced by the imprecise estimate of household consumption in 2012. The extremely low level of consumer confidence in future economic development, together with the implementation of the government's austerity measures, led to cautious behaviour on the part of consumers and to an increase in the rate of savings as a precaution against any further worsening of the economic situation. Thus the decrease in household consumption by 2.1% in 2012 exceeded all expectations. After all, in 2009 during the recession household consumption had even increased by 0.2%!

The average value of Theil's coefficient fluctuated below 1.0 in the horizon up to 18 months. However, in 2007–2012 the coefficient reached considerably higher values than in the other two periods, which was caused in particular by imprecise estimates in 2009 and 2012. According to modified Diebold-Mariano test, there are no the differences between forecast and naïve forecast for 15-month and longer time horizon at 5% level of significance.

Figure 8 Mean Absolute Error in the 18-Month Horizon (in p.p.)



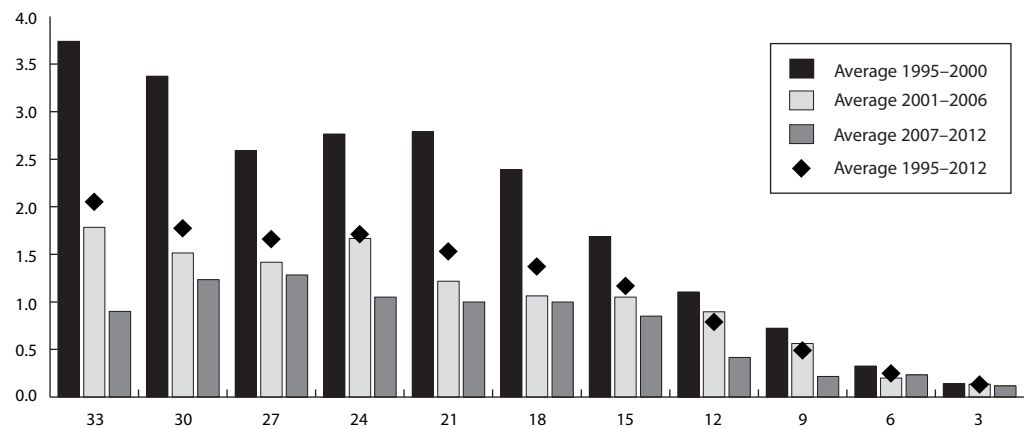
Source: Czech Statistical Office, own calculation

4.5 Average Inflation Rate

Forecasts of inflation in the Macroeconomic Forecast were precise in most cases, since in the horizon up to 30 months the average forecasting error did not exceed 1 p.p. for the whole monitored period. In 1995–2000 and 2001–2006, forecasts slightly overvalued the average inflation rate, while in the second period the overvaluation was higher. Conversely, in 2007–2012 the average mean error achieved negative values, although it did not fall below –0.5 p.p. in any of the horizons.

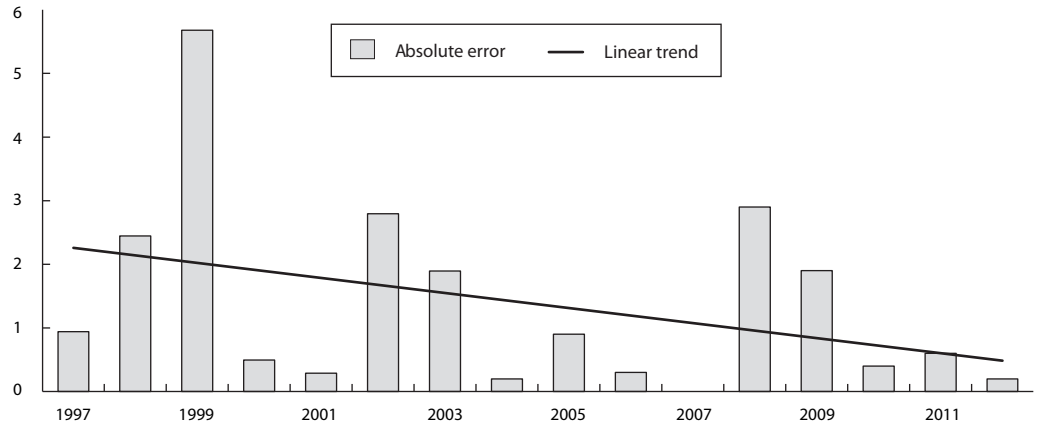
In the horizon up to 30 months, the mean absolute error did not exceed 2 p.p. In the budget horizon of 18 months the mean absolute error has a decreasing tendency. The error for 1999 relates to a period of severe disinflation, when the average inflation rate fell from 10.7% in 1998 to 2.1% in 1999. Although this tendency was identified correctly, its extent exceeded all expectations. The fact that in the budget horizon of 18 months the absolute error did not exceed 1.0 p.p. in 10 out of the 16 monitored years is testimony to the precision of inflation forecasting.

