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How to explain errors in budget balance forecasts in euro area countries? Empirical evidence based on real-time data

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Abstract

The aim of this study is to explore budget planning in the euro area countries in 2004-2014. Our analyses are based on annual real-time data from the IMF World Economic Outlook publications. As forecasts made by different institutions are strongly correlated, our dataset reasonably reflects information available for policy makers in real-time. We examine whether real-time forecasts of overall budget balance, real GDP growth and output gap have been systematically biased. We also analyse forecast accuracy of potential output growth, which we construct using different vintages of real-time data. Our results indicate systematic biases in forecasts. Further, we study how real-time macroeconomic conditions affect budget planning. For comparison, we also consider how ex post economic conditions and ex post budget balance developments are related. We find robust evidence of mean reversion in budget balances, in both real-time and revised data. Mean reversion is related only to negative budget balances, and it is systematically stronger with respect to revised information. Finally, we analyse errors in budget balance forecasts. We provide robust evidence that revisions to current budget balance have contributed to errors in budget balance forecasts. We also find that forecasted macroeconomic conditions (potential output growth and real GDP growth) and their revisions have affected errors in budget balance forecasts. Overall, our results indicate that real-time uncertainty and revisions materially affect budget planning.

Keywords: fiscal policy, real-time data, economic crisis

JEL Codes: E62, E32

E62 Fiscal Policy

E32 Business Fluctuations, Cycles

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1 Introduction

Real-time uncertainty is closely related to budget planning. When making budget decisions, policymakers must rely on inaccurate macroeconomic information available at the time. It is quite common that real-time information is revised afterwards, often many times, before revised (final) data are published. Real-time economic uncertainty may lead to substantial surprises in public sector finances and unexpected debt accumulation, as was observed during the recent financial crisis.[3]

The overall budget balance measures the difference between the government revenues and expenditures (including the interest on the debt). It is an essential part of the EU fiscal framework, the aim of which is to enhance long-run fiscal sustainability in the member states. In order to be effective, fiscal policy decisions must be based on accurate monitoring and forecasting. Current-year estimates are central in fiscal monitoring, whereas forecasts for the next year are related to expected stance of fiscal policy. If for example, budget balance forecasts are systematically over-optimistic, it may lead to excessively expansive fiscal policy as regards long-term sustainability of government debt, even if the fiscal rules are not violated. [4]

Real GDP and the economic cycle are central inputs in fiscal policy decisions. Tax revenue and public spending respond automatically to changes in output, and fiscal balances are typically measured as shares of GDP. In order to make counter cyclical budget decisions, policy makers must decompose real GDP estimates into a long term trend (potential output) and a short-term business cycle (the output gap). Potential output reflects the highest level of production that an economy can reach without generating inflationary or financial pressures. Therefore, it indicates the future growth prospects beyond the current business cycle.[5] The

[3] Several authors have used real-time data in fiscal policy analysis. See Cimadomo (2016) for a survey of real-time fiscal policy literature.

[4] The structural balance is another essential part of the EU fiscal framework. It refers to the budget balance, which is corrected for both cyclical effects and one-off or other temporary measures. The EU fiscal framework (The Stability and Growth Pact) consists of a preventive and a corrective arm. In the preventive arm the central concept is medium term budgetary objective (MTO). How fast countries have to reach their medium term budgetary objectives depends on economic conditions and debt sustainability. In the corrective arm the central concept is the excessive deficit procedure, which aims to correct excessive overall deficits or government debt levels. (See http://ec.europa.eu/economy_finance/economic_governance/sgp/index_en.htm.) If overall budget deficit in a member state is over the 3 % (of GDP) threshold, an excessive deficit procedure (EDP) will be initiated for that state. A member state's medium term budgetary objective (MTO) is defined in terms of its structural budget balance - typically -0.5 % of GDP. Structural budget balance is also used to measure whether a member state has taken effective action to meet the targets of its stability program.

[5] Statistical techniques provide one method of estimating the level of potential output; another widely used method is based on economic relationships such as the production function. Different methods can also be

output gap identifies the current situation within the economic cycle and it is defined as the difference between real and potential output, relative to the potential output ($OG_t = 100*(GDP_t - POT_t)/POT_t$). Changes in real GDP can lead to changes in potential output. It is clear that inaccurate forecasts of cyclical variables contribute to inaccuracy in budget balance forecasts.[6]

The global financial crisis increased economic uncertainty and errors in forecasting. High inaccuracy of budget balance forecasts may reflect increased real-time uncertainty, but inaccurate forecasts may be also due to policy makers' intentions at the time of budget decisions (for example, they want to avoid unpleasant policy decisions). Frankel and Schreger (2013) have provided evidence that large deficits and economic booms correspond to over-optimistic official budget balance forecasts.

The aim of this study is to explore real-time uncertainty in budget planning in eleven euro area countries. Using annual real-time panel data from the IMF World Economic Outlook publications we examine whether real-time forecasts of budget balances, real GDP growth, potential output growth and the output gap have been systematically biased. We also analyse the impacts of current macroeconomic conditions on budget planning. Finally, we explore whether errors in budget balance forecasts can be explained by real-time information and/or by revisions (factors unanticipated at the time of forecasting). The novelty of our study is in extensive use of real-time information. Especially, we construct real-time potential output values using real-time values of output gap and real GDP. Our analyses cover the years 2004 – 2014. In order to make robustness analysis, we consider also two sub-samples divided by the onset of the financial crisis. In addition to whole euro area, we study the GIIPS countries and high-rated countries (denoted by AAA) separately.

The results suggests that forecasting errors have been systematic and, compared to pre-crisis years, they increased substantially after the Lehman Brothers collapse. Mean reversion in budget planning seems to have been substantial in both real-time and revised data, but it relates only to negative budget balances. Our analysis indicates that mean reversion is systematically stronger with respect to revised information. We provide robust evidence that revisions to

combined. Whatever the method, the estimates are characterized by significant uncertainty, which is largest among the observations for the most recent years. Thus, estimates for potential output need to be typically revised for many years. IMF estimates potential outputs using several methods, for example a production function approach, where potential output is a function of trend capital, labour and total factor productivity. IMF estimation methods for potential output are discussed in De Masi, P. R. (1997) IMF Estimates of Potential Output: Theory and Practice. IMF Working Paper No. 177.

[6] See Orphanides and van Norden (2002) for challenges to measure output gap in real time.

current budget balance have contributed to errors in budget balance forecasts. We also find that forecasted macroeconomic conditions (potential output growth and real GDP growth) and their revisions have affected errors in budget balance forecasts. Overall, our results indicate that real-time uncertainty is an important element in budget planning.

The paper proceeds as follows. Section 2 presents the data and section 3 analyses forecast accuracy. Empirical analyses are reported in section 4 and conclusions are presented in section 5.

2 Data description

Annual real-time data for eleven euro area countries[7] are constructed using the IMF World Economic Outlook publications (autumn 2003 –2015). From each publication, we use time series for overall budget balance, real GDP (growth and level) and output gap. For all variables our panel data set includes real-time estimates (nowcasts) of current-year values and corresponding real-time forecasts for the following year. The 'final' data, for our purposes, are from the latest IMF World Economic Outlook (autumn 2015). [8]

We also construct values of real-time potential output using real-time output gap and real GDP information. Since the base-year has changed in national accounts over the years, original real GDP levels in different data vintages are not comparable without rescaling. First, we rescale real GDP levels by setting the real GDP level in 1980 in all data vintages equal to the real GDP level in 1980 in autumn 2015 data vintage, and then we calculate the implied real-time potential output levels using the formula: $POT_t = GDP_t/[(OG_t/100) +1]$.

Appendix figures 3–6 show current-year estimates, forecasts made in the previous autumn and final estimates of all the variables in our data set for Germany, France, Italy and Spain. These countries dominate the euro area, with a combined weight of about 80%. Although the sharp decrease in real GDP was totally unexpected in 2008 in all countries, it was observed in 2009 in real time (see appendix figure 3). Appendix figure 4 indicates that current-year output gap estimates and corresponding forecasts made in the previous year have been typically very similar, but afterwards these estimates have been clearly revised upwards, especially before the financial crisis. In Italy and France, potential output growth was permanently over-estimated

[7] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherland, Portugal and Spain.
[8] Statistics for the most recent years are not yet final. This is particularly true for output gap.

in real time in the pre-crisis years (see appendix figure 5). In France and Germany, current-year estimates of potential output growth were negative in 2009, but according to revised information it was negative only in Italy. The financial crisis deteriorated budget balances in all countries, as shown in appendix figure 6. In 2011 and 2012 budget balance developments in Spain were clearly weaker than assessed in real time.

3 Analysis of forecast errors

Next, we consider the average errors of all variables in our panel data set. Forecast errors are defined as the difference between forecasts (made in the previous autumn) and the corresponding revised information (WEO autumn 2015). In addition to the euro area and its individual countries in the whole sample (2004 – 2014), we consider average forecast errors in two sub-periods and two country groups separately.

The two sub-periods are separated by the onset of the financial crisis: 2004 – 2007 (boom years before the crisis) and 2008 – 2014 (years since the beginning of the crisis).[9] The country groups are separated by developments in their government bond yields. Ten-year government bond interest rate differentials vs. Germany were negligible until 2008 when Lehman Brothers collapsed (see figure 1). Interest rate differentials rose gradually in 2009–2010 in Greece and Ireland, and in 2010 even in Portugal, Spain and Italy. In these countries, classified as GIIPS countries, government debt-to-GDP ratios were already high or rising fast since the beginning of the financial crisis. Austria, Belgium, Finland, France, Germany and the Netherlands are classified as high-rated (or AAA) countries.[10] It is clear that the financial crisis contributed to lower real GDP growth rates and more negative budget balances (see Appendix figures 1 and 2). Economic developments have been highly divergent in the two country groups since 2008.

[INSERT FIGURE 1 HERE]

[9] Lehman Brothers collapsed in September 2008.

[10] Belgium is classified as a high-rated country, although its government debt ratio is high. France is also classified as a high-rated country despite recent sluggish economic growth. Another way to construct the country groups would be to apply a switching parameters' model using government interest rate differentials as the shift indicator.

Figure 2 illustrates the average forecast errors for real GDP growth. Positive (negative) mean forecast error, i.e. positive (negative) bar, indicates that growth forecasts have on the average been overly optimistic (pessimistic) in comparison to final data. Figure 2 shows that real-time growth forecasts were overly pessimistic before the crisis but overly optimistic since the beginning of the crisis. Forecast errors seem to have been asymmetrical, i.e. overestimation of growth has typically been greater than underestimation, particularly in the GIIPS countries.

[INSERT FIGURE 2 HERE]

According to Figure 3 forecast errors for the output gap have generally been negative before the crisis as well as since the crisis. This suggests that in real time the cyclical situation is typically assessed as weaker than it actually is. Forecast errors seem to be much greater during the boom years before the crisis in both the GIIPS countries and the high-rated countries.[11] The negative forecast error for the output gap may be the result of either underestimation of GDP or overestimation of potential output. Both underestimation of GDP and overestimation of potential output indicate that, according to the revised data, cyclical conditions were in fact better than assessed in real time.

