Fiscal sustainability and the accuracy of macroeconomic forecasts: Do supranational forecasts rather than government forecasts make a difference?

Carlos Fonseca Marinheiro

GEMF, Faculty of Economics,
University of Coimbra,
Av. Dias da Silva, 165,
Coimbra P-3004-512, Portugal
E-mail: marinheiro@fe.uc.pt

Abstract: Credible fiscal plans that aim at restoring fiscal sustainability will be essential to counter the present increase in debt levels all across Europe. The macroeconomic scenario of such plans will be crucial. This paper assesses whether there is any advantage in delegating (part of) such power to supranational forecasts. The evidence on the relative performance of the European Commission's (EC) growth forecast is rather mixed, with considerable variation at the country level. Some national government forecasts (France, Italy and Portugal) perform worse in terms of descriptive statistics than the EC forecast for all forecast horizons. For the year ahead the EC growth forecast is better than the official forecasts for almost three quarters of the EU-15 countries. All in all, since the EC forecast appears to be a good benchmark, in order to reduce the (optimistic) forecast bias, national governments could be forced to justify any large (optimistic) deviation from this benchmark when presenting their respective national Stability and Growth Programmes.

Keywords: sustainability of public debt; fiscal policy; Stability and Growth Pact; fiscal forecasting; forecast evaluation; real-time data.

Reference to this paper should be made as follows: Marinheiro, C.F. (2011) 'Fiscal sustainability and the accuracy of macroeconomic forecasts: Do supranational forecasts rather than government forecasts make a difference?' *Int. J. Sustainable Economy*, Vol. 3, No. 2, pp.185–209.

Biographical notes: Carlos Fonseca Marinheiro is an Assistant Professor in the Faculty of Economics at the University of Coimbra, Portugal and a Researcher at the GEMF – Group for Monetary and Financial Studies of the University of Coimbra. He holds a PhD in Economics from the Catholic University of Leuven, Belgium. His research interests include fiscal policy in the context of the European Union, namely sustainability issues, its stabilising role, the use of real-time data and the budget process.

1 Introduction

Government support for the financial sector and for hard-hit industries in the 2008/2009 financial and economic crisis has greatly increased public debt levels in many European

countries, posing a serious challenge to fiscal sustainability at a time of increased spending pressures caused by ageing populations. Hence, there is now a greater need for close monitoring of fiscal developments in terms of fiscal outcomes but of fiscal plans, too.

Credible fiscal plans that aim at restoring fiscal sustainability will be essential. Yet governments can present a rosier picture of public finances by basing their fiscal forecasts on optimistic economic growth assumptions.

There are several reasons why government growth forecasts are typically more optimistic than the outcome, but if there is no bias towards optimism in the forecasts produced by supranational organisations, this is evidence that such forecasting errors are due to the strategic use of optimistic economic growth forecasts rather than the outcome of true (unbiased) forecast errors.

This paper compares the accuracy of (national) EU governments' own growth forecasts with the accuracy of supranational forecasts, particularly those of the European Commission (EC) and the IMF. This analysis expands the literature on the accuracy of fiscal and macroeconomic forecasting by making use of a real-time measure of outcomes and by focusing on the budget process, while simultaneously trying to overcome some limitations of previous studies, which have tended to rely on over-pooled analysis. Thus, this contribution adds to existing literature by providing: a higher degree of detail at the country level, avoiding the mix of forecast horizons (that could be a source of statistical problems); the first use of a full business cycle of data since the start of the euro when the Stability and Growth Pact started to be enforced; and a systematic detailed comparison of national government forecasts with EC and IMF supranational forecasts.

Previous related work includes that by Jonung and Larch (2006) which assesses whether potential output forecasts are systematically biased, while Beetsma et al. (2009) analyse the determinants of planned and budgetary adjustment implemented in the EU, focusing on the budgetary process and estimating the impact of the strength of national fiscal institutions on fiscal outcomes. Finally, Strauch et al. (2009) assess the accuracy of the forecasts of Stability and Growth Programmes (SGPs) for the period 1991–2004.

Jonung and Larch (2006) supported delegating the preparation of macroeconomic forecasts, for the purpose of the budget process, to independent national offices. Along similar lines, this paper assesses if there is some advantage in delegating such power to supranational forecasters. If the forecasts by the EC really perform better than national government forecasts, the bias in the macroeconomic assumptions which are used to draw up the medium-term fiscal plans could be reduced if EU countries started to use the EC forecasts, or at least if these countries were compelled to justify any given departure from such benchmark when presenting a more optimistic national forecast. This could be done through a revision of the code of conduct (on the submission of the SGPs).

However, the evidence we found on the relative performance of the EC growth forecast is rather mixed. The accuracy of the EC autumn growth forecast is not uniform over forecast horizons: the year-ahead forecast performs relatively well, but there is room for improvement in the two-years-ahead forecast. Hence, at the individual country/forecast-horizon level there is some weak evidence supporting the view that EU Member States would reduce their forecast bias if they followed the EC growth forecasts for the year-ahead period when preparing their national SGPs.

Moreover, there is considerable variation in the accuracy of national forecasts at the individual country level. The analysis shows that the national government forecasts of France, Italy and Portugal perform worse in terms of descriptive statistics than the EC

forecast for all forecast horizons. Taking the EU countries as a whole and the different forecast horizons, the EC autumn forecast appears to be a good benchmark. Using country-pooled data for the year-ahead forecast horizon, the evidence in favour of the EC forecast is the strongest.

All in all, in order to reduce the forecast bias, national governments could be forced to justify any large (optimistic) deviation from the EC forecast, which would serve as benchmark, when presenting their SGPs.