Figure 9 Mean Absolute Error (in p.p.)



Source: Czech Statistical Office, own calculation

Figure 10 Mean Absolute Error in the 18-Month Horizon (in p.p.)



Source: Czech Statistical Office, own calculation

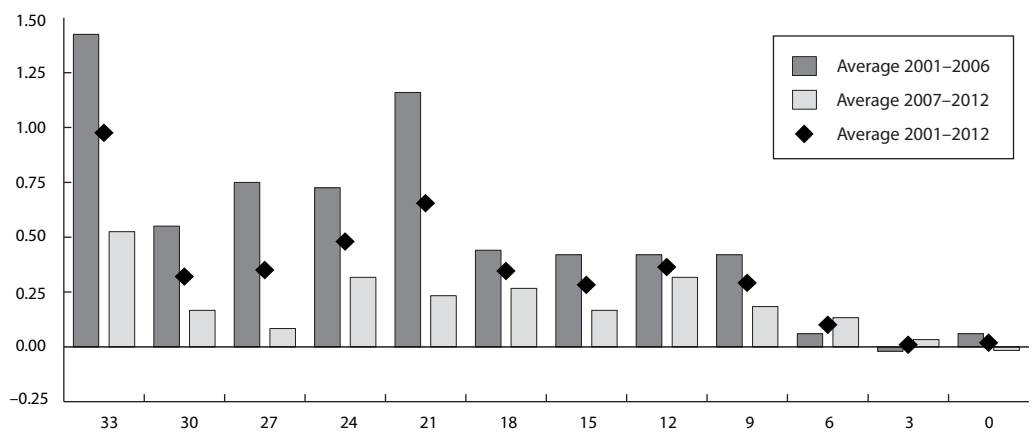
Theil's inequality coefficient for all monitored periods did not exceed 0.85 in the whole time horizon and was 0.15 in the short 1-year period. As can be seen in the Table 12, also modified Diebold-Mariano test showed that there are no the differences between forecast and naïve forecast for 24-month and longer time horizon on 1% level of significance.

4.6 Average Unemployment Rate (LFS)

The unemployment rate according to LFS has only been forecast since 2000, so any comparison of the quality of forecasts over time was possible only for the periods of 2001–2006 and 2007–2012.

The forecasts systematically overvalued the unemployment rate, still the average mean error did not exceed 1.0 p.p. in any time horizon. In 2007–2012, the overvaluation compared to the previous period was considerably lower: the average mean forecasting error did not exceed 0.55 p.p. in any horizon.

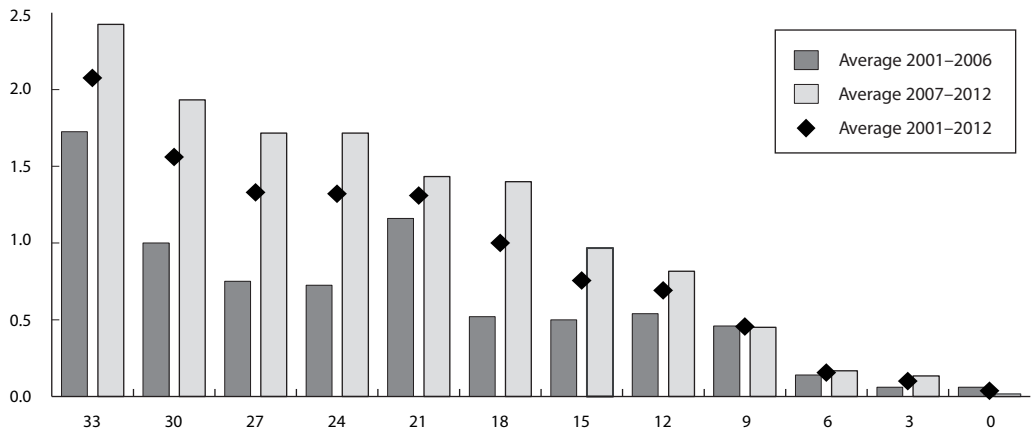
Figure 11 Average Forecasting Error (in p.p.)