[INSERT FIGURE 3 HERE]

The average forecast errors for real GDP level and potential output level are presented in figures 4 and 5. These forecast errors are calculated as logarithmic differences of forecasted and revised levels. Forecast errors for output gap can be approximated by the difference of forecast errors for GDP and potential output.[12] Thus, figures 4 and 5 show that the large negative forecast errors for the output gap in the pre-crisis years in figure 3 are mainly due to negative errors in real GDP level, i.e. underestimation of real GDP level. In the pre-crisis years the largest negative forecast errors in potential output level has been measured for the Netherlands and the largest positive errors for Belgium and Ireland. After 2007 the biggest

[11] Borio, Disyatat and Juselius (2013) have made similar observations.
[12] See Turner et al., 2016.

positive errors have been measured for Greece and Finland and the largest negative errors for Ireland and the Netherlands.

[INSERT FIGURES 4 AND 5 HERE]

On the other hand, the average forecast errors for potential output growth have been systematically positive (with only one exception) as shown in figure 6. The largest errors are measured for Ireland, Portugal and Italy in the 1st sub-sample and for Greece, Finland, Portugal and Italy for the 2nd sub-sample. In the pre-crisis years, overestimation of potential output growth was substantial in the GIIPS countries compared to high-rates countries, but the corresponding difference between the two country-groups is minor in the after-crisis period.

[INSERT FIGURE 6 HERE]

Figure 7 shows that budget balances were typically under-forecasted before the crisis but over-forecasted after the crisis (to an even greater extent). One possible explanation points to growth forecasts, which are correspondingly biased according to figure 2. A clear exception is Greece, where positive forecast errors before the crisis are partly explained by earlier deficiencies in the quality of statistics. Germany is also an interesting exception in that the forecasts have been pessimistic in both periods. It is worth noting that budget balance is the difference between two variables, government revenues and government expenditures. This complicates the forecasting since the two variables react in different way to economic shocks.

[INSERT FIGURE 7 HERE]

T-test results for means of forecast errors are reported in in appendix table 1. They indicate that forecasts of budget balances, real GDP growth, output gaps and potential output growth have been systematically biased in the full sample: in all cases the null hypotheses, according to which the mean of forecast error is zero, are rejected at the 5 per cent significance level. However, the same result is not obtained for all subsamples. For budget balance forecasts, we

find evidence of systematic forecasting bias only for the full sample period and after-crisis period in the sets of all countries and GIIPS countries. Correspondingly, growth forecasts have been systematically biased in all sub-samples except for the full sample period for high-rated countries and the pre-crisis period for GIIPS countries. However, potential output growth forecasts have been systematically biased in all sub-samples except for the after-crisis period for the GIIPS countries. Finally, the output gap forecasts have been systematically biased in all sub-samples except for post-crisis periods. The result for output gap forecasts is not surprising, as final data revisions for the most recent years are yet to come.

Distributions of real-time forecasts of budget balances and corresponding final data variables for all the euro area countries in the two sub-periods are shown in figure 8. The vertical blue line stands for the 3 % (of GDP) threshold value of the excessive deficit procedure (EDP). Figure 8 illustrates how the distribution of budget balance forecasts differs from the final data. Before the crisis, final data for budget balances are more evenly distributed compared to the forecasted figures. Yet in both periods the distribution of final data is more skewed to the left, compared to the forecasts.

[INSERT FIGURE 8 HERE]

Overall, figures 2 – 8 indicate that forecast errors have been quite heterogeneous across the euro area countries. Forecasts of budget balances have been systematically biased and final data on real GDP growth, output gaps and potential output growth seem also to have systematically differed from real-time forecasts. Typically the forecasts for both growth and budget balances have been somewhat too gloomy before the crisis but clearly overoptimistic since the onset of the crisis. Forecast errors for output gap have been negative and were especially large before the crisis. Errors in potential output growth have been positive in both sub-periods. Overall, forecast error calculations presented above highlight the fact that the financial crisis has further increased the real-time uncertainty surrounding fiscal policy decisions. Because of large data revisions, policy makers' intentions at the time policy decisions need to be analysed using real-time data.

Real-time forecast errors of fiscal variables have been explained by political and institutional factors. For example, de Castro et al. (2013), who study fifteen EU countries for the period 1995–2008, provide evidence that preliminary releases of government balances are

systematically biased and are poor predictors of subsequent releases. They argue that the evolution of data revisions reflect political cycles (real-time estimates are too optimistic before elections and during recessions). Beetsma et al. (2013) have examined budget planning and implementation in the Netherlands in 1958 – 2009. They find that on average planned balances have been unbiased. However, plans were too optimistic in the first half of the sample and too pessimistic in the second half of the sample. According to their findings, errors in budget planning are related to institutional factors.

4 Regression analysis

In this section we first analyse how current economic conditions at the time of budget planning affect forecasted budget balance changes. Then we explore whether errors in budget balance forecasts can be explained by real-time information and/or by revisions. The common data source (IMF World Economic Outlook publications) is useful for pooling and panel least squares estimations, since all variables are constructed using the same methodology and comparable across the countries. Without data pooling, we could not analyse the two sub-periods or the two country groups because of the short samples.[13, 14]

4.1 How current economic conditions and budget balance changes are related?

Forecasted change in the budget balance is defined as $FDBB_t = BBF1_t - BBC_{t-1}$. In this definition, the term $BBF1_t$ denotes forecasted budget balance in period t (forecast made in period t-1) and the term BBC_{t-1} refers to nowcast of budget balance, assessed in period t-1. Period t-1 nowcasts of output gap and real GDP growth are denoted by OGC_{t-1} and $GDPC_{t-1}$. In the following equations forecasted budget balance changes are explained by nowcast estimates of economic conditions at the time of forecasting:

$$FDBB_t = \alpha + \beta BBC_{t-1} + \lambda OGC_{t-1} + \varepsilon_t \quad (1)$$

$$FDBB_t = \alpha + \beta BBC_{t-1} + \lambda GDPC_{t-1} + \varepsilon_t \quad (2).$$

[13] Timmermann (2007) has shown that the performance of the WEO forecasts is similar to that of the consensus forecasts.

[14] Pooling is commonly used in the analysis of fiscal policies. Bernoth et al. (2008) have shown that poolability cannot be rejected in the case of fiscal policy reaction functions for 14 European countries.

We measure cyclical conditions using two alternative variables: the output gap and real GDP growth. We assume that due to challenges to assess output gap in real time, policy makers may evaluate cyclical conditions by focusing on real GDP growth indicators. Compared to the output gap, real GDP growth indicators are easier to understand and measure, and are frequently used in policy debate and media discussion.

A negative β coefficient in equations (1) and (2) reflects mean reversion in budget planning.[15] On the other hand, a negative λ coefficient indicates that a positive output gap (or real GDP growth) at the time of budget planning is expected to lead to a negative budget balance change (deterioration of the balance) next year. This could indicate mean reversion in cyclical conditions, i.e. that beneficial cyclical conditions this year lead to less beneficial cyclical conditions next year.

For comparison, we also analyze the relationship between actual budget balance improvements and ex post economic conditions. The term BBF_t refers to the revised budget balance in period t, so that the actual budget balance improvement is $DBB_t = BBF_t - BBF_{t-1}$. Revised output gap and real GDP growth in period t-1 are denoted by OGF_{t-1} and $GDPF_{t-1}$. We estimate the following equations:

$$DBB_t = \alpha + \beta BBF_{t-1} + \lambda OGF_{t-1} + \varepsilon_t \quad (3)$$

$$DBB_t = \alpha + \beta BBF_{t-1} + \lambda GDPF_{t-1} + \varepsilon_t \quad (4).$$

It is interesting to compare estimation results based on real-time data vs. revised data. Equations (1) and (2) indicate how economic conditions assessed at the time (nowcast estimates) and budget planning are related, whereas equations (3) and (4) reveal the relationship between the corresponding revised variables (measured afterwards). It is worth pointing out that our extensive use of real-time information enables us to study of policymakers' intentions at decision time.[16]

Panel least squares estimation results for equations (1) – (4) are summarised in table 1. They clearly indicate that, compared to revised data, mean reversion has been under-forecasted in real time. In almost all cases the estimated β coefficients of BBF_{t-1} are lower (more negative)

[15] In terms of a simple AR(1) process $S_t = \alpha S_{t-1} + \varepsilon_t$, mean reversion means that $0 < \alpha < 1$ (see Hillebrand, 2003, and Mpatswe et al., 2011). For mean reversion in fiscal policy, see also Lau and Baharumshah, 2009.

[16] Frankel and Schreger (2013) estimate also equation (1), but only forecasted budget balances are based on real-time information.

than for the BBC_{t-1} term; only in the pre-crisis period is the opposite the case. Intended mean reversion coefficients (based on real-time data) are quite similar and close to zero in all cases, but according to the revised data the strongest mean reversion, i.e. the largest negative coefficients, are obtained for the crisis period and for the GIIPS countries. It is worth noting that in Frankel and Schreger (2013) mean reversion is over-forecasted in real time, but their analysis is only partially based on real-time data.

[INSERT TABLE 1 HERE]

Most of the estimated λ coefficients are insignificant in table 1, which suggests that the impact of cyclical conditions on budget balance change is very weak in both real-time estimations and estimations based on revised data. For the full sample, the estimated coefficient of the nowcasted output gap does not deviate significantly from zero (but we obtain a negative and statistically significant coefficient in two other cases). Instead, the coefficient of nowcasted real GDP growth is positive and statistically significant with only one exception. When output gap specification with revised data is considered, the estimated λ parameter is statistically significant for the full sample and two other cases (after-crisis period and GIIPS countries)[17]. In the case of real GDP growth with revised data, the significant λ coefficient is obtained for the full sample and high-rated countries.[18]

Next, we examine the determinants of forecasted budget balance changes in more detail. We follow Frankel and Schreger (2013) and use dummy variables $Surplus_{t-1}$ and $Decifit_{t-1}$ to estimate separate coefficients for positive and for negative nowcasts of budget balances in period t-1. For example, modified equation (1) has the following form:

$$FDBB_t = \alpha + \beta_1 Surplus_{t-1} BBC_{t-1} + \beta_2 Deficit_{t-1} BBC_{t-1} + \lambda OGC_{t-1} + \varepsilon_t \qquad (5).$$

Estimation results in table 2 clearly reveal that mean reversion is related only to deficits. The estimated β parameters are statistically insignificant when the budget balance is positive but clearly negative when the balance is negative. This holds for estimations based on both real-

[17] This result for the output gap is consistent with the findings of Frankel and Schreger (2013).

