The accuracy of alternative GDP growth forecasts: Do they represent a credible alternative to the official ones?

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Abstract: The paper deals with the accuracy of the real GDP growth forecasts produced by two Czech non-governmental institutions: the Czech-Moravian Confederation of Trade Unions (CMKOS) and the Czech Banking Association (CBA) in the years 2007-2014 and 2011-2014 respectively. Utilizing a research method composed of simple (AFE), scale-dependent (RMSE) as well as relative (MASE) error measures, we found out that (i) CMKOS predictions achieved a lower forecasting error on average, beginning with a notable overestimation in the first turnover point from growth to decline (2008-2009), yet followed by gradual improvement resulting in superior accuracy over set benchmarks (Ministry of Finance, Czech National Bank, OECD) in later years (2010-2014). The CBA predictions, on the other hand, exhibited (ii) a high level of interconnection with official bodies (MF, CNB), but with overall inferior forecasting accuracy, despite the shorter time frame (2011-2014). Overall, the study suggests that of the two surveyed non-governmental bodies, only CMKOS forecasts represent a viable alternative to the official predictions published by the Ministry of Finance or the Czech National Bank, as CBA forecasts were found to be a less accurate satellite of these bodies.

Key words: GDP forecast, Scale-dependent error measures, Relative error measures, Alternative macroeconomic forecasts, Czech-Moravian Confederation of Trade Unions, Czech Banking Association

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Introduction

Forecasts of macro-economic indicators are of vital importance for decision makers in both the public and private spheres. This is particularly true for GDP related forecasts produced by central institutions (i.e. ministry of finance, or national bank) which form the basis of a fiscal or monetary policy and also provide an important signal for business

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entities. However, the forecasting credibility of many central institutions was shattered in the recent volatile years, mainly because of their inability to foresee the economic turning point and an underestimation of the amplitude of the changes that arrived (Stekler, 2008; Frankel & Schreger, 2013; Wickens, 2014). Indeed, available empirical evidence suggests that predictions issued by some[2] central institutions are often marked by systemic bias (Daníelson, 2008; Campbell & Murphy, 2006) and display difficulties with incremental and over-time improvement (Öller & Barot, 2000; Heilemann & Stekler, 2003). It further reveals a strong mutual interconnection (correlation) between forecasts prepared by the central institutions and their supra-national patrons (Öller, 2000; Marinheiro, 2011). While such interconnection might provide a degree of stability, it naturally undermines the ability of these institutions to produce dissenting and significantly dissimilar views on the country´s future development. This rigidity gradually raises interest in the alternative (private) predictions, often aggregated into a consensus forecast, particularly when the official ones sustain large forecasting errors, as evinced by papers Ager et al. (2009) or Novotný & Raková (2010).

The so-called alternative forecasts are complementary to official GDP predictions. They are prepared outside of the central bodies with presumably a higher degree of independence, most often by financial conglomerates, academics or commercial/trade unions. According to some earlier theoretical works (e.g. Gavin and Mandal, 2000), this might result in greater flexibility and thus better performance in volatile periods with trend-turning points. However, as far the empirical performance of alternative forecasts is concerned, current literature offers mixed results. While some papers (e.g. Batchelor, 2001; Novotný & Raková, 2010) indicate that they are less biased and more accurate than their official counterparts, other studies point to no significant differences between the two (e.g. Artis, 1996; Hawkins, 2002; Juhn & Loungani, 2002; or Timmermann, 2007) or even to an inferior performance of alternative predictions (Ager et al., 2009). This naturally puts the frequent hypothesis of "greater independence means higher flexibility and accuracy in volatile times" at stake.