Source: Czech Statistical Office, own calculation

The average mean absolute error showed a gradually decreasing tendency. Nonetheless, in 2007–2012 it reached higher values due to the difficultly in forecasting at a time of economic instability compared to the previous period. In the 18-month budget horizon, the mean absolute error has an increasing tendency with respect to imprecise estimates in 2009 and 2007. In 2009, the unemployment rate was undervalued when as a result of the economic recession it increased by 2.3 p.p. compared to the previous year. On the other hand, in 2007 the unemployment rate was overvalued, since strong economic growth resulted in its decrease down to 4.4%. Data for 2004 are missing due to a change in methodology.

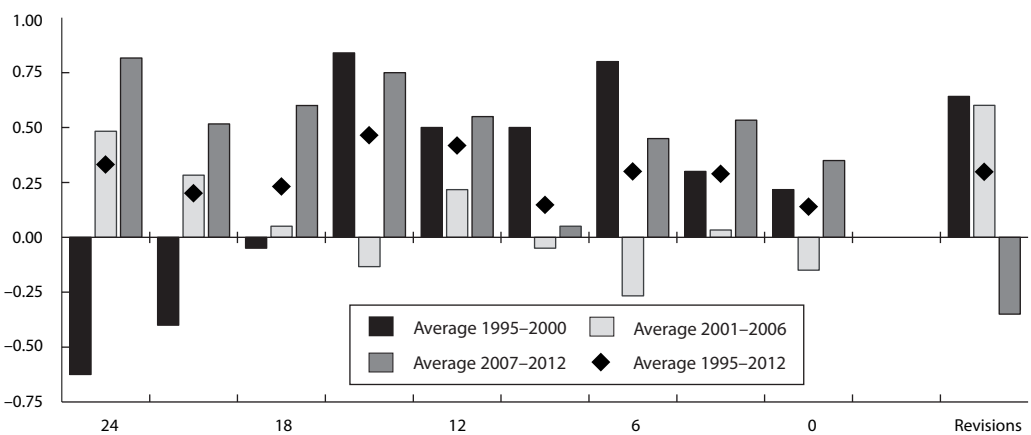
Figure 12 Mean Absolute Error (in p.p.)



Source: Czech Statistical Office, own calculation

These imprecise estimates are also reflected in the higher average value of Theil's coefficient, which exceeds the value of 1.0 in the horizon of 33, 21 and 18 months. Modified Diebold-Mariano test showed that there are no the differences between forecast and naïve forecast for 12-month and longer time horizon at 5% level of significance.

Figure 13 Average Forecasting Error (in p.p.)

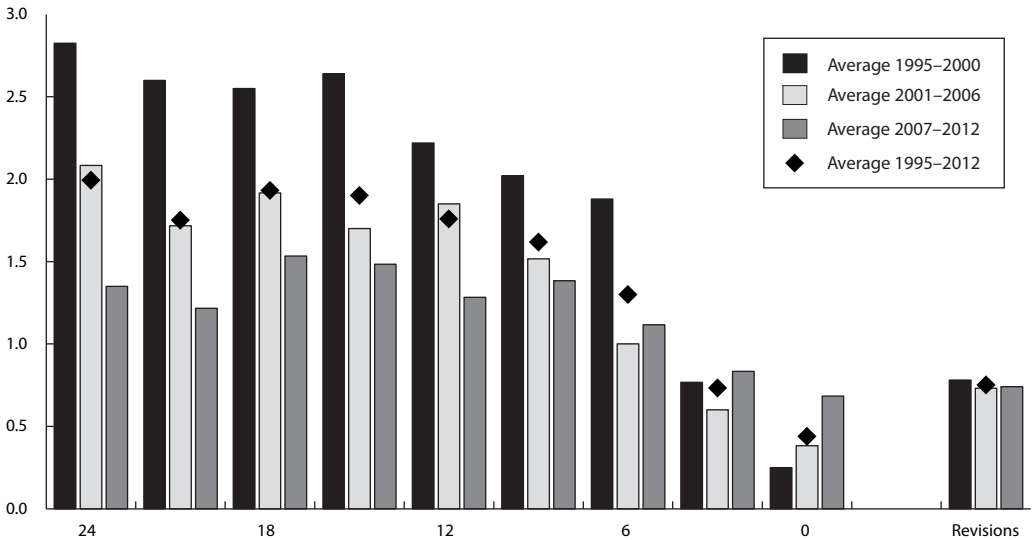


Source: Czech Statistical Office, own calculation

4.7 Current Account Balance to GDP Ratio

During the monitored period, the forecasts overvalued the ratio of the current account balance to GDP. However, the average forecasting error did not exceed 0.5 p.p. on average. The average mean absolute error was between 1 and 2 p.p. in the horizon of 6–24 months, while it was usually the lowest in the third monitored period. Absolute error in the 18-month horizon has a decreasing character.