[18] We also estimated equations (1) – (4) with period fixed effects, which are assumed to capture common factors driving all fiscal policies and common changes in variable definitions. In addition, they are assumed to capture interdependence in fiscal policies caused by factors other than common economic conditions. We obtain only few statistically significant λ coefficients when period effects are included in estimations. Period fixed effects are not used in panel least estimations presented by Frankel and Schreger (2013).

time and revised data. Again, more negative β coefficients are estimated when we use revised data, and the strongest mean reversion coefficients are obtained for the crisis period and for the GIIPS countries. Still variation in β coefficients is relatively small. The separate coefficients for budget balance surpluses and deficits seems not to notably affect the estimated λ coefficients. With period fixed effects the estimation results are qualitatively unchanged, but the empirical fit is somewhat higher (see table 3). [19]

[INSERT TABLES 2 AND 3 HERE]

We provide robust evidence that in real time negative budget balances are expected to be reduced, but reduction is even larger according to the revised data. This may be due to the fact that, although quite stable budget balance developments are expected in all cases in real time, budget balances have been quite volatile in the second sub-period and in the GIIPS countries. It is interesting to notice that real GDP growth seems to better explain forecasted change in budget balance than the output gap. This supports the view that because of serious difficulties in measuring output gap in real time, policymakers also pay attention to real GDP growth as a proxy for cyclical conditions.

4.2 How to explain errors in budget balance forecasts?

Is this section we consider errors in budget balance forecasts, which are defined as the difference between the forecasted variable (based on real-time information) and the corresponding ex-post variable (based on revised information):

$$BBFE_t = BBF1_t - BBF_t \qquad (6).$$

A positive (negative) forecast error indicates that expectations are over-optimistic (too pessimistic) compared to revised information. Nowcast errors in period t can be expressed as follows:

[19] We also examined the impact of Greece on the estimation results. If Greece is excluded in our panel data set, the results for OGF_t and OGC_t become weaker, but for $GDPF_t$ and $GDPC_t$ they become stronger in specifications without period fixed effects. Otherwise, excluding Greece does not greatly affect the results in broad terms.

$$BBCFE_t = BBC_t - BBF_t \quad (7)$$

$$OGCFE_t = OGC_t - OGF_t \quad (8)$$

$$GDPCFE_t = GDPC_t - GDPF_t \quad (9).$$

Thus, it is clear that we can divide our revised variables into two components, i.e. nowcasted estimate and the corresponding nowcast error (measured afterwards)[20]:

$$BBF_t = BBC_t - BBCFE_t \quad (10)$$

$$OGF_t = OGC_t - OGCFE_t \quad (11)$$

$$GDPF_t = GDPC_t - GDPFE_t \quad (12).$$

When analyzing errors in budget balance forecasts, we estimate the following equations:

$$BBFE_t = a + bBBC_{t-1} + cBBCFE_{t-1} + dOGC_{t-1} + eOGCFE_{t-1} + \varepsilon_t \quad (13)$$

$$BBFE_t = a + bBBC_{t-1} + cBBCFE_{t-1} + dGDPC_{t-1} + eGDPCFE_{t-1} + \varepsilon_t \quad (14).$$

The BBC_{t-1} and $BBCFE_{t-1}$ terms are indicators for policy persistence, which measures the degree of dependence of policy decisions on past fiscal developments.[21] The terms BBC_{t-1} and OGC_{t-1} ($GDPC_{t-1}$) are related to real-time information, whereas the terms $BBCFE_{t-1}$ and $OGCFE_{t-1}$ ($GDPCFE_{t-1}$) are related to revisions (unanticipated components) measured afterwards. Therefore, the *b* and *d* parameters in the above equations reveal possible real-time reasons for over-optimism, whereas the *c* and *e* parameters reflect the importance of revisions.[22]

Estimation results are summarised in table 4. They clearly indicate that errors in budget balance forecasts are mainly due to revisions in current budget balance and the contribution of other variables is quite limited. We obtain statistically significant coefficients for the nowcasted budget balance (parameter *b*) only in the case of real GDP growth specification, but the estimated *c* parameters for the term $BBCFE_{t-1}$ are positive and statistically significant (with only one exception). Therefore, a positive error of the nowcasted budget balance typically

[20] These two components cannot be analyzed separately in Frankel and Schreger (2013) dataset.

[21] According to Afonso et al. (2010) policy persistence restrains policy makers' leeway in policy decisions in the short run.

[22] Avellan and Vuletin (2015) have examined implications of output forecast errors on fiscal procyclicality. They have defined the forecast error of output growth (Δy^{FE}) as the difference between ex-post (Δy) and predicted (Δy^{PRED}) changes in output (i.e. $\Delta y^{FE} = \Delta y - \Delta y^{PRED}$).

increases positive error in budget balance forecasts. The effects of cyclical variables on budget balance forecast errors is surprisingly small, since only few estimated *d* and *e* parameters are statistically significant. Overall, table 4 reveals the dominant role of revisions in current budget balances.[23,24]

[INSERT TABLE 4 HERE]

So far we have analysed how errors in budget balance are related to current economic conditions. Next, using forward looking specifications, we examine how errors in budget balance forecasts are related to expected economic conditions, i.e. the forecasted output gap or forecasted real GDP growth:

$$BBFE_t = a + bBBC_{t-1} + cBBCFE_{t-1} + dOGF1_t + eOGFE_t + \varepsilon_t \quad (15)$$

$$BBFE_t = a + bBBC_{t-1} + cBBCFE_{t-1} + dGDPF1_t + eGDPFE_t + \varepsilon_t \quad (16).$$

Two-stage least squares estimation results (we use nowcast estimates of current economic conditions and their revisions as instruments) are reported in table 5. They clearly confirm the earlier finding that errors is budget balance forecast are dominantly explained by errors in current budget balances. Compared to table 4, we get more statistically significant *b* parameters for nowcasted budget balance when considering the output gap specification, but the opposite is true in the case of real GDP growth specification. The impact of expected cyclical conditions on errors in budget balance forecasts is still weak, especially in the case of the output gap. The results in table 5 lend weak support to our earlier suggestion that policy makers may have reasons to rely more on real GDP growth than on the output gap in real-time budget planning (see section 4.1).

[INSERT TABLE 5 HERE]

[23] The dominant role of revisions in current budget balances is confirmed, if equations (13) and (14) are estimated with period fixed effects (available upon request).

[24] We analysed separately the impact of Greece on our estimation results. If Greece is excluded from our panel data set, the results for $BBCFE_t$ become somewhat weaker but for $GDPCFE_t$ they become somewhat stronger in specifications with real GDP growth. Moreover, the results for $GDPC_t$ become somewhat stronger in specifications without period fixed effects, but the impact of excluding Greece becomes mixed without them. Otherwise, excluding Greece does not greatly affect the results in broad terms.

The above estimation results clearly indicate that revisions on current budget balance mainly explain errors in forecasting, but the low impact of expected cyclical conditions and their errors is somewhat puzzling. Especially, the insignificant *d* and *e* parameters in the output gap -based specification is surprising. Next, we analyse errors in real-time output gaps in more detail. Using our real-time data set, we are able to divide the forecasted error in the output gap into two separate components (i.e. the forecasted error in real GDP level and the forecasted error in potential output level):

$$OGFE_t \sim GDPLEVFE_t - POTFE_t \qquad (17).$$ [25]

The estimation results in table 6 confirm the result that the role of revisions to current budget balance is dominating, but still, the two separate error components of the expected output gap are insignificant in most cases. For high-rated countries, the impact of output gap forecasting error on budget balance forecast error is related to both of its components, i.e. forecast error in real GDP level and forecast error in potential output level.[26]

[INSERT TABLE 6 HERE]

Finally, we estimate the equation for budget balance forecast errors, in which we use potential output growth (and corresponding forecast error term) and real GDP growth (and corresponding forecast error term) instead of output gap (and corresponding forecast error term). We estimate the following equation:

$$BBFE_t = a + bBBC_{t-1} + cBBCFE_{t-1} + dPOTGF1_t + ePOTGFE_t + fGDPF1_t + gGDPFE_t + \varepsilon_t \qquad (18).$$

Again, the terms BBC_{t-1} and $BBCFE_{t-1}$ refer to nowcasted budget balance and its nowcast error. The other explanatory variables are forecasted potential output growth and real GDP growth[27] and their forecast error terms.

[25] Turner et al. (2016) have recently decomposed output gap revisions into revisions in real GDP level and potential output level.

[26] If we estimate the equation behind table 6 with period fixed effects, the results are qualitatively unchanged (estimation results are available upon request).

[27] These two variables represent decomposition of forecasted output gap *change*.

Estimation results are reported in table 7. They confirm the earlier robust finding that revisions to current budget balance contribute to errors in budget balance forecasting. Instead, nowcast estimates of budget balance still do not affect errors in budget balance forecasting. In our earlier estimations, the output gap seemed not to be important determinant of errors in budget balance forecasts. However, when considering a more detailed specification, our full sample estimations reveal that both expected potential output growth and expected real GDP growth, as well as forecast errors of these variables have a clear impact on budget balance forecast errors. The same result is obtained also for the after-crisis period and GIIPS counties. In these three samples all estimated coefficients which are related to macroeconomic conditions (parameters *d, e, f* and *g*) are statistically significant. For high-rated countries only expected real GDP growth and forecast error of expected real GDP growth are significant.[28, 29] These results are consistent with the earlier analysis of forecast errors in section 3.

[INSERT TABLE 7 HERE]

Favourable real GDP growth expectations tend to restrain whereas favourable potential output growth expectations tend to increase over-optimism in budget balance forecasts. Regarding forecast errors of macroeconomic conditions, optimism in real GDP growth forecasts increases over-optimism in budget balance forecasts. This result is very natural as better growth is expected to improve budget balances. However, optimism in potential output growth forecasts restrains over-optimism in budget balance forecasts. This could reflect the facts that in case of negative output gap a strong potential output growth forecast implies a pressure for the forecasted output gap to widen and that a wider output gap is associated with weaker budgetary outcomes.

All in all, errors in nowcasted budget balance estimates seem to be important determinants of errors in forecasted budget balances. In addition, an extensive use of real-time information indicates that both the forecasted real GDP growth and forecasted potential output growth and their revisions are indeed central determinants of budget balance forecast errors. We find that it is very challenging to assess both real GDP growth and potential output growth in real time.

[28] If we introduce period fixed effects into equation 18, the results become somewhat weaker.

[29] Using the difference between the forecasted and actual budget balance change: $\Delta BBFE_t = (BBF1_t - BBC_{t-1}) - (BBF_t - BBF_{t-1})$ instead of $BBFE_t$ as the dependent variable does not qualitatively change the results.

Using large IMF WEO real-time data for 175 countries, Ley and Misch (2014) have studied how inaccurate output data at the time affect overall and structural fiscal balances. They compute Hodrick-Prescott filtered output gap for each data vintage and develop a model to formalize the linkages between output data revisions and fiscal policy balances. They provide evidence that the impact of output revisions is significant on overall and structural balances. In addition, output data revisions may lead to significant surprises in debt accumulation. Our analysis of euro area countries using production function based output gaps and a different approach, confirm the findings in Ley and Misch (2014).

5 Conclusions

This paper has examined budget planning in the euro area countries using real-time data constructed from IMF World Economic Outlook publications. Annual panel estimations were used to illustrate the effects of current economic conditions on budget planning. Errors in budget balance forecasts were also investigated. Our analysis has been based on extensive use of real-time information.