In the Czech context, except from central institutions (Ministry of Finance of the Czech Rep./MF and the Czech National Bank/CNB) only few bodies regularly publish independent forecasts of macro-economic aggregates. Czech-Moravian Confederation of Trade Unions (CMKOS) and the Czech Banking Association (CBA) are two of the most prominent, and they represent an interesting polarization between left wing, state-oriented trade unions and the liberal, conservative commerce association. While the forecasting performance of the official Czech predictions came under scrutiny either from the institutions themselves (MF 2013; Vacková, 2014; Arnoštová et al., 2011; Antal et al., 2008; Antoničová et al., 2009), or even external scholars (Soukup, 2012; Boček, 2012; Polák, 2011), evaluation of the performance of alternative forecasts is – apart from limited self-assessment (CMKOS, 2013) – non-existent. Considering their occasionally critical stance to official GDP forecasts, this creates an interesting research

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[2] There is abundant empirical evidence suggesting that a particularly positive forecasting bias is related to the state of a country´s public finance (Frankel, 2011) and stage of the business cycle (Jalles et al., 2011; Brück& Stephan, 2006).

opportunity, the necessity of which is amplified by increased discussion over the credibility of GDP forecasts produced by central institutions in recent years (e.g. Öller and Barot, 2000; Allan, 2013; or Keerman, 1999).

With respect to the above, this paper seeks to evaluate the accuracy of GDP forecasts produced by CMKOS and CBA in the years 2007-2013. In doing so, it follows on from the author´s previous research dealing with the accuracy of the central institutions´ GDP predictions. In the first step, the forecasts published by both surveyed institutions (CMKOS and CBA) were gathered. Then a composite set of accuracy metrics (AFE, RMSE and MASE) is utilized in order to evaluate the direction, magnitude, as well as benchmark-performance of selected alternative forecasts. Finally, the results of evaluations are discussed in comparison with official predictions (MF, CNB) and OECD representing control variable.

Data and Methods

As mentioned, this paper deals with evaluation of real GDP growth forecasts produced by two alternative (non-governmental) Czech institutions: CMKOS and CBA. The examined period is delimited by the range of forecasts historically published by the two, and generally covers predictions from the fourth quarter of 2007 to the fourth quarter of 2013. Because of the different frequency both institutions utilize in their forecasting, the resulting data matrix is defined as follows:

(i) Since 2007, CMKOS has annually published its main GDP growth forecasts for the next year in the fourth quarter (most often in October). This defines a typical evaluated forecasting horizon to 15 months. Apart from the crucial next-year forecast, CMKOS occasionally (Q4 of 2009 and 2013) also produces a prediction of current year GDP growth (forecast horizon 3 months), but these were isolated activities without regular frequency needed for thorough analysis. The data itself were obtained from a dedicated section of the CMKOS website (*Ekonomické analýzy*) and in part, for years before 2009, by investigating its bulletin (*Revue Pohledy*) in the institution´s library.

(ii) CBA, on the other hand, publishes its GDP growth forecasts for current year and next year alike, and on a biannual basis: in the second (April) and fourth quarter (October), starting in 2009. This offers a shorter time scale, but with a much richer internal structure, leading to four evaluated forecasting horizons: 3 months, 9 months, 15 months and 21 months. The predictions themselves were collected, again, from the relevant section of the CBA website (*ČBA Prognózy*).

Looking at the data structure available, two things need to be stressed. First, being a common point of both surveyed institutions, the 15M forecast represents the pivotal part of the analysis and will be given special attention, also in comparison with central (MF, CNB) based predictions. Secondly, while the data range enables us to assess forecasting errors achieved in the volatile 2009-2012 period, it is too limited to enable statistics testing of the systemic nature of observed patterns (such as with Wilcoxon or Diebold-Mariano test). Nevertheless, this limitation, which will be further discussed in the conclusions, does not prevent dissemination of the forecasting performance (accuracy) itself. Finally, the data on the benchmark forecasts were collected from the official online databases (MF, 2015 – *Makroekonomická predikce*; CNB, 2015 – *Aktuální*

prognóza) and from the relevant volume of *Economic Outlook* (OECD, 2015) respectively. For the real GDP growth values (Y_t) in the surveyed period, actual (2015) data from the Czech Statistical Office (CZSO, 2015) statistics of macro-indicators (*Hlavní makroekonomické ukazatele*) were utilized (using ESA 95 standard data-set).Using the most recent (outturn) data limits the reflection of information efficiency at the time of forecast creation, yet it enables the most accurate performance evaluation, because of the most accurate underlying indicator (for details on the methodological rationale, see McNees and Ries, 1983).