Figure 14 Mean Absolute Error (in p.p.)



Source: Czech Statistical Office, own calculation

Except for the horizon of 15 months, the average Theil's coefficient was lower than 1. However, it reached its lowest values in the first period, while in 2007–2012 it was even higher than 1 in the horizon of 6–18 months. This phenomenon can largely be attributed to a change in the system of revisions. While revisions were previously on-going, now they occur only once a year. Consequently, the period in which the forecast is based on subsequently revised data is extended.

Modified Diebold-Mariano test showed that there are no the differences between forecast and naïve forecast for 12-month and longer time horizon at 5% level of significance, as is evident from the Table 14.

5 COMPARISON OF RESULTS OF MINISTRY OF FINANCE'S FORECASTS WITH FORECASTS OF INTERNATIONAL INSTITUTIONS

The Ministry of Finance's forecasts were compared with macroeconomic forecasts of the OECD, the European Commission and the International Monetary Fund for 2001–2012 in the horizons corresponding to their mainly half-yearly publishing cycle. The results indicate that the forecast success rate of all institutions does not differ much in essence. The best results are mostly achieved by forecasts from the Ministry of Finance and OECD. The Ministry of Finance's forecasts are the most precise, especially in terms of nominal GDP growth, GDP deflator growth and average inflation rate. On the other hand, the Ministry of Finance's forecasts were the least accurate in the case of unemployment rate.

Table 1 Forecasts of Real GDP Growth (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error				Mean Absolute Error				Theil's Inequality Coefficient			
	MoF	EC	OECD	IMF	MoF	EC	OECD	IMF	MoF	EC	OECD	IMF
27 months	**0.98**	1.13	1.18	-	**2.49**	2.57	2.62	-	1.06	**0.99**	1.11	-
21 months	**0.63**	0.95	1.05	0.69	**2.34**	2.47	2.44	2.45	0.88	0.93	**0.83**	0.89
15 months	**0.42**	0.55	0.61	0.53	2.00	2.05	**1.79**	2.16	0.57	0.56	**0.45**	0.62
9 months	**0.03**	–0.03	–0.10	–0.26	1.09	1.03	**0.75**	0.99	0.15	0.14	**0.08**	0.12
3 months	–0.06	–0.17	**–0.02**	–0.28	0.51	**0.43**	0.47	0.63	0.04	0.04	**0.04**	0.07

Note: The best estimate is marked in bold.
Source: Czech Statistical Office, European Commission, OECD, IMF, own calculation

Table 2 Forecasts of Nominal GDP Growth (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error			Mean Absolute Error			Theil's Inequality Coefficient		
	MoF	EC	OECD	MoF	EC	OECD	MoF	EC	OECD
27 months	**1.98**	2.49	2.09	3.36	3.64	**3.17**	1.18	1.08	**0.99**
21 months	**1.33**	2.05	2.20	**2.76**	2.94	2.82	0.85	1.03	**0.67**
15 months	**0.83**	1.36	1.58	**2.53**	2.67	2.53	**0.60**	0.63	0.71
9 months	**0.24**	0.36	0.91	1.78	**1.77**	1.96	**0.32**	0.41	0.51
3 months	**0.08**	0.14	0.11	**0.67**	1.39	0.78	**0.06**	0.29	0.08

Note: The best estimate is marked in bold.
Source: Czech Statistical Office, European Commission, OECD, own calculation

Table 3 Forecasts of GDP Deflator Growth (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error			Mean Absolute Error			Theil's Inequality Coefficient		
	MoF	EC	OECD	MoF	EC	OECD	MoF	EC	OECD
27 months	0.93	1.13	**0.82**	1.47	1.45	**1.02**	1.56	0.97	**0.84**
21 months	**0.67**	1.03	1.09	1.37	1.43	**1.15**	0.56	0.78	**0.33**
15 months	**0.35**	0.86	0.90	**1.28**	1.39	1.32	**0.40**	0.65	0.55
9 months	**0.21**	0.50	0.98	**1.21**	1.32	1.53	**0.33**	0.63	0.66
3 months	0.11	0.32	**0.11**	**0.44**	1.14	0.51	**0.05**	0.44	0.06