We provide evidence that developments in budget balances, real GDP growth, the output gap and potential output growth have systematically deviated from forecasts made in the previous autumn. The financial crisis reduced forecast accuracy and increased heterogeneity across euro area countries. Our analyses indicate that mean reversion in budget planning has been substantial in both real-time and revised data, but only in the case of negative budget balances. Stronger mean reversion is systematically related to revised information. A robust result is that revisions to current budget balance contribute to errors in budget balance forecasts. We also find that both real-time forecasts of macroeconomic conditions and their revisions have contributed to errors in budget balance. This means that even without intentional optimism in forecasting, revisions to current budget balance estimates, forecasted real GDP growth and forecasted potential output growth may lead to large mistakes in budgetary planning and substantial unplanned debt accumulation.

We have analysed here only the intended path of fiscal policy at the time of budget planning. However, additional policy decisions are typically made during the budget implementation stage in the course of the budgetary year, in response to data revisions and new economic information. Thus, the central role of data revisions in budget balance forecast errors may partly reflect fiscal adjustments after the budgetary planning stage. We would point out that fiscal

adjustments in the course of the budgetary year may have negative effects on the economy. Economic agents' expectations on next years' fiscal policy are mainly based on budget plans. If, however, plans are notably adjusted in the implementation stage, it might be costly for economic agents to change their behaviour accordingly.[30]

Real-time uncertainty in fiscal policy is not only related to macroeconomic information, but also to institutional and political factors as well as forecasting models. In order to handle real-time uncertainty, we need good fiscal governance, reliable statistics and tight budgetary monitoring. In spite of real-time challenges, macroeconomic stabilisation objectives and long-term sustainability of government debt can be achieved, with sufficient fiscal prudence. Strong institutions and fiscal discipline can handle both positive and negative shocks. They can ensure that enough room of manoeuvre and fiscal buffers are created in favourable economic conditions.

In recent years the nature of the business cycle may have changed due to increasing linkages between the financial and real sides of the economy. Also sensitivity of many countries to economic shocks may have strengthened due to increased debt levels. These changes have increased uncertainty about the output gap, and hence about budget balances. Real-time economic uncertainty is inevitably present, when fiscal policy is conducted. Uncertainty in fiscal policy has monetary policy implications as appropriate fiscal policy in the euro area countries supports the price stability objective in the monetary union.

[30] For example, Beetsma and Giuliodori (2010) have used real-time information in order to analyse fiscal plans and their implementation separately in OECD countries in 1995–2006.

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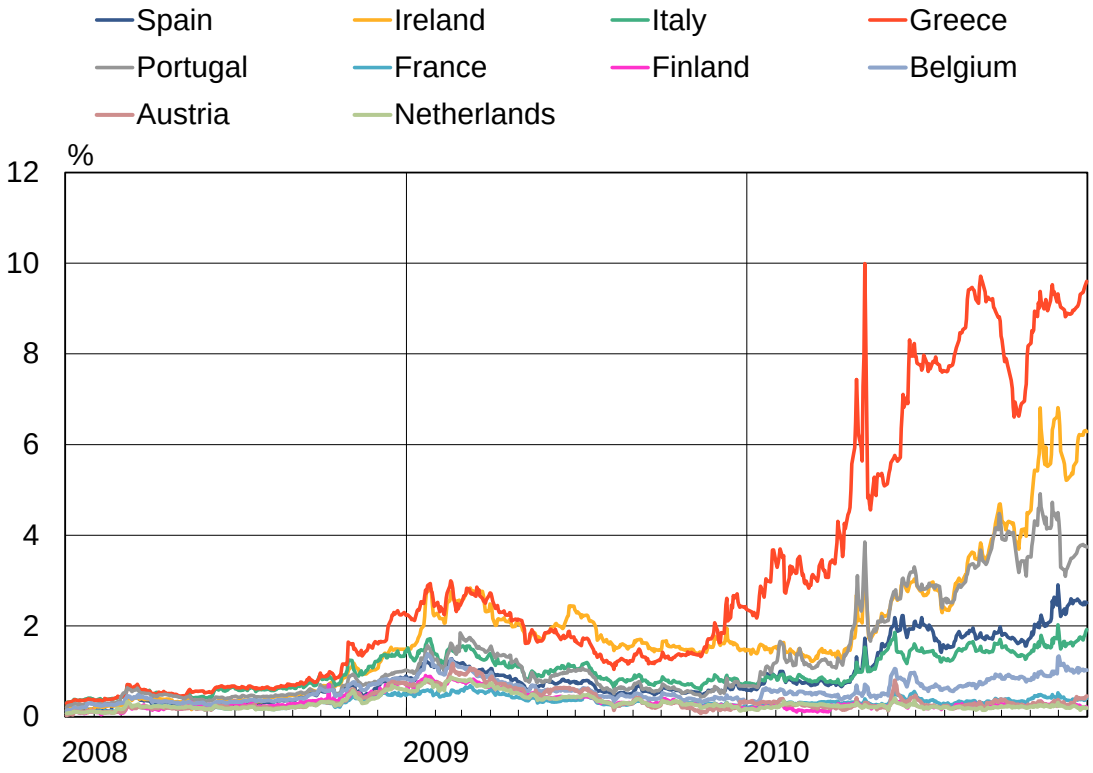
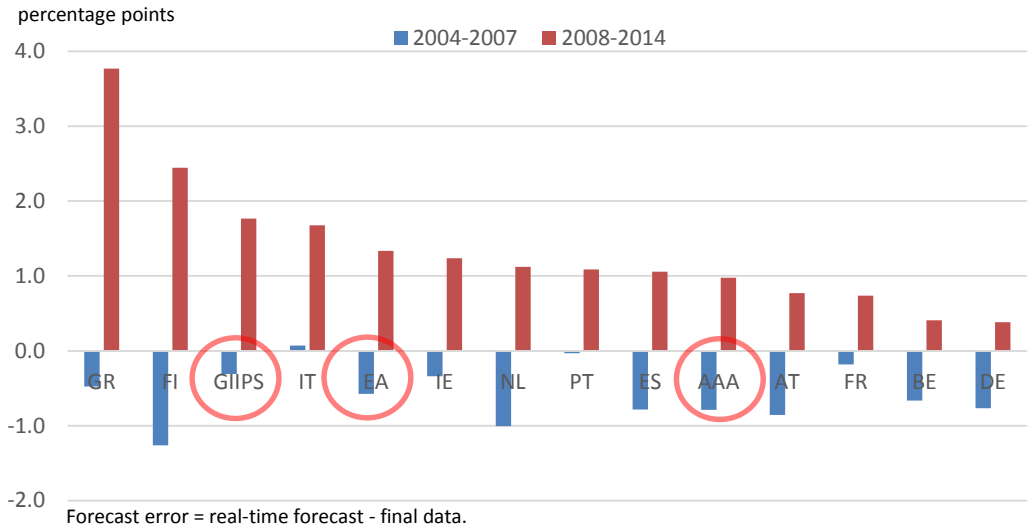
Figure 1. Ten-year government bond interest rate differentials vs. Germany



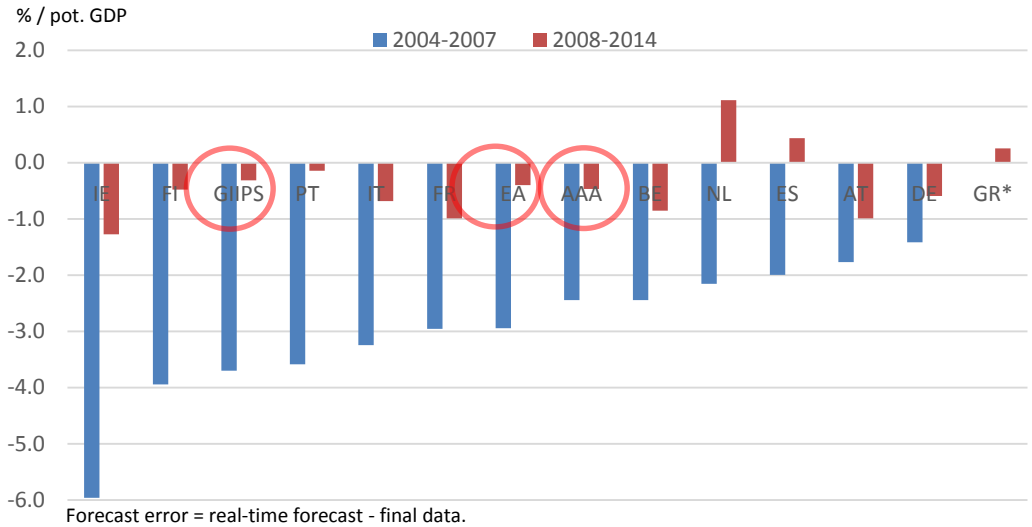
Source: Bloomberg.

Figure 2. Mean forecast error for real GDP growth



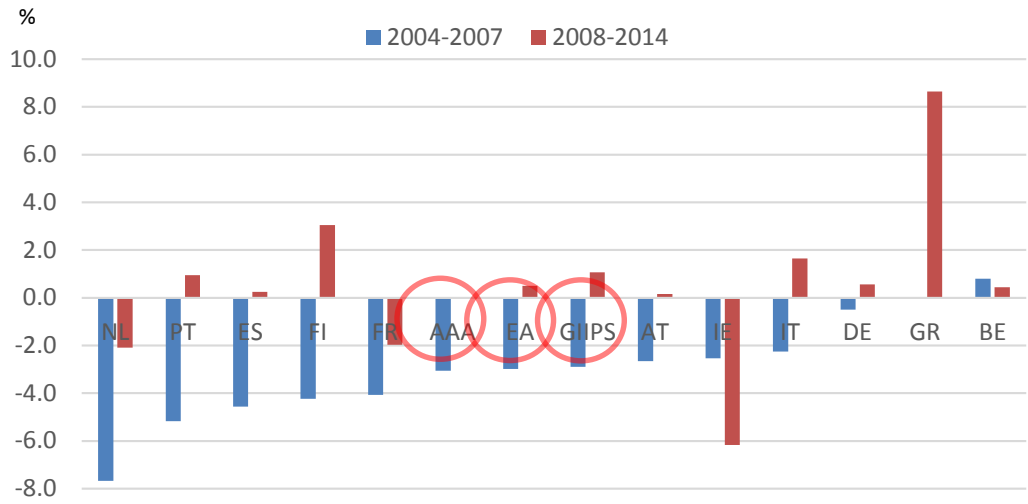
Forecast error = real-time forecast - final data.
Figures for country aggregates are unweighted averages of shown countries.
Sources: IMF WEO autumn 2003-2013, IMF WEO spring 2015 and Bank of Finland calculations.