Method

The evaluation strategy of this paper follows methodological recommendations provided in forecasting literature, particularly by the prominent works of Hyndman & Koehler (2006) and Armstrong (2001). A total set of three error measures was utilized; for definition purposes, let us denote Y_t as real value at time t, F_t as its forecast and subsequently ($Y_t - F_t$) as forecast error (E_t), with n being the number of observations:

(i) **Average Forecasting Error (AFE)** – represents a simple scale-dependent method that enables initial assessment of predominant forecast error direction:

$$AFE = \frac{\sum_{i=1}^{n} E_t}{n}$$

(ii) **Root Mean Squared Error (RMSE)** – represents a squared scale-dependent method that inherently puts a heavier penalty on bigger errors, providing a contrast view on error magnitude:

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(E_t)^2}$$

(iii) **Mean Absolute Scaled Error (MASE)** – provides a comparison of the actual forecast with a naïve in-sample benchmark, indicating whether the forecast provided more accurate information (MASE < 1) or not (MASE > 1):

$$MASE = \frac{1}{n}\sum_{t=1}^{n}|q_t|$$

$$q_t = \left(\frac{E_t}{\frac{1}{n-1}\sum_{i=2}^{n}|Y_i - Y_{i-1}|}\right)$$

Compared to the more frequent Theil's Inequality Coefficient (TIC), MASE has two advantages which are particularly useful in the evaluation of macroeconomic forecasts: robustness to extreme and infinite or undefined F_t/Y_t values (for further detail see Hyndman & Koehler, 2006). Also, it enables us to obtain an innovative outlook on

comparison of forecasting performance that complements the metrics found in already existing studies (e.g. Öller and Barot, 2000; or Vacková, 2014).

In order to achieve the most comprehensive evaluation, all error measures will be calculated for both surveyed institutions (CMKOS, CBA) as well as for their public (MF, CNB) and supra-national (OECD) benchmarks. As for the metrics composition itself, the combination of the simple scale-dependent, squared and relative error measures covers all important aspects of forecasting accuracy (i.e. error direction, magnitude, performance in changes) and offers, according to meta-research provided by Armstrong (2001), fair construct validity, fair reliability, and high outlier protection. Furthermore, it also ensures direct comparability with the relevant international and domestic papers mentioned earlier, relying on the same methodology foundations.

Results

Accuracy of CMKOS growth forecasts

The results of selected error measures for CMKOS growth forecasts are outlined in Table 1 below. All of the errors were calculated for each year individually and for the whole period in total, with RMSE metrics, due to its interval settings, being divided into the crisis turning-point (2007-2009) and recession (2010-2013) sub-periods.

Table 1 CMKOS Growth Forecast Error Measures

	Year of F_t[3]	CMKOS AFE[a]	CMKOS RMSE	CMKOS MASE[b]	MF AFE[a]	MF RMSE	MF MASE[b]	CNB AFE[a]	CNB RMSE	CNB MASE[b]	OECD AFE[a]	OECD RMSE	OECD MASE[b]
	2007	-1.9	4.7	0.7	-1.9	5.0	0,7	-1.9	4.5	0.7	-1.5	4.1	0.6
	2008	-6.5		0.9	-8.2		1,1	-7.4		1.0	-7.0		0.9
	2009	4.5		0.6	2.2		0,3	1.1		0.2	0.5		0.1
15M Forecast	2010	0.8	1.5	1.3	-0.2	1.4	0,3	0.6	1.3	1.0	-1.0	1.8	1.5
	2011	-2.0		0.7	-2.0		0,7	-2.2		0.8	-2.6		0.9
	2012	0.2		1.9	-1.8		22,8	-1.3		16.5	-1.9		24.1
	2013	2.0		0.6	0.7		0,2	-0.1		0.0	0.9		0.3
	2007-2013	-0.4	3.3	1.0	-1.6	3.5	3,7	-1.6	3.1	2.9	-1.8	3.0	4.1