Note: The best estimate is marked in bold.
Source: Czech Statistical Office, European Commission, OECD, own calculation

Table 4 Forecasts of Private Consumption Growth (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error			Mean Absolute Error			Theil's Inequality Coefficient		
	MoF	EC	OECD	MoF	EC	OECD	MoF	EC	OECD
27 months	**0.85**	2.19	1.51	2.52	2.81	**2.37**	1.32	1.37	**1.27**
21 months	**0.42**	1.45	0.93	**2.05**	2.33	2.05	**1.28**	1.45	1.50
15 months	**0.19**	1.11	0.50	1.76	1.93	**1.75**	0.81	0.91	**0.73**
9 months	**0.06**	0.39	–0.13	1.19	1.21	**0.94**	0.50	0.48	**0.29**
3 months	**0.21**	0.32	0.30	**0.61**	0.62	0.75	0.11	**0.11**	0.13

Note: The best estimate is marked in bold.
Source: Czech Statistical Office, European Commission, OECD, own calculation

Table 5 Forecasts of Average Inflation Rate (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error			Mean Absolute Error			Theil's Inequality Coefficient		
	MoF	OECD	IMF	MoF	OECD	IMF	MoF	OECD	IMF
27 months	0.52	**0.38**	-	1.35	**1.35**	-	0.78	**0.78**	-
21 months	**0.41**	0.51	0.53	**1.11**	1.30	1.38	**0.48**	0.51	0.62
15 months	**0.47**	0.53	0.54	0.95	**0.94**	1.20	0.33	**0.29**	0.40
9 months	**0.07**	0.45	0.37	**0.39**	0.59	0.51	**0.06**	0.11	0.11
3 months	**0.02**	0.12	0.17	**0.13**	0.19	0.33	**0.01**	0.01	0.03

Note: The best estimate is marked in bold.
Source: Czech Statistical Office, OECD, IMF, own calculation

Table 6 Forecasts of Average Unemployment Rate LFS (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error			Mean Absolute Error			Theil's Inequality Coefficient		
	MoF	EC	OECD	MoF	EC	OECD	MoF	EC	OECD
27 months	0.35	0.28	**0.23**	1.33	1.30	**1.26**	0.90	0.89	**0.81**
21 months	0.65	**0.49**	0.67	1.31	**1.21**	1.27	1.21	**0.83**	1.04
15 months	0.28	**0.28**	0.28	0.75	**0.70**	0.80	0.76	0.71	**0.62**
9 months	**0.29**	0.31	0.42	0.45	0.47	**0.44**	0.31	**0.31**	0.35
3 months	**0.01**	0.18	0.07	**0.10**	0.18	0.15	**0.02**	0.08	0.03

Note: The best estimate is marked in bold.
Source: Czech Statistical Office, European Commission, OECD, own calculation

Table 7 Forecasts of Current Account Balance to GDP Ratio (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error			Mean Absolute Error			Theil's Inequality Coefficient		
	MoF	OECD	IMF	MoF	OECD	IMF	MoF	OECD	IMF
27 months	3.70	**0.25**	-	3.70	**1.63**	-	2.75	**0.91**	-
21 months	0.40	0.55	**–0.06**	1.47	1.65	**1.01**	0.86	1.41	**0.76**
15 months	0.31	0.36	**0.23**	1.59	1.89	**1.26**	1.32	1.48	**1.09**
9 months	**0.00**	0.48	0.04	1.45	1.33	**1.08**	1.18	1.09	**0.67**
3 months	0.28	0.22	**0.19**	**0.72**	1.02	0.93	**0.35**	0.62	0.59

Note: The best estimate is marked in bold.
Source: Czech Statistical Office, OECD, IMF, own calculation

As far as consumer prices are concerned, the EC forecasts HICP, which cannot be compared with the national CPI. In the forecasts of the EC, current account balance to GDP ratio is defined in national accounts terms. The IMF forecasts include only the forecasts for real GDP growth, inflation rate and the current account balance to GDP ratio.

CONCLUSION

Based on the forecast error measurement statistics, it is possible to say that for most macroeconomic indicators forecasts contain valid data in a horizon of approximately up to 18 months (it is important to note that the macroeconomic framework of the draft state budget is usually drawn up in this horizon). In longer horizons, however, the objective is geared more towards determining the expected trends of economic development. The results of the modified Diebold-Mariano test are even stricter. According

to the results, the most macroeconomic indicators forecasts contain valid data only in a horizon of approximately up to 12 months at 5% level of significance. In this case, it can be generalized that modified Diebold-Mariano test confirms null hypothesis of no difference in the accuracy of Ministry of Finance's Macroeconomic Forecasts and naïve forecast at 5% level of significance for most macroeconomic indicators at 0.6 to 0.8 value of Theil's coefficient.