Figure 3. Mean forecast error for output gap



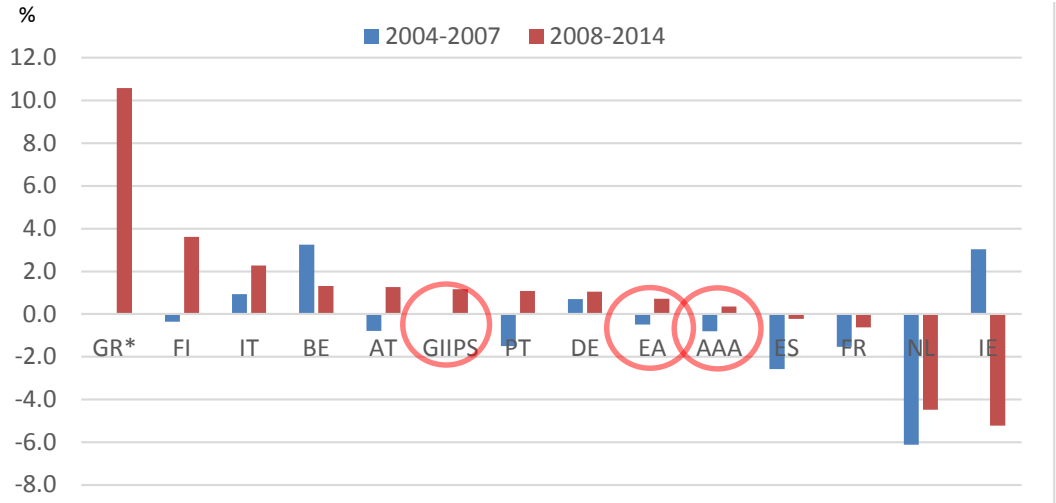
Forecast error = real-time forecast - final data.
*Greece 2010-2014, figures for country aggregates are unweighted averages of shown countries.
Sources: IMF WEO autumn 2003-2013, IMF WEO spring 2015 and Bank of Finland calculations.

Figure 4. Mean forecast error for real GDP level



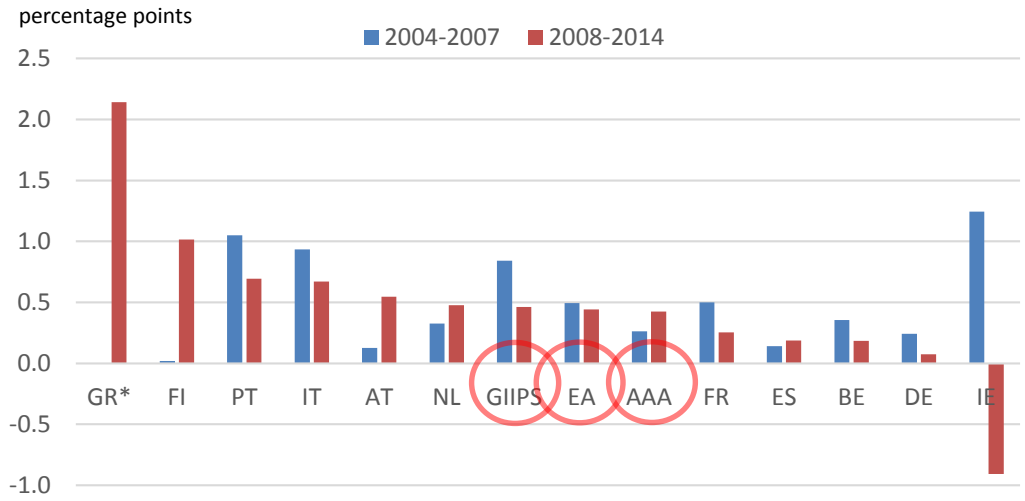
Forecast error = real-time forecast - final data.
Figures for country aggregates are unweighted averages of shown countries.
Sources: IMF WEO autumn 2003-2013, 2015 and Bank of Finland calculations.

Figure 5. Mean forecast error for potential output level



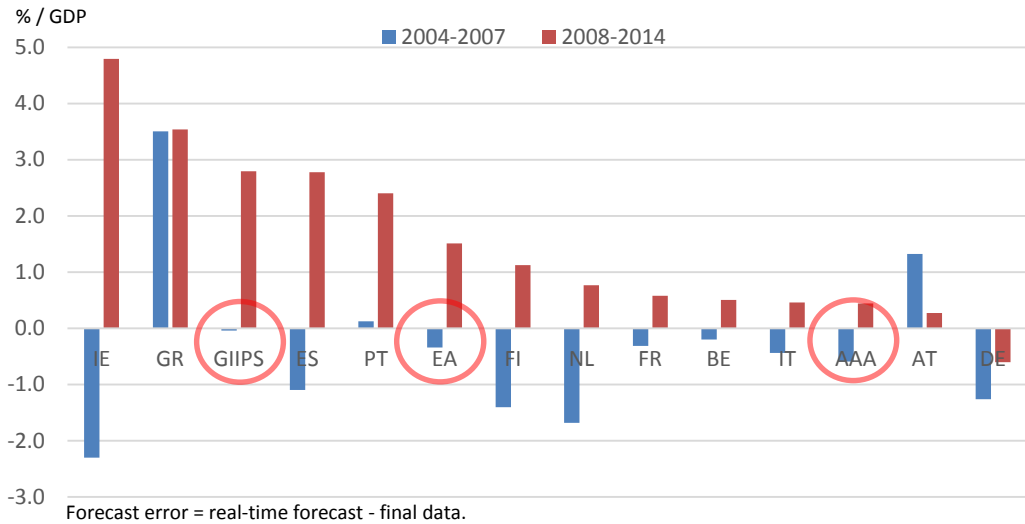
Forecast error = real-time forecast - final data.
*Greece 2010-2014, figures for country aggregates are unweighted averages of shown countries.
Sources: IMF WEO autumn 2003-2013, 2015 and Bank of Finland calculations.

Figure 6. Mean forecast error for potential output growth



Forecast error = real-time forecast - final data.
*Greece 2010-2014, figures for country aggregates are unweighted averages of shown countries.
Sources: IMF WEO autumn 2003-2013, 2015 and Bank of Finland calculations.

Figure 7. Mean forecast error for overall budget balance



Forecast error = real-time forecast - final data.
Figures for country aggregates are unweighted averages of shown countries.
Sources: IMF WEO autumn 2003-2013, IMF WEO spring 2015 and Bank of Finland calculations.

Figure 8. Real-time forecasts and final data for budget balances

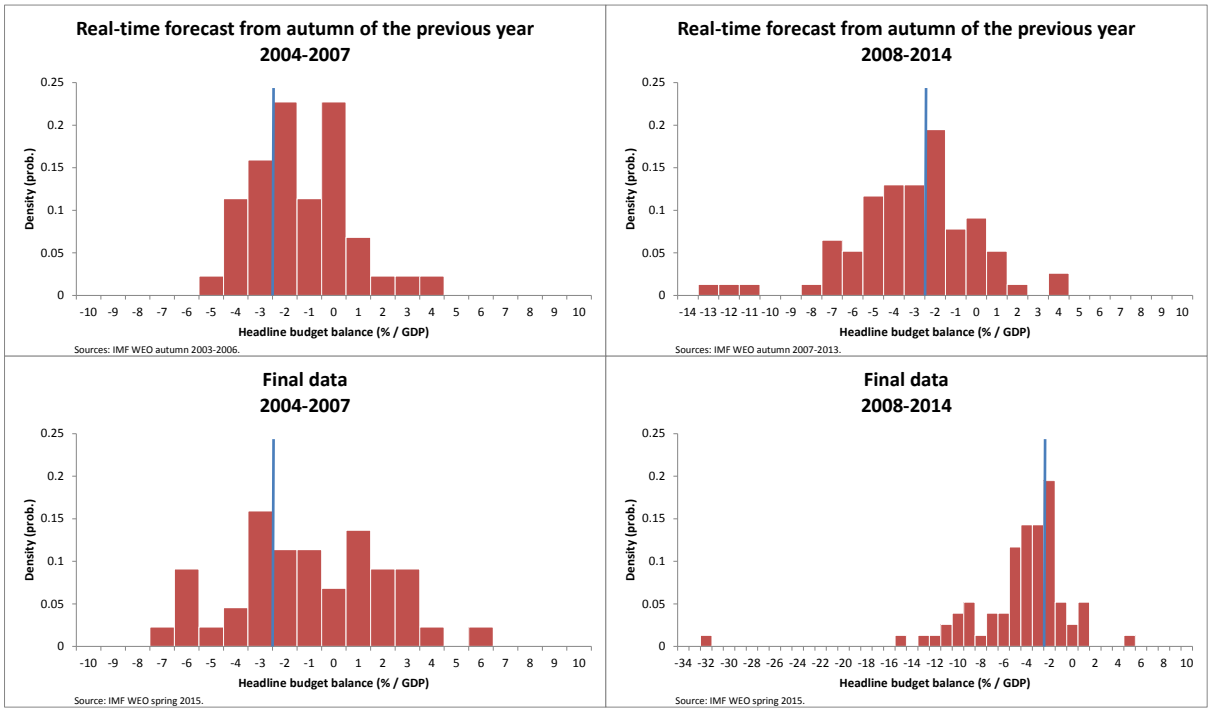


Table 1 Impact of economic conditions on budget balance change

Output gap specification

Sample:	FULL		PRECRISIS		AFTER-CRISIS		AAA		GIIPS	
Dep. Var:	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB
C	-1.010	-0.308	0.380	-0.047	-2.163	-0.351	-0.484	-0.035	-1.894	-0.602
	(0.357)***	(0.121)**	(0.274)	(0.130)	(0.534)***	(0.179)*	(0.294)	(0.127)	(0.786)**	(0.242)**
BBF(-1)	-0.235		-0.041		-0.339		-0.182		-0.312	
	(0.063)***		(0.079)		(0.080)***		(0.112)		(0.101)***	
OGF(-1)	-0.271		-0.094		-0.329		-0.175		-0.286	
	(0.085)***		(0.107)		(0.104)***		(0.126)		(0.130)**	
BBC(-1)		-0.142		-0.142		-0.138		-0.128		-0.157
		(0.030)***		(0.049)***		(0.039)***		(0.043)***		(0.043)***
OGC(-1)		-0.083		0.118		-0.123		0.090		-0.171
		(0.052)		(0.081)		(0.065)*		(0.075)		(0.073)**
Observations:	121	115	44	40	77	75	66	66	55	49
R-squared:	0.217	0.313	0.033	0.189	0.326	0.326	0.179	0.129	0.257	0.437

Real GDP growth specification

Sample:	FULL		PRECRISIS		AFTER-CRISIS		AAA		GIIPS	
Dep. Var:	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB
C	-1.620	-0.598	0.454	-0.333	-2.415	-0.588	-1.103	-0.528	-2.677	-0.740
	(0.414)***	(0.124)***	(0.465)	(0.185)*	(0.578)***	(0.167)***	(0.330)***	(0.114)***	(0.870)***	(0.251)***
BBF(-1)	-0.360		-0.048		-0.439		-0.378		-0.433	
	(0.069)***		(0.083)		(0.088)***		(0.090)***		(0.113)***	
GDPF(-1)	0.244		-0.052		0.195		0.225		0.269	
	(0.106)**		(0.128)		(0.145)		(0.096)**		(0.179)	
BBC(-1)		-0.241		-0.119		-0.260		-0.181		-0.272
		(0.026)***		(0.041)***		(0.033)***		(0.031)***		(0.045)***
GDPC(-1)		0.166		0.072		0.203		0.234		0.132
		(0.034)***		(0.059)		(0.043)***		(0.037)***		(0.056)**
Observations:	121	121	44	44	77	77	66	66	55	55
R-squared:	0.186	0.413	0.019	0.167	0.253	0.457	0.222	0.458	0.222	0.431

Note: ***, ** and * denote significance at the level of 1, 5 and 10 per cent, respectively.