[a] Figures in individual years represent forecasting error (E_t), their average in summary statistics (2007-2013) completes the AFE measure.
[b] Figures in individual years represent scaled error (q_t), their average in summary statistics (2007-2013) completes the MASE measure.
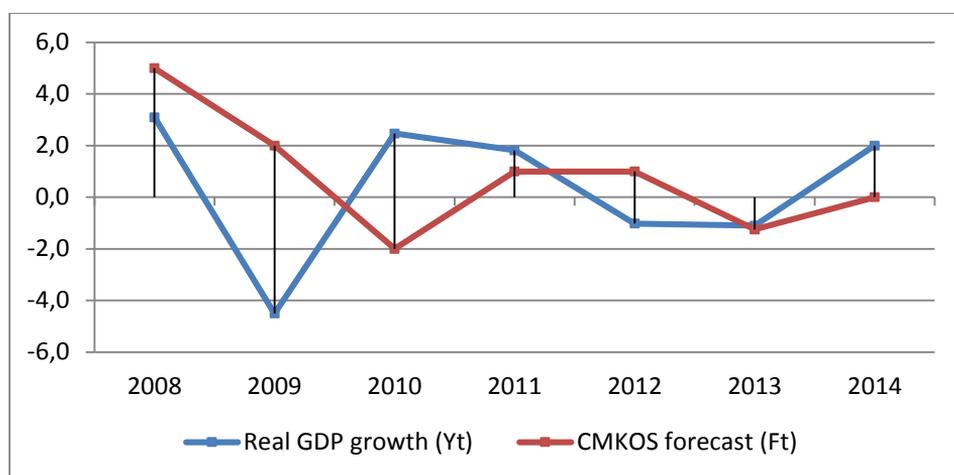
Source: own research, utilizing MF (2015), CNB (2015), OECD (2015) and CZSO (2015) data

Going through the results reveals three main findings. First, CMKOS predictions, while achieving on average a lower error rate, initially exhibited the same error pattern as the rest of the sample (MF, CNB, OECD): beginning with overestimation of 2008-2009

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[3] A year when GDP forecast (F_t) was created. For CMKOS, it predicts the next year's GDP growth (15M horizon), hence it is compared with the next year real value.

growth (particularly excessive in the2009 forecast) and followed by underestimation of the 2010-2011 positive turnaround. Only in 2012-2013did the tide begin to change: The 2012 forecast fared notably differently from the benchmark forecasts, not only in terms of clearly lowest error (0.2), but also in terms of its positive direction, indicating the sole correct estimation of the economy´s repeated fall into red numbers. In 2013, however, this fresh trend was not fully confirmed (see Graph no. 1 for visual depiction). Finally, in comparison with in-sample naïve benchmark (MASE), the CMKOS predictions exhibited slightly better performance (MASE<1) than the rest of the sample – except for the 2012 forecast, the MASE values were not notably different, indicating similar performance to MF, CNB and OECD.