As far as the development of forecast precision over time is concerned, it is apparent that forecast precision increased in the second and third monitored periods (2001–2006, 2007–2012) compared to the first period (1995–2000). In this context, however, it must be pointed out that forecasting future economic development is considerably more difficult at a time of economic crisis and recession than in a period of stable economic growth. This fact was the main reason for several imprecise forecasts in 2007–2012.

Assessment of the history of the Ministry of Finance's Macroeconomic Forecasts also has showed that they are fully comparable to the forecasts of renowned international institutions, and in a number of cases even surpass them. The Ministry of Finance usually publishes its forecasts earlier than the other institutions included in this comparison.

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ANNEX

Table 8 Forecasts of Real GDP Growth (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error				Mean Absolute Error				TIE	DM test
	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2012
36 months	2.01	4.93	–0.48	3.03	2.98	4.93	1.15	3.83	1.08	0.12
33 months	1.83	4.77	–0.60	2.80	2.87	4.77	1.23	3.57	1.05	0.10
30 months	1.63	4.27	–0.80	2.75	2.90	4.27	1.53	3.58	1.04	0.12
27 months	1.69	3.83	–0.77	2.72	2.88	4.03	1.50	3.48	1.09	0.33
24 months	1.48	3.83	–0.87	2.25	2.70	3.98	1.47	3.08	1.04	0.15
21 months	1.30	3.33	–0.80	2.05	2.75	3.98	1.63	3.05	0.93	–0.30
18 months	1.09	2.48	–0.70	1.95	2.63	3.53	1.53	3.12	0.85	–0.77
15 months	0.86	1.92	–0.62	1.45	2.18	2.60	1.35	2.65	0.69	–1.70
12 months	0.64	1.60	–0.62	1.10	1.77	2.24	1.22	1.93	0.51	–2.55**
9 months	0.37	1.20	–0.50	0.55	1.38	2.08	0.97	1.22	0.33	–3.54***
6 months	0.14	0.62	–0.38	0.25	0.90	1.26	0.75	0.75	0.15	–4.58***
3 months	0.04	0.23	–0.18	0.07	0.59	0.77	0.45	0.57	0.07	–5.31***
0 month	0.01	–0.02	–0.15	0.18	0.33	0.28	0.38	0.32	0.02	–5.89***
Revisions	0.40	0.86	0.49	–0.14	0.79	1.47	0.66	0.25	x	x

Note: Stars indicate if the null hypothesis of the same forecast accuracy of the compared forecasts can be rejected at these level of significance: *** 1%, ** 5%, * 10%.
Source: Czech Statistical Office, own calculation

Table 9 Forecasts of Nominal GDP Growth (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error				Mean Absolute Error				TIE	DM test
	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2012
36 months	3.48	7.43	0.62	4.37	4.03	7.43	1.02	5.33	1.04	0.09
33 months	3.26	7.37	0.40	4.07	3.97	7.37	1.20	5.03	1.06	0.16
30 months	2.82	6.47	–0.27	4.08	3.94	6.47	1.50	5.12	1.04	0.13
27 months	3.03	6.20	–0.18	4.13	4.07	6.20	1.55	5.17	0.96	–0.21
24 months	2.69	6.38	–0.15	3.07	3.71	6.38	1.58	4.07	0.97	–0.14
21 months	2.46	5.88	–0.22	2.87	3.54	5.88	1.78	3.73	0.91	–0.46
18 months	2.04	4.53	–0.38	2.80	3.21	4.53	1.88	3.67	0.86	–0.75
15 months	1.79	4.10	–0.50	2.15	2.99	4.10	1.87	3.18	0.75	–1.47
12 months	1.43	3.12	–0.33	1.78	2.49	3.12	1.83	2.62	0.59	–2.17**
9 months	0.83	2.24	–0.42	0.90	1.94	2.32	1.98	1.57	0.36	–3.45***
6 months	0.45	1.14	–0.30	0.62	1.13	1.22	1.27	0.92	0.15	–4.76***
3 months	0.18	0.37	–0.27	0.43	0.83	1.17	0.50	0.83	0.07	–5.96***
0 month	0.08	0.00	–0.07	0.32	0.36	0.33	0.30	0.45	0.01	–6.66***
Revisions	0.15	0.95	–0.22	–0.29	0.87	1.45	0.82	0.34	x	x