Table 2 Impact of economic conditions on budget balance change

Separate coefficients for positive and negative budget balances

Output gap specification

Sample:	FULL		PRECRISIS		AFTER-CRISIS		AAA		GIIPS	
Dep. Var:	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB
C	-1.404	-0.387	0.113	-0.216	-2.319	-0.406	-0.812	-0.050	-2.638	-0.691
	(0.413)***	(0.141)***	(0.435)	(0.159)	(0.584)***	(0.206)*	(0.397)**	(0.167)	(0.927)***	(0.292)**
BBF(-1)*(BBF(-1)>=0)	0.393		0.196		0.020		0.082		1.150	
	(0.347)		(0.310)		(0.534)		(0.243)		(0.998)	
BBF(-1)*(BBF(-1)<0)	-0.289		-0.115		-0.357		-0.279		-0.386	
	(0.069)***		(0.122)		(0.085)***		(0.137)**		(0.112)***	
OGF(-1)	-0.313		-0.139		-0.346		-0.192		-0.327	
	(0.087)***		(0.122)		(0.107)***		(0.126)		(0.131)**	
BBC(-1)*(BBC(-1)>=0)		-0.020		0.075		-0.055		-0.115		0.133
		(0.115)		(0.133)		(0.158)		(0.102)		(0.530)
BBC(-1)*(BBC(-1)<0)		-0.158		-0.225		-0.147		-0.134		-0.166
		(0.033)***		(0.067)***		(0.042)***		(0.057)**		(0.047)***
OGC(-1)		-0.083		0.157		-0.124		0.091		-0.179
		(0.052)		(0.082)*		(0.065)*		(0.076)		(0.075)**
Observations:	121	115	44	40	77	75	66	66	55	49
R-squared:	0.239	0.321	0.048	0.252	0.330	0.328	0.198	0.129	0.287	0.440

Real GDP growth specification

Sample:	FULL		PRECRISIS		AFTER-CRISIS		AAA		GIIPS	
Dep. Var:	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB
C	-1.738	-0.695	0.353	-0.520	-2.361	-0.620	-1.456	-0.546	-2.897	-0.719
	(0.461)***	(0.141)***	(0.536)	(0.226)**	(0.625)***	(0.187)***	(0.434)***	(0.147)***	(0.986)***	(0.273)**
BBF(-1)*(BBF(-1)>=0)	-0.157		0.059		-0.568		-0.131		0.087	
	(0.351)		(0.286)		(0.553)		(0.218)		(1.081)	
BBF(-1)*(BBF(-1)<0)	-0.377		-0.083		-0.433		-0.486		-0.454	
	(0.075)***		(0.122)		(0.093)***		(0.125)***		(0.121)***	
GDPF(-1)	0.236		-0.065		0.199		0.232		0.240	
	(0.107)**		(0.134)		(0.147)		(0.095)**		(0.189)	
BBC(-1)*(BBC(-1)>=0)		-0.098		0.053		-0.208		-0.167		-0.371
		(0.103)		(0.130)		(0.139)		(0.081)**		(0.492)
BBC(-1)*(BBC(-1)<0)		-0.261		-0.174		-0.265		-0.187		-0.269
		(0.030)***		(0.057)***		(0.036)***		(0.041)***		(0.048)***
GDPC(-1)		0.168		0.086		0.203		0.234		0.133
		(0.034)***		(0.059)		(0.043)***		(0.037)***		(0.057)**
Observations:	121	121	44	44	77	77	66	66	55	55
R-squared:	0.189	0.424	0.023	0.205	0.253	0.458	0.241	0.459	0.225	0.431

Note: ***, ** and * denote significance at the level of 1, 5 and 10 per cent, respectively.

Table 3 Impact of economic conditions on budget balance change

Separate coefficients for positive and negative budget balances, period fixed effects

Output gap specification

Sample:	FULL		PRECRISIS		AFTER-CRISIS		AAA		GIIPS	
Dep. Var:	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB
C	-1.427	-0.431	0.142	-0.202	-2.147	-0.521	-0.549	-0.203	-2.894	-0.527
	(0.387)***	(0.122)***	(0.416)	(0.162)	(0.573)***	(0.166)***	(0.281)*	(0.162)	(1.003)***	(0.305)*
BBF(-1)*(BBF(-1)>=0)	0.221		0.200		0.011		-0.067		0.280	
	(0.306)		(0.298)		(0.493)		(0.157)		(1.003)	
BBF(-1)*(BBF(-1)<0)	-0.311		-0.114		-0.336		-0.222		-0.462	
	(0.069)***		(0.119)		(0.087)***		(0.096)**		(0.135)***	
OGF(-1)	-0.225		-0.198		-0.230		0.024		-0.165	
	(0.103)**		(0.132)		(0.136)*		(0.109)		(0.194)	
BBC(-1)*(BBC(-1)>=0)		-0.006		0.093		-0.049		-0.052		-0.084
		(0.087)		(0.136)		(0.112)		(0.078)		(0.525)
BBC(-1)*(BBC(-1)<0)		-0.194		-0.262		-0.197		-0.143		-0.207
		(0.031)***		(0.075)***		(0.036)***		(0.054)**		(0.057)***
OGC(-1)		-0.038		0.219		-0.078		0.010		-0.043
		(0.045)		(0.103)**		(0.051)		(0.073)		(0.077)
Observations:	121	115	44	40	77	75	66	66	55	49
R-squared:	0.472	0.655	0.202	0.308	0.491	0.706	0.751	0.588	0.522	0.715

Real GDP growth specification

Sample:	FULL		PRECRISIS		AFTER-CRISIS		AAA		GIIPS	
Dep. Var:	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB	DBB	FDBB
C	-1.396	-0.507	0.460	-0.540	-2.038	-0.522	-0.852	-0.429	-2.822	-0.576
	(0.427)***	(0.133)***	(0.535)	(0.270)*	(0.582)***	(0.168)***	(0.327)**	(0.192)**	(1.006)***	(0.264)**
BBF(-1)*(BBF(-1)>=0)	0.053		0.024		-0.097		-0.111		0.057	
	(0.309)		(0.277)		(0.501)		(0.139)		(1.046)	
BBF(-1)*(BBF(-1)<0)	-0.312		-0.064		-0.348		-0.236		-0.452	
	(0.073)***		(0.118)		(0.092)***		(0.093)**		(0.136)***	
GDPF(-1)	0.066		-0.082		0.119		0.230		0.093	
	(0.135)		(0.140)		(0.187)		(0.141)		(0.239)	
BBC(-1)*(BBC(-1)>=0)		-0.026		0.056		-0.086		-0.100		-0.222
		(0.085)		(0.136)		(0.111)		(0.081)		(0.449)
BBC(-1)*(BBC(-1)<0)		-0.224		-0.181		-0.238		-0.157		-0.238
		(0.029)***		(0.063)***		(0.035)***		(0.051)***		(0.050)***
GDPC(-1)		0.064		0.088		0.058		0.178		0.104
		(0.041)		(0.075)		(0.050)		(0.102)*		(0.060)*
Observations:	121	121	44	44	77	77	66	66	55	55
R-squared:	0.450	0.653	0.162	0.218	0.473	0.698	0.763	0.611	0.516	0.719

Note: ***, ** and * denote significance at the level of 1, 5 and 10 per cent, respectively.

Table 4 Errors in budget balance forecasts

Output gap specification

Sample:	FULL	PRECRISIS	AFTER-CRISIS	AAA	GIIPS
Dep. Var:	BBFE	BBFE	BBFE	BBFE	BBFE
C	0.254	-0.853	1.191	0.776	-0.116
	(0.482)	(0.467)*	(0.656)*	(0.392)*	(1.295)
BBC(-1)	-0.007	0.082	0.055	0.099	-0.095
	(0.109)	(0.137)	(0.143)	(0.118)	(0.215)
BBCFE(-1)	0.537	0.647	0.409	0.828	0.337
	(0.148)***	(0.208)***	(0.189)**	(0.241)***	(0.255)
OGC(-1)	0.144	-0.275	0.199	0.345	0.057
	(0.165)	(0.245)	(0.200)	(0.183)*	(0.274)
OGCFE(-1)	-0.317	-0.014	-0.426	-0.064	-0.468
	(0.138)**	(0.181)	(0.171)**	(0.158)	(0.258)*
Observations:	115	40	75	66	49
R-squared:	0.207	0.350	0.239	0.298	0.196

Real GDP growth specification

Sample:	FULL	PRECRISIS	AFTER-CRISIS	AAA	GIIPS
Dep. Var:	BBFE	BBFE	BBFE	BBFE	BBFE
C	1.384	-0.761	2.637	0.412	3.414
	(0.458)***	(0.550)	(0.668)***	(0.299)	(1.009)***
BBC(-1)	0.243	-0.040	0.418	0.169	0.568
	(0.105)**	(0.121)	(0.147)***	(0.081)**	(0.210)***
BBCFE(-1)	0.825	0.969	0.890	0.714	0.967
	(0.134)***	(0.140)***	(0.188)***	(0.207)***	(0.209)***
GDPC(-1)	-0.136	0.230	-0.170	0.240	-0.532
	(0.130)	(0.164)	(0.170)	(0.100)**	(0.240)**
GDPCFE(-1)	0.259	0.278	-0.258	1.271	-0.286
	(0.266)	(0.253)	(0.413)	(0.248)***	(0.415)
Observations:	121	44	77	66	55
R-squared:	0.286	0.571	0.272	0.490	0.316

Note: ***, ** and * denote significance at the level of 1, 5 and 10 per cent, respectively.