Figure 1 Real GDP Growth vs. CMKOS Forecast (2008-2014)

Source: own research,utilizing CZSO (2015) data

Overall, the calculated error measures indicate that in the initial 2007-2009 crisis turning point and 2010-2011 stagnation, CMKOS predictions did not offer notably higher accuracy than their official (MF, CNB) and supranational (OECD) counterparts. It did, however, succeed in predicting the 2012-2013 "second dip", where it clearly presented more credible (and accurate) projections than the official institutions. On one hand, this contributes to over one percent lower overall AFE error (-0.4 to the ministry´s -1.6) and MASE comparison (1.0 to the bank´s 2.9[4]), but on the other hand, the positive deviance was not enough to outweigh the higher errors penalised by RMSE, resulting in generally comparable values. Core implications regarding the value added of CMKOS forecasts and their substitutability with the benchmark ones follow these findings.

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[4]0.8 to 0.6 excluding the outlying year 2012.

Accuracy of CBA Growth Forecasts.

The Czech Banking Association (CBA) is the second of the surveyed non-governmental bodies producing GDP growth forecasts on a regular basis, utilizing *de facto* consensus forecast of the most important Czech banks. While its forecasting history is considerably shorter, essentially covering only years from 2011 on, it utilizes a much wider portfolio of forecasting horizons, enabling us to evaluate predictions ranging from 3 to 21 months ahead.

Table 2 CBA Growth Forecast Error Measures

Year of F_t[5]		CBA			MF			CNB			OECD		
		AFE[a]	RMSE	MASE[b]	AFE[a]	RMSE	MASE[b]	AFE[a]	RMSE	MASE[b]	AFE[a]	RMSE	MASE[b]
3M Forecast	2011	-2.3	2.2	0.8	-3.1	2.5	1.1	-3.0	2.4	1.1	-3.1	2.7	1.1
	2012	-0.2		1.9	-0.1		1.3	-0.2		2.5	-0.2		2.5
	2013	3.0		1.0	3.0		1.0	2.9		0.9	3.5		1.1
	2011-2013	0.2		1.2	-0.1		1.1	-0.1		1.5	0.1		1.6
9M Forecast	2011	-2.9	2.2	1.0	-2.9	2.2	1.0	-2.5	2.1	0.9	-3.4	2.6	1.2
	2012	-1.1		13.9	-1.3		16.5	-1.1		13.9	-0.6		7.6
	2013	2.2		0.7	2.0		0.6	2.5		0.8	3.0		1.0
	2011-2013	-0.6		5.2	-0.7		6.1	-0.4		5.2	-0.3		3.3
15M Forecast	2011	-4.0	2.5	1.4	-2.0	1.6	0.7	-2.2	1.5	0.8	-2.6	1.9	0.9
	2012	-1.6		19.6	-1.8		22.8	-1.3		16.5	-1.9		24.1
	2013	0.4		0.1	0.7		0.2	-0.1		0.0	0.9		0.3
	2011-2013	-1.7		7.1	-1.0		7.9	-1.2		5.8	-1.2		8.4
21M Forecast	2011	-4.0	2.9	1.4	-3.3	2.4	1.2	-3.8	2.8	1.3	-4.5	3.1	1.6
	2012	-3.1		39.3	-2.4		30.4	-3.0		38.0	-2.8		35.5
	2013	0.2		0.1	0.8		0.3	0.2		0.1	0.7		0.2
	2011-2013	-2.3		13.6	-1.6		10.6	-2.2		13.1	-2.2		12.4

[a] Figures in individual years represent forecasting error (E_t), their average in summary statistics (2011-2013) completes the AFE measure.

[b] Figures in individual years represent scaled error (q_t), their average in summary statistics (2011-2013) completes the MASE measure.

Source: own research, utilizing MF (2015), CNB (2015), OECD (2015) and CZSO (2015) data

As with the previous CMKOS evaluation, CBA forecasts exhibited accuracy in most patterns comparable with the benchmark institutions, albeit over a shorter time frame. However, the direction of the metrics in individual years never took an opposite sign to the official ones, indicating a stronger interconnection of CBA forecasting with projections published by those bodies. This also results in at best similar, but mostly sub-par total error values (AFE, RMSE) mainly in the longer horizons (15/21M), as well as very similar performance versus the naïve in-sample benchmark. In many cases (15M and 21M forecast again), the MASE indicator even surpassed the values achieved by

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[5] A year when GDP forecast (F_t) was created. For CBA, it predicts either the current year (3M and 9M horizon) or the next year's GDP growth (15M and 21M horizon).