Note: Stars indicate if the null hypothesis of the same forecast accuracy of the compared forecasts can be rejected at these level of significance: *** 1%, ** 5%, * 10%.
Source: Czech Statistical Office, own calculation

Table 10 Forecasts of GDP Deflator Growth (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error				Mean Absolute Error				TIE	DM test
	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2012
36 months	1.32	2.03	1.05	1.22	1.88	4.17	1.26	1.37	0.85	–0.13
33 months	1.25	2.10	0.93	1.15	1.91	4.23	1.23	1.42	0.92	–0.09
30 months	1.06	1.80	0.53	1.22	1.93	4.07	1.30	1.48	0.83	–0.26
27 months	1.19	1.98	0.55	1.32	2.03	3.73	1.28	1.65	0.81	–0.44
24 months	1.14	2.15	0.73	0.88	1.82	3.35	1.40	1.22	0.77	–0.53
21 months	1.04	2.18	0.58	0.75	1.92	3.58	1.48	1.25	0.71	–0.91
18 months	0.84	1.73	0.30	0.78	1.79	2.83	1.53	1.35	0.57	–1.47
15 months	0.81	1.90	0.10	0.60	1.69	2.66	1.50	1.07	0.45	–2.59**
12 months	0.69	1.26	0.30	0.60	1.65	2.34	1.53	1.20	0.36	–3.71***
9 months	0.40	0.86	0.07	0.35	1.39	1.82	1.57	0.85	0.26	–4.54***
6 months	0.28	0.42	0.08	0.35	0.85	1.02	1.12	0.45	0.11	–5.72***
3 months	0.09	0.07	–0.12	0.33	0.51	0.63	0.52	0.37	0.03	–6.74***
0 month	0.05	–0.02	0.04	0.12	0.28	0.22	0.26	0.35	0.01	–7.62***
Revisions	–0.29	0.00	–0.70	–0.16	0.73	1.12	0.83	0.25	x	x

Note: Stars indicate if the null hypothesis of the same forecast accuracy of the compared forecasts can be rejected at these level of significance: *** 1%, ** 5%, * 10%.
Source: Czech Statistical Office, own calculation

Table 11 Forecasts of Private Consumption Growth (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error				Mean Absolute Error				TIE	DM test
	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2012
36 months	1.69	4.53	–0.90	2.85	2.79	4.53	1.20	3.52	1.01	0.01
33 months	1.49	4.20	–1.15	2.77	2.79	4.20	1.45	3.43	1.09	0.20
30 months	1.41	3.90	–1.18	2.77	2.81	3.90	1.65	3.43	1.11	0.3
27 months	1.46	3.30	–1.13	2.83	2.71	3.30	1.53	3.50	1.21	0.69
24 months	1.34	3.18	–1.13	2.58	2.54	3.18	1.43	3.22	1.17	0.61
21 months	1.01	2.78	–1.13	1.97	2.23	2.78	1.47	2.63	1.11	0.39
18 months	0.84	1.70	–0.90	2.02	1.91	2.00	1.17	2.58	0.88	–0.45
15 months	0.41	0.92	–0.83	1.22	1.75	1.72	1.23	2.28	0.58	–2.01*
12 months	0.48	1.12	–0.60	1.02	1.36	1.28	0.97	1.82	0.46	–2.42**
9 months	0.24	0.66	–0.62	0.73	1.15	1.06	1.05	1.33	0.35	–2.81**
6 months	0.32	0.60	–0.25	0.67	0.81	0.72	0.68	1.00	0.18	–3.18***
3 months	0.22	0.25	–0.20	0.62	0.64	0.72	0.57	0.65	0.11	–4.86***
0 month	0.23	0.07	0.15	0.48	0.42	0.40	0.38	0.48	0.05	–5.75***
Revisions	0.11	0.21	–0.09	0.23	0.72	0.96	0.51	0.69	x	x

Note: Stars indicate if the null hypothesis of the same forecast accuracy of the compared forecasts can be rejected at these level of significance: *** 1%, ** 5%, * 10%.
Source: Czech Statistical Office, own calculation