Table 5 Errors in budget balance forecasts, forward looking specification

Output gap specification

Sample:	FULL	PRECRISIS	AFTER-CRISIS	AAA	GIIPS
Dep. Var:	BBFE	BBFE	BBFE	BBFE	BBFE
C	1.079	-0.589	1.844	1.096	1.516
	(0.439)**	(0.531)	(0.600)***	(0.268)***	(1.295)
BBC(-1)	0.236	0.091	0.322	0.302	0.233
	(0.102)**	(0.134)	(0.134)**	(0.083)***	(0.209)
BBCFE(-1)	0.646	0.630	0.658	0.483	0.599
	(0.139)***	(0.213)***	(0.176)***	(0.201)**	(0.230)**
OGF1	-0.221	-0.238	-0.185	-0.152	-0.210
	(0.166)	(0.209)	(0.215)	(0.151)	(0.294)
OGFE	0.285	0.063	0.115	0.529	0.124
	(0.116)**	(0.146)	(0.178)	(0.088)***	(0.256)
Observations:	115	40	75	66	49
R-squared:	0.218	0.349	0.176	0.534	0.150

Real GDP growth specification

Sample:	FULL	PRECRISIS	AFTER-CRISIS	AAA	GIIPS
Dep. Var:	BBFE	BBFE	BBFE	BBFE	BBFE
C	1.337	-1.187	1.821	0.689	3.522
	(0.615)**	(0.822)	(0.917)*	(0.466)	(1.383)**
BBC(-1)	0.164	-0.069	0.219	0.096	0.431
	(0.102)	(0.125)	(0.152)	(0.072)	(0.213)**
BBCFE(-1)	0.637	0.945	0.616	0.515	0.803
	(0.133)***	(0.151)***	(0.191)***	(0.164)***	(0.231)***
GDPF1	-0.371	0.293	-0.436	-0.370	-0.652
	(0.206)*	(0.251)	(0.299)	(0.215)*	(0.348)*
GDPFE	0.449	0.054	0.395	0.600	0.098
	(0.129)***	(0.236)	(0.193)**	(0.076)***	(0.280)
Observations:	121	44	77	66	55
R-squared:	0.396	0.553	0.340	0.679	0.329

Note: ***, ** and * denote significance at the level of 1, 5 and 10 per cent, respectively. Nowcasted economic conditions at the previous period and their revisions as instruments.

Table 6 Errors in budget balance forecasts, forward looking specification

Forecast error of the output gap decomposed to forecast errors of real GDP level and potential output level

Sample:	FULL	PRECRISIS	AFTER-CRISIS	AAA	GIIPS
Dep. Var:	BBFE	BBFE	BBFE	BBFE	BBFE
C	1.017	-0.498	1.740	1.020	1.420
	(0.433)**	(0.574)	(0.630)***	(0.254)***	(1.303)
BBC(-1)	0.172	0.099	0.277	0.241	0.187
	(0.107)	(0.137)	(0.159)*	(0.082)***	(0.229)
BBCFE(-1)	0.575	0.598	0.621	0.421	0.556
	(0.143)***	(0.227)**	(0.190)***	(0.192)**	(0.246)**
OGF1	-0.174	-0.268	-0.152	-0.142	-0.177
	(0.167)	(0.222)	(0.226)	(0.144)	(0.304)
GDPLEVFE	0.340	0.104	0.158	0.571	0.152
	(0.119)***	(0.176)	(0.195)	(0.084)***	(0.265)
POTFE	-0.231	-0.074	-0.108	-0.424	-0.095
	(0.119)*	(0.152)	(0.177)	(0.090)***	(0.263)
Observations:	115	40	75	66	49
R-squared:	0.240	0.352	0.179	0.588	0.155

Note: ***, ** and * denote significance at the level of 1, 5 and 10 per cent, respectively. Nowcasted output gap at the previous period used as an instrument for OGF1. Revisions for nowcasted real GDP level and potential output level at the previous period used as instruments for GDPLEVFE and POTFE.

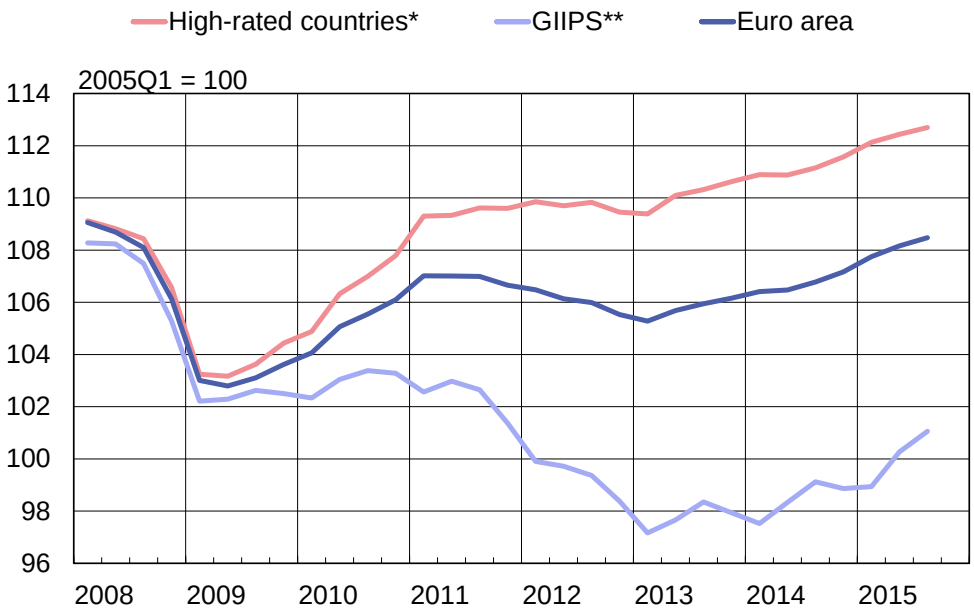
Table 7 Errors in budget balance forecasts, forward looking specification

Output gap change decomposed to real GDP change and potential output change

Sample:	FULL	PRECRISIS	AFTER-CRISIS	AAA	GIIPS
Dep. Var:	BBFE	BBFE	BBFE	BBFE	BBFE
C	0.668	0.575	0.835	0.033	2.434
	(0.635)	(1.002)	(0.904)	(0.662)	(1.391)*
BBC(-1)	0.074	0.142	0.119	0.031	0.286
	(0.093)	(0.146)	(0.132)	(0.084)	(0.199)
BBCFE(-1)	0.332	0.499	0.339	0.522	0.397
	(0.126)***	(0.230)**	(0.166)**	(0.164)***	(0.228)*
POTGF1	1.294	0.112	1.724	0.624	1.450
	(0.400)***	(0.663)	(0.591)***	(0.419)	(0.658)**
POTGFE	-1.541	0.133	-1.923	-0.428	-1.930
	(0.295)***	(0.433)	(0.376)***	(0.361)	(0.487)***
GDPF1	-1.211	-0.371	-1.386	-0.601	-1.494
	(0.293)***	(0.647)	(0.354)***	(0.271)**	(0.502)***
GDPFE	0.773	0.623	0.734	0.656	0.698
	(0.137)***	(0.325)*	(0.198)***	(0.099)***	(0.323)**
Observations:	115	40	75	66	49
R-squared:	0.486	0.413	0.487	0.693	0.464

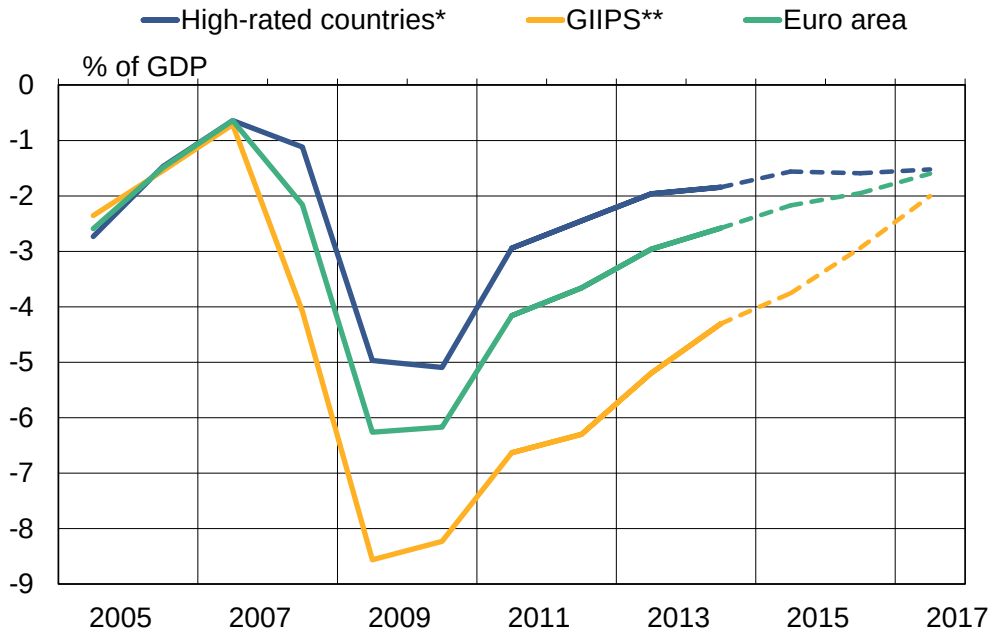
Note: ***, ** and * denote significance at the level of 1, 5 and 10 per cent, respectively. Nowcasted potential output growth and real GDP growth at the previous period and their revisions used as instruments.

Appendix Figure 1. Growth of real GDP



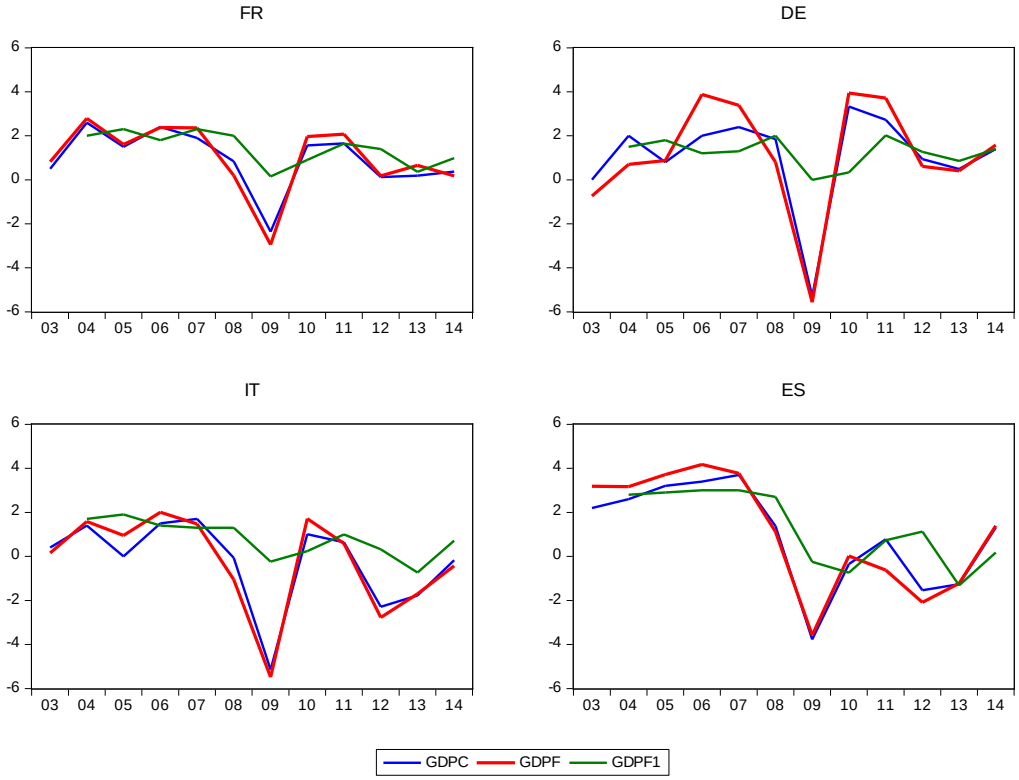
* Germany, France, Netherlands, Belgium, Austria and Finland.
** Greece, Italy, Ireland, Portugal and Spain.
Sources: Eurostat and Bank of Finland calculations. 27255@BKT3(en)