MF/CNB, indicating lower forecasting value added vs. naïve model. From a chronological perspective, the CBA´s predictions did exhibit a mild shape of incremental improvement (i.e. higher accuracy with shortening horizon), yet on the other hand, their accuracy declined more progressively with longer horizons than the one of the benchmarks. All this composes a picture of not fatal, but mostly inferior forecasting performance, as documented also by visual comparison of achieved forecasting error (graph no. 2).

Figure 2 Comparison of GDP Growth Forecast Error (Et, common 15M horizon)
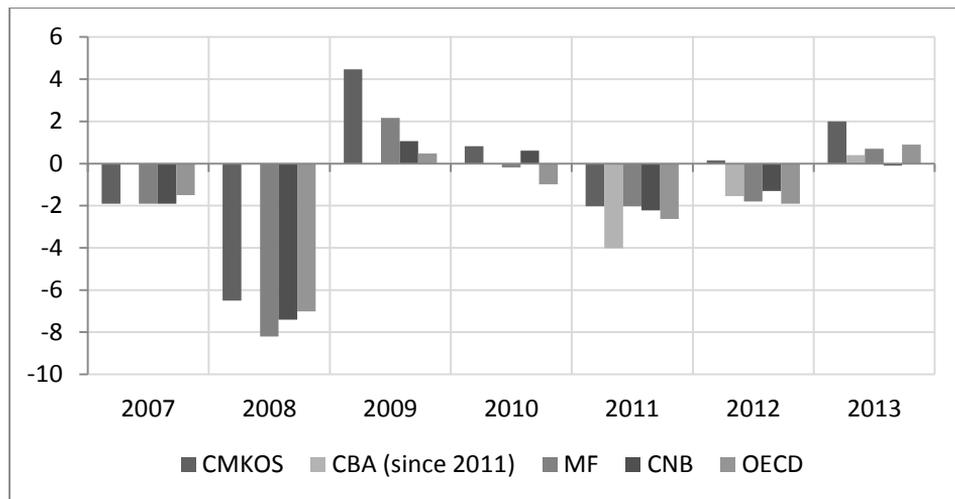
Source: own research, utilizing MF (2015), CNB (2015), OECD (2015) and CZSO (2015) data

As far as the performance in turning points is concerned, the available time frame offers a single study example: 2013/2014 transition from decline to growth. While the single example cannot be considered definitive evidence, a quick look at the error measures (table no. 2, AFE column) shows that CBA was not able to predict the discontinuity any better than the official institutions, regardless of forecasting horizon. Actually, in three out of four horizons (3M, 9M and 15M AFE – considering 2013 forecast), the association offered lower forecasting accuracy than either MF or CNB and notably surpassed only control-variable OECD predictions. As mentioned, a similar pattern of directional congruence with occasionally even more inferior performance (e.g. 15M forecast) was detected in the overall accuracy as well. These findings point to an assumption that CBA forecasts do not yet represent independent competition to forecasts of the official bodies, in terms of their accuracy shape, but rather work as some sort of consensus modulator, built on top of them.

Discussion

Returning to the introductory statement on the forecasting value added of non-governmental forecasts, the study offers mixed results. The accuracy pattern of CMKOS predictions indicates their operational independence from central institutions, as well as overall superior forecasting accuracy, thus supporting the conclusions of Batchelor (2001) or Novotný & Raková (2010). The CBA forecasting, though handicapped by the shorter time-frame, has been found to be rather a satellite of official forecasts so far, not representing a distinct alternative in terms of direction, magnitude or naïve benchmark measures. This is in line with general observations made by Artis, (1996), Hawkins (2002), Juhn & Loungani (2002), or Timmermann (2007). In this respect, we can conclude that our research did confirm the thesis of non-governmental forecasts having the potential to be a credible, independent alternative to the official ones (CMKOS), as well as indicating that not every alternative forecast offers such value added (CBA). The main theoretical implication here is that every alternative forecast must be evaluated separately before being taken as a control variable for the governmental ones.

