



Are budget deficit forecasts over-optimistic?

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The paper studies the bias of forecasts of budget deficit of three institutions – the European Central Bank, the European Commission and national ministries. It is focused on 27 EU members. There are four main findings in the paper: (1) budget deficit forecasts are over-optimistic on average, i.e. institutions usually undervalue the deficit forecast compared to future reality, (2) there is even more optimism in longer forecasting time periods than in shorter periods, (3) there is usually more optimism in booms (good times), (4) the best forecasting institution out of these three is the European Commission, then the European Central Bank and then national ministries.

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² The word deficit here is used as deficit to GDP ratio, not the absolute value of deficit.

³ Technical note: all of the deficits have minus signs so maybe it would be better to use wording „budget balance forecast“ instead of „budget deficit forecast“, but still we used the other way.

In this paper we found that there is over-optimism on average in almost all budget forecasts. That means institutions which make forecasts usually underestimate budget deficits.² This is true on average for all three analyzed institutions and all forecasting periods. The longer is the forecasting time period, the higher is the optimism in forecasts.) The forecasts are more optimistic in booms (good times). Different institutions have different quality of forecasts. After comparing three institutions, we have found that best forecasts are made by the European Commission, followed by the European Central Bank and lastly the national ministries. The data comes from the Annual Public Finance Report of ESCB, Economic Forecasts of the European Commission and Stability and Convergence Programmes.

We analyzed 27 EU members in the period from 1999 to 2011, where the data were available. We obtained forecasts for the current year (t), the next year (t+1) and the year after (t+2). We will divide this paper into four parts, according to our four findings, which were presented in the abstract.

GENERAL OVER-OPTIMISM IN BUDGET DEFICIT FORECAST

The main finding of the paper is that budget deficit forecasts are on average over-optimistic, i.e. forecasting institutions usually underestimate deficit forecasts – they expect it will be lower than it actually will be. This can happen because of two reasons:

- overestimating GDP (GDP growth),
- underestimating absolute deficit.

Here we will not focus on the bias of GDP growth forecast; our interest will be only in the forecasts of deficits. Over-optimism in budget deficit forecasting can have unfavorable consequences: if deficit forecasts are underestimated, the governments have lower incentive to consolidate the budget. This was happening during the boom era of 2002-2007, which were good times for decreasing budget deficits – executing countercyclical policy (save in good times, spend in bad times). Actually, many countries failed to implement co-

untercyclical policy. Policy makers usually follow the political cycle and there are always elections ahead and politicians are rather prone to spend additional income, which is gained during good times. If during the good times you also forecast future good times, the incentive to save is lower. Thus, also over-optimism in budget deficit forecasts can be one of the reasons, why the consolidation process during this boom era was not quite successful. If forecasts underestimate the budget deficits policy makers are satisfied with the consolidation process, even though in the future the deficits will be always higher.

The paradoxical outcome of today's fiscal policies is that countries rather try to save, by which they decrease the aggregate demand even further. It is the consequence of lacking past consolidation. Thus countries should take lesson from this and try to save more in good times. This can be partly done also by improving the forecasting and do it more conservative. Frankel (2011) mentions, that a very good example is Chile, which established a separate independent fiscal authority, and one of their responsibilities is to create good forecasts, which was quite successful in recent years, and helped Chile to make countercyclical policy in the beginning of the millennium.

The analysis in this paper was done in the way that the forecast error was calculated and then used to evaluate the forecasting performance of different institutions. The forecast error was calculated as follows:

$$\text{forecast error (t)} = \text{deficit forecast (t)} - \text{actual deficit (t)}$$

where „deficit forecast (t)“ is a forecast of deficit made for period t.³ We used three forecasting periods – forecast for actual year (t), forecast for next year (t+1), and forecast for two years ahead (t+2). For example, „deficit forecast (t+2)“ is a forecast made for year t+2, at time t (e.g. deficit forecast for 2011 made in 2009). Forecast errors were calculated for periods t, t+1 and t+2, for each country and every year.



4 We are aware, that our t-test doesn't fulfill all of the requirements for its usage (e.g. independence of observations), but we still use it as an approximation.

First, we will present average forecast errors for each institution (all forecasting time periods, countries and years were taken into account). We tested for statistical significance of the average forecast errors. The hypotheses were:

$$H_0: \text{average forecast error} = 0$$

$$H_1: \text{average forecast error} > 0$$

Test statistic used was⁴:

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$$

First we took all the forecasting errors (for all years, all countries and all forecasting time periods) and made a simple average. Then, we tested, using the above test statistic, if the average forecast error is statistically different from zero. We did this separately for forecasts of the ECB, forecasts of the EC and forecasts of national ministries. Therefore, we got three values (one for each institution) that tell us, which institutions' forecasts are better on average. Of course, the closer is the forecast error to zero, the better. The results are presented in Table 1.