Table 12 Forecasts of Average Inflation Rate (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error				Mean Absolute Error				TIE	DM test
	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2012
33 months	1.09	1.11	1.78	–0.30	2.05	3.74	1.78	0.90	0.83	0.00
30 months	0.56	0.81	1.38	–0.40	1.77	3.37	1.51	1.23	0.68	–0.76
27 months	0.52	0.55	1.42	–0.38	1.66	2.59	1.42	1.28	0.60	–1.33
24 months	0.77	1.22	1.67	–0.42	1.71	2.77	1.67	1.05	0.64	–1.42
21 months	0.59	1.15	1.12	–0.30	1.53	2.79	1.22	1.00	0.46	–3.16***
18 months	0.44	0.70	0.80	–0.10	1.37	2.39	1.06	1.00	0.40	–3.92***
15 months	0.54	0.73	0.98	–0.05	1.17	1.68	1.05	0.85	0.37	–4.54***
12 months	0.37	0.39	0.73	–0.02	0.79	1.10	0.90	0.42	0.14	–6.16***
9 months	0.09	0.13	0.27	–0.12	0.49	0.72	0.56	0.22	0.05	–7.31***
6 months	0.03	–0.07	0.17	–0.03	0.25	0.33	0.20	0.23	0.01	–8.19***
3 months	0.04	0.06	0.13	–0.08	0.13	0.14	0.13	0.12	0.00	–8.66***

Note: Stars indicate if the null hypothesis of the same forecast accuracy of the compared forecasts can be rejected at these level of significance: *** 1%, ** 5%, * 10%.
Source: Czech Statistical Office, own calculation

Table 13 Forecasts of Average Unemployment Rate LFS (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error			Mean Absolute Error			TIE	DM test
	2001–2012	2001–2006	2007–2012	1995–2012	2001–2006	2007–2012	2001–2012	2001–2012
33 months	0.98	1.43	0.53	2.08	1.73	2.43	1.36	x
30 months	0.32	0.55	0.17	1.56	1.00	1.93	0.98	x
27 months	0.35	0.75	0.08	1.33	0.75	1.72	0.90	x
24 months	0.48	0.73	0.32	1.32	0.73	1.72	0.85	–0.24
21 months	0.65	1.16	0.23	1.31	1.16	1.43	1.21	0.61
18 months	0.35	0.44	0.27	1.00	0.52	1.40	1.06	0.15
15 months	0.28	0.42	0.17	0.75	0.50	0.97	0.76	–0.66
12 months	0.36	0.42	0.32	0.69	0.54	0.82	0.68	–0.97
9 months	0.29	0.42	0.18	0.45	0.46	0.45	0.31	–2.30**
6 months	0.10	0.06	0.13	0.15	0.14	0.17	0.05	–3.59***
3 months	0.01	–0.02	0.03	0.10	0.06	0.13	0.02	–4.04***
0 month	0.02	0.06	–0.02	0.04	0.06	0.02	0.01	–4.51***

Note: Stars indicate if the null hypothesis of the same forecast accuracy of the compared forecasts can be rejected at these level of significance: *** 1%, ** 5%, * 10%.
Source: Czech Statistical Office, own calculation

Table 14 Forecasts of Current Account Balance to GDP Ratio (average forecasting error and mean absolute error in p.p.)

	Average Forecasting Error				Mean Absolute Error				TIE	DM test
	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2000	2001–2006	2007–2012	1995–2012	1995–2012
24 months	0.33	–0.63	0.48	0.82	1.99	2.83	2.08	1.35	0.85	–0.86
21 months	0.20	–0.40	0.28	0.52	1.75	2.60	1.72	1.22	0.81	–1.03
18 months	0.23	–0.05	0.05	0.60	1.93	2.55	1.92	1.53	0.91	–0.49
15 months	0.46	0.84	–0.13	0.75	1.90	2.64	1.70	1.48	1.04	0.25
12 months	0.42	0.50	0.22	0.55	1.76	2.22	1.85	1.28	0.86	–0.95
9 months	0.15	0.50	–0.05	0.05	1.62	2.02	1.52	1.38	0.74	–1.76**
6 months	0.30	0.80	–0.27	0.45	1.30	1.88	1.00	1.12	0.55	–3.05***
3 months	0.29	0.30	0.03	0.53	0.73	0.77	0.60	0.83	0.18	–6.88***
0 month	0.14	0.22	–0.15	0.35	0.44	0.25	0.38	0.68	0.05	–9.40***
Revisions	0.30	0.64	0.60	–0.35	0.75	0.78	0.73	0.74	x	x

Note: Stars indicate if the null hypothesis of the same forecast accuracy of the compared forecasts can be rejected at these level of significance: *** 1%, ** 5%, * 10%.
Source: Czech Statistical Office, own calculation