From a practitioner's perspective, the key question outlined in public dispute[6] is, whether using the information provided by alternative forecast provides any tangible benefit in terms of (i) early warning or (ii) consistently better accuracy. From the evidence provided by the metrics used, only CMKOS forecasting exhibits such traits. The somewhat dissenting, independent nature of the CMKOS forecasts is not surprising, given that trade unions are often found in opposition to the country´s government, especially in times of right wing coalitions (2006-2013). What makes them interesting is the fact that they are able to achieve consistently better or comparable accuracy to their official counterparts, moving them from the dubious alternatives category to the credible predictions basket. In other words: with respect to their performance over the past eight years, CMKOS forecasts should not be omitted from any serious decision making model. CBA, on the other hand, fails in both categories and is not – currently – of much use in public/private decision making. This can of course change with the lengthening of the forecasting track-record, and this creates one of the main implications for further research.

Conclusions

The goal of this paper was to evaluate the real GDP-growth forecasting performance of two non-governmental institutions: Czech-Moravian Confederation of Trade Unions (CMKOS) and the Czech Banking Association (CBA). We found out that:

- Both institutions publish their growth forecasts regularly, although using a different scheme and within a different time frame. CMKOS´ next year forecast is published once a year in the third quarter (September/October – average horizon 15M). CBA, however, presents its forecast, as with the governmental institutions, biannually (April and October), for both the current and the next year, resulting in multiple forecasting horizons (3M, 9M, 15M and 21M).

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[6]See e.g. MF (2012) or Holub (2013).

- As for overall accuracy shape, the comparison with the official benchmarks (MF, CNB, OECD) shows that the CMKOS forecast indicates a higher degree of independence, offering a rather discrete vision of future development. The CBA forecast, on the other hand, has seemed to be more of a dependent derivative of the official, governmental predictions so far.
- As for accuracy magnitude, the same outcome was detected. While the CMKOS was able to achieve higher or comparable accuracy with all metrics, a necessary condition of forecasting credibility, a present four year track-record of CBA was found to offer more substantial, sub-par errors.

Overall and with study limitations in mind, we can conclude that of the surveyed non-institutional forecasts, only CMKOS predictions represent a viable alternative for control analysis or addition to a wider consensus panel. The CBA predictions were found to offer strong interconnection with official forecasts as well as inferior accuracy so far, implying an opposite outcome. The banking association predictions, however, were more affected by the most important analytical limitation, which is a restricted time-frame available, affecting the range of the data as well as methodological tools used. Nevertheless, the study still jointly covered the vital period from 2011 to 2014, including at least one real-value turning point (2013/2014), with a comprehensive set of error measures, meaning that results represent a valid opening point for future discussion. This applies more in the case of CMKOS, where a substantially longer period led to more representative results. Finally, by focusing on the accuracy perspective, the study did not take into account the methodological aspects of the forecast preparation process inside the surveyed institutions, which represents an important, yet separate topic.

As for implications for further research, these are closely tied to the above-mentioned study limitations. The most obvious recommendation is related to a validating, longitudinal research that needs to be carried out over time in order to (i) confirm or disprove the outcomes of the paper and (ii) assess their validity over a longer time frame. The second point should also incorporate application of more advanced statistical methods (i.e. tests of comparative performance, systemic bias and incremental improvement), enabled by the longer data-frame available. These are natural directions to further develop the core ideas behind the presented paper. The author is of the opinion that due to the increasing public prominence of macro-forecasts, such follow-up papers are likely to come within the very near future.

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