Table 1 Average forecast errors

	Average forecast error (for all periods together)
ECB	0.76*** (1.91)
EC	0.37*** (1.88)
Ministry	1.43*** (1.89)

***p<0.01, **p<0.05, *p<0.10 Standard errors in parentheses.

The results are all statistically significant at 1% significance level. All the three institutions underestimate the budget deficits. All of them are over-optimistic about the future deficits. For example, the ECB undervalues the budget deficit on average by 0.76 percentage points. Standard errors are quite similar.

As an alternative for evaluating the quality of forecasts we calculated also the RMSE (root mean squared error). Standard errors give us information about a distribution of values around their means. The forecast errors can be systematically biased, yet very precise (i.e. not very far from the mean). On the other hand, forecast errors can be more spread around the mean, but the mean can be less biased. Therefore, the RMSE is also useful for evaluation of forecasts. The RMSE measures the total distance between forecasted deficit and actual deficits. In Table 2 we see that the RMSEs are quite similar, with the lowest RMSE for the European Commission.

Table 2 RMSE for all periods together

	RMSE
ECB	3.74
EC	3.51
Ministry	3.85

EVEN MORE OPTIMISM IN LONGER TIME PERIODS

We expect that the longer is the time horizon the higher is the forecast uncertainty. This can be expressed by higher standard errors in longer forecasting horizons. As we will see, this will be confirmed. Yet the interesting thing is that also over-optimism is higher in longer forecasting periods, which is expressed by higher averages of forecasting errors.

Forecast errors are calculated in the same way as before (positive forecast errors mean undervaluing the forecasts). Average forecast errors for three different time periods (t, t+1, t+2) for each institution (all countries and years were taken into account) will be presented. Again, as before, first we test if they are statistically different from zero by the same procedure as before. Table 3 summarizes our results.

Table 3 Average forecast errors for different time periods (t, t+1, t+2)

	Average error of forecast (t)	Average error of forecast (t+1)	Average error of forecast (t+2)
ECB	0.26*** (1.54)	0.61*** (1.93)	1.63*** (2.18)
EC	-0.03 (1.14)	0.23* (2.07)	1.06*** (2.08)
Ministry	0.58*** (1.66)	1.52*** (1.93)	2.41*** (2.02)

***p<0.01, **p<0.05, *p<0.10 Standard errors in parentheses.

We can see from the p-values that some results are significant and some are not. For the ECB and ministries the results are significant, the only lower significance is for the one year ahead forecast (t+1) for the European Commission. However, notice the forecast of the European Commission for time t, which is almost 0 (-0.03%). The p-value for this figure is 0.63, which means we cannot reject the hypothesis that it is equal to zero.

As we mentioned, the standard errors increase as the forecasting time period increases. That means in longer time horizons there is higher uncertainty. But for us is more interesting that also underestimation of deficit forecasts increases with longer time period. All the average errors of forecasts are higher in t+1 forecasting period than t, and all the average errors of forecasts are higher in t+2 than in t+1. That means if we forecast so-

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something one year ahead we are more optimistic than when we forecast for current year. The RMSE results can be found in Table 4.

Table 4 RMSE for different time periods

	RMSE (t)	RMSE (t+1)	RMSE (t+2)
ECB	2.36	3.76	5.02
EC	1.29	4.27	4.43
Ministry	1.96	4.01	4.72

We see that the RMSE rises with a time horizon, which is true for all institutions. The RMSE is lowest for the European Commission, with exception for time period t+1.

We tested whether the differences between time periods are statistically significant. We used these hypotheses:

$$H_0: \text{average forecast error (t)} = \text{average forecast error (t+1)}$$

$$H_1: \text{average forecast error (t)} < \text{average forecast error (t+1)}$$

An equivalent hypothesis is used to compare (t+1) and (t+2).

Test statistic:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

For the degrees of freedom we used the Satterthwaite's formula:

$$d.f. \approx \frac{\left(\frac{s_1^2}{n_1} - \frac{s_2^2}{n_2}\right)^2}{\frac{1}{n_1 - 1} \left(\frac{s_1^2}{n_1}\right)^2 + \frac{1}{n_2 - 1} \left(\frac{s_2^2}{n_2}\right)^2}$$

In Table 5 we provide just t-statistics for the tests of significance of differences between time periods.

We can see that at 5% level all differences are significant (except one, which is still significant at 10% level). Therefore we can conclude that the differences are significant and the result is that the

Table 5 T-statistics for the tests of significance of differences between time periods

	H1: mean(t) <mean(t+1)	H1: mean(t+1) <mean(t+2)
ECB (t-statistics)	-1.91	-4.34
EC (t-statistics)	-1.47	-3.73
Ministry (t-statistics)	-5.56	-4.50

longer the time horizon of forecasting, the bigger is the over-optimism in forecasting budget deficits (undervaluing the deficits).

MORE OPTIMISM IN BOOMS (GOOD TIMES)

All economies develop in business cycles. We used the HP-filter to decompose GDP dynamics into trend and cyclical components. Then we explore whether in booms institutions tend to overestimate the budget deficit. The reason can be, if you see that economy is doing well then you extrapolate this experience also to the future. One of the basic textbook facts about business cycle is that it is extremely difficult to predict the turning points.