Appendix Figure 2. Overall budget balance



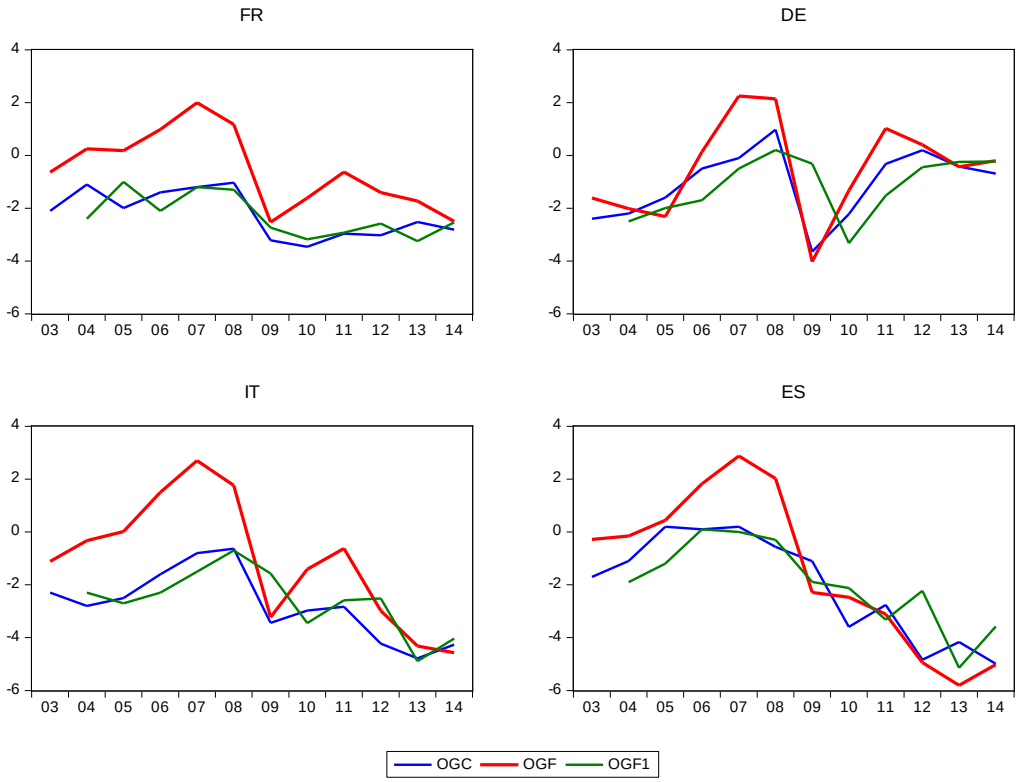
* Germany, France, Netherlands, Belgium, Austria and Finland.
** Greece, Ireland, Italy, Portugal and Spain.
Sources: European Commission and Bank of Finland calculations.
The figures for 2015-2017 are based on the Commission's winter 2016 forecast.

Appendix Figure 3. Nowcast, forecast and revised real GDP growth



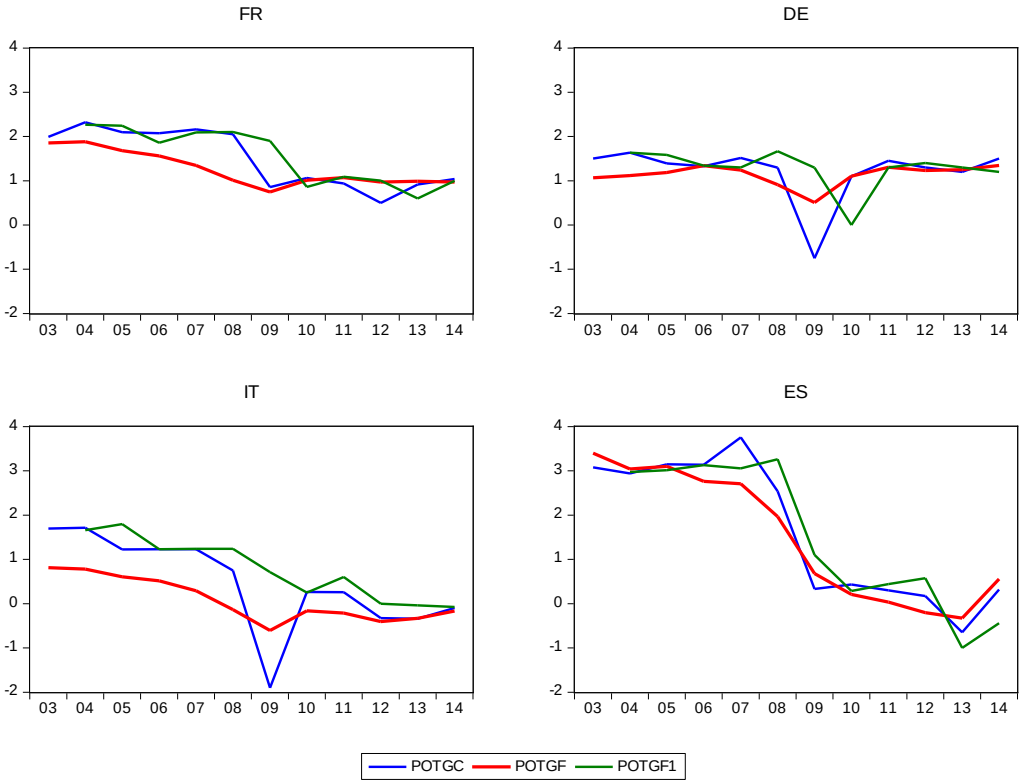
Sources: IMF WEO autumn 2003-2015.

Appendix Figure 4. Nowcast, forecast and revised output gap



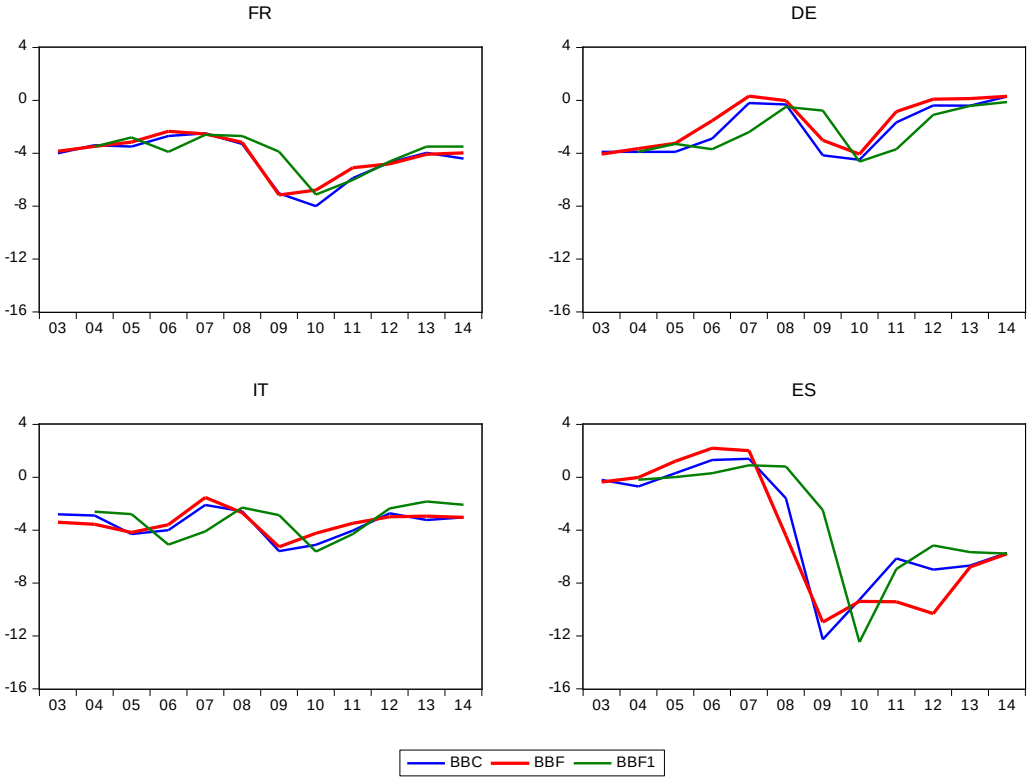
Sources: IMF WEO autumn 2003-2015.

Appendix Figure 5. Nowcast, forecast and revised potential output growth



Sources: IMF WEO autumn 2003-2015 and Bank of Finland calculations.

Appendix Figure 6. Nowcast, forecast and revised overall budget balance



Sources: IMF WEO autumn 2003-2015.

Appendix Table 1. T-tests for the mean of forecast errors

Sample Countries:		ALL			AAA			GIIPS	
Sample Period:	FULL	PRECRISIS	AFTER-CRISIS	FULL	PRECRISIS	AFTER-CRISIS	FULL	PRECRISIS	AFTER-CRISIS
BBFE									
Sample Mean:	0.842	-0.341	1.518	0.059	-0.594	0.432	1.781	-0.038	2.820
Sample Std.Dev.:	3.264	2.042	3.632	1.956	1.549	2.080	4.174	2.521	4.590
P-Value of T-Test:	**0.005**	**0.274**	**0.001**	**0.808**	**0.073**	**0.186**	**0.003**	**0.947**	**0.001**
Observations:	121	44	77	66	24	42	55	20	35
GDPFE									
Sample Mean:	0.597	-0.599	1.281	0.340	-0.758	0.968	0.906	-0.408	1.657
Sample Std.Dev.:	2.251	1.030	2.469	2.149	0.981	2.381	2.350	1.080	2.554
P-Value of T-Test:	**0.004**	**0.000**	**0.000**	**0.203**	**0.001**	**0.012**	**0.006**	**0.108**	**0.001**
Observations:	121	44	77	66	24	42	55	20	35
OGFE									
Sample Mean:	-1.232	-2.801	-0.396	-1.032	-2.249	-0.337	-1.502	-3.628	-0.471
Sample Std.Dev.:	2.245	1.715	2.044	2.072	1.393	2.088	2.456	1.860	2.017
P-Value of T-Test:	**0.000**	**0.000**	**0.098**	**0.000**	**0.000**	**0.302**	**0.000**	**0.000**	**0.189**
Observations:	115	40	75	66	24	42	49	16	33
POTGFE									
Sample Mean:	0.459	0.493	0.441	0.365	0.261	0.425	0.585	0.842	0.461
Sample Std.Dev.:	0.986	0.686	1.117	0.593	0.404	0.675	1.343	0.870	1.517
P-Value of T-Test:	**0.000**	**0.000**	**0.001**	**0.000**	**0.004**	**0.000**	**0.004**	**0.002**	**0.090**
Observations:	115	40	75	66	24	42	49	16	33

Zero hypothesis of a t-test is that the mean of forecast errors is equal to zero.

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