In our analysis we found that the stronger is the boom, usually the higher is the over-optimism in forecasting budget deficits (undervaluing deficits). We performed this analysis by simple OLS regression. The formula we used was:

$$\text{forecast error} = \hat{\beta}_0 + \hat{\beta}_1 \log(\text{output gap}) + \varepsilon$$

The output gap is approximated by:

$$\log[(\text{output gap})] = \log(\text{gdp}) - \log(\text{HPtrend})$$

The regression was estimated for different institutions (ECB, EC, ministries) and for different forecasting periods (t, t+1 t+2). Table 6 presents the $\hat{\beta}_1$ coefficients.

Table 6 $\hat{\beta}_1$ coefficients for regression

$\hat{\beta}_1$ coefficients	t	t+1	t+2
ECB	-1.04 (3.32)	28.01*** (7.11)	54.21*** (8.66)
EC	4.69*** (1.75)	26.77*** (8.27)	55.86*** (5.53)
Ministry	-11.73*** (3.78)	10.4 (8.41)	41.54*** (7.08)

***p<0.01, **p<0.05, *p<0.10 Robust standard errors in parentheses.

The results support the fact that during expansions over-optimism in budget deficit forecasts increases. We can see it from mostly positive signs of coefficients. Two coefficients are insignificant (the ECB in period t, and national ministries in period t+1), so we can ignore them. All the other forecasts are significant even at 1% significance level. All the signs are positive besides one exception, which is the coefficient for national ministries at time t. That means, the higher is the boom, the national ministries for the same forecasting period overvalue the deficits or at least undervalues them less. Yet all of the other institutions undervalue the deficits more in boom times. For example, if we take the ECB forecast for t+1, if the GDP is 1% above its potential, than they on average undervalue the deficit forecast by extra 0.28 percentage



points (or % of GDP). Or if we take the European Commission forecast for t+2, if the GDP is 1% above its potential, than they on average undervalue the deficit forecast by additional 0.56 percentage points. If we generalize the outcomes, we can say that usually the forecasts are more overoptimistic in good times than in bad times.

WHO IS THE BEST FORECASTER?

We already presented all of the results so now we can focus on the fact, who is the best forecaster. Table 7 shows the ranking (the less optimistic the forecast – the forecast error closer to zero – the better the forecaster).

Table 7 Ranking of institutions according to quality of forecasts

Institution (ranking)	Average error of forecast	RMSE
1. European Commission	0.37*** (1.88)	3.51
2. European Central Bank	0.76*** (1.91)	3.74
3. State ministries	1.43*** (1.89)	3.85

***p<0.01, **p<0.05, *p<0.10 Standard errors in parentheses.

We see that the best results are attained by the European Commission, where the average forecast error is only 0.37% of GDP, that means the undervaluation of the forecasts is the lowest on average. This is the average for all years, all countries and all three forecasting time periods. The second

one in ranking is the European Central Bank⁵ and the third position belongs to forecasts of national ministries. Actually, if the forecasts of national ministries are used in countries to judge what will be the deficit in the future, this over-optimism can be the reason why they had high deficits also in good times and the consolidation process wasn't so successful. An advice to national ministries can be to take more into account the forecasts of the European Commission, because on average they would achieve better results than with their own forecasts. If we use the RMSE as an alternative evaluation, the ranking remains the same.

Even if we take into account different time periods, there is still no change in the ranking of institutions. Here we show forecast errors for different forecasting periods (t, t+1, t+2).

Still, the winner is the European Commission, and this is true for all time periods. In each forecasting period (t, t+1, t+2), the best forecasts (lowest forecast error) is published by the European Commission. Interestingly, the forecast of the European Commission for the same year (t) is not significantly different from zero, i.e. there is virtually no error. Second is always the European Central Bank and third national ministries. National ministries have excessive over-optimism in forecast for 2 years ahead (t+2), where they undervalue the budget deficit by 2.41 % of GDP, which is very close to the Maastricht criterion benchmark of 3%. Usually the forecast is also a kind of target for national ministries and here we see that they usually do not achieve this target, and in two years ahead forecast they are quite far from reality. Using the RMSE as different assessment (see Table 4), still the best is the European Commission, with the exception of time period t+1.

Table 8 Ranking of institutions according to quality of forecasts

Institution (ranking)	Average error of forecast (t)	Average error of forecast (t+1)	Average error of forecast (t+2)
1. EC	-0.03 (1.14)	0.23* (2.07)	1.06*** (2.08)
2. ECB	0.26*** (1.54)	0.61*** (1.93)	1.63*** (2.18)
3. Ministry	0.58*** (1.66)	1.52*** (1.93)	2.41*** (2.02)

***p<0.01, **p<0.05, *p<0.10 Standard errors in parentheses.

⁵ ECB forecasts are published six months earlier than forecasts of the European Commission (or ministries), so the ECB results in the ranking are (partly) due to the longer forecasting horizon.

References:

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