The structure of this paper is as follows. Section 2 looks at the role of forecasts in fiscal plans and contains a review of the literature, the methodology and empirical results. Section 3 discusses some policy implications and conclusions.

2 The role of forecasts in attaining fiscal sustainability

2.1 Objectives and comparison with previous literature

If European countries are to reduce their current (high) debt levels, it will be necessary to pursue ambitious fiscal consolidation strategies within the framework of the Stability and Growth Pact, involving some peer pressure and the definition of a differentiated medium-term objective (MTO) for each country. Therefore, much will rely on the setting up of credible fiscal plans. Recent research has shown that the use of forecasts is an issue in the design of fiscal policy. When designing fiscal policy decisions, policy makers have to make use of (*ex-ante*) real-time output gap estimates and these usually differ from actual (*ex-post*) output gap estimates, which use more information than that available at the time of the decision (see Orphanides and van Norden, 2002).[1] However, part of the difference between *ex-ante* and *ex-post* output gaps might be the result of a deliberate optimism in official government forecasts. Government use of overoptimistic macroeconomic assumptions is a practical way of not actually making the required fiscal consolidation effort while appearing to be planning to consolidate public finances. As Jonung and Larch (2006) put it, if a government regularly builds its budget on an optimistic medium-term growth outlook, it will project a higher level of structural revenues than it would under a more cautious and realistic assessment. The overprojection of revenues then makes it possible to budget for a higher level of expenditure than would be allowed under a realistic growth assumption, while appearing not to be following an expansionary fiscal policy. As a result, the *ex-post* budget balance is worse than forecast.

Thus, it is relevant to assess to what extent such forecast errors are genuine or politically motivated. If they are genuine, they are likely to appear both in official national forecasts and in other forecasts, including the supranational forecasts of the EC, which has a relevant role in the process of multilateral fiscal supervision in Europe. However, as pointed out by Strauch et al. (2009) the literature still contains little of such cross-country analysis for advanced economies. This paper contributes to such field of the literature.

The national forecasts used in this empirical comparison are those presented in the annual update of each country's SGP, which must be submitted to Brussels by the end of the year. Our sample starts with the 1998 vintage of programmes and ends with the 2008 programmes. As Member States are subject to a common code of conduct on the submission of their national SGP annual updates, the data is relatively homogenous, following the same ESA95 system of national accounts and submitted in the same time

frame. All such characteristics enable a cross-country analysis of forecast accuracy. The delimitation of the time frame of the empirical analysis to broadly coincide with the time period after the introduction of the euro, when the Stability and Growth Pact was binding, makes the use of SGP data meaningful for our purposes.

Previous studies on this subject include the seminal paper by Artis and Marcellino (2001) that analysed the track record of the IMF, OECD and EC in forecasting the government deficit as a ratio to GDP for the G7 countries for the period 1981–1994. The authors concluded that no single agency is best for all countries, but some agencies perform particularly well for certain countries: the IMF for France and Germany, the OECD and the EC for Italy and the UK. However, the authors did not compare the forecast accuracy of the international agencies with the national government (official) forecasts.

The main international organisations regularly assess the track record of their own forecasts. Recent examples are Melander et al. (2007) for the EC forecasts; Vogel (2007) for the OECD forecasts and Timmermann (2007) for the IMF forecasts. These assessments usually compare the particular organisation's forecasts with outcomes and with competing forecasts made by other international organisations or with consensus forecasts but no comparison is made with national government (official) forecasts.

Jonung and Larch (2006) compute the forecast errors of one-year ahead official forecasts for potential and real GDP growth, and test the impact of these forecast errors on the cyclically adjusted budget balances for four large EU countries (Germany, France, Italy and the UK) for the period 1998–2003. The accuracy of official GDP growth forecasts is also compared with the accuracy of EC forecasts and consensus forecasts. They find an optimism bias and make a case for delegating forecasts to an independent forecasting authority, citing as examples the case of forecasts made in Austria, Belgium and the Netherlands by independent forecasters, which show no statistically significant bias. However, their paper restricts its sample to the four large EU economies for the year-ahead forecast horizon only.

Strauch et al. (2009), previously circulated as Strauch et al. (2004), assess the accuracy of SGP forecasts in an approach which is closest to the one followed in our paper. It evaluates the performance of official forecasts for GDP growth and for the budget balance published in SGPs submitted by EU Member States in the period 1991–2004 (the subset 1998–2004 is also analysed). The authors calculate standard descriptive statistics for national SGP forecast errors for each forecasting horizon (pooling observations over the different countries) and for each country (pooling observations over the different projection horizons). Next they compare the SGP forecasts by forecasting horizon (pooling observations over the different countries) with those made by the EC.

As a result, this paper makes three contributions to the existing literature:

- Firstly, it provides a comprehensive and systematic comparison of national governments' official forecasts with those made by the EC (and the IMF) for all the former EU-15 Member states.[2]
- Secondly, the time period covered is 1998–2008, which makes this paper the first to assess the accuracy of SGP forecasts covering a full business cycle since the start of the euro. The choice of the onset of the 3rd stage of EMU as the first year of our sample, when the Stability and Growth Pact started to be applied, makes SGP data submitted by member states more reliable than pre-1998 data, since the national SGP

started to be regularly updated and assessed by the EC under the EU budgetary framework.

– Finally, the assessment is made without pooling forecast horizons. While considerably decreasing the number of observations, from an economic point of view, it is natural to expect that forecast errors increase with the length of the forecasting horizon (h) due to greater uncertainty. Moreover, from an econometric point of view, all the theory on forecast encompassing assumes that the series of forecasts to be compared should all be for the same forecasting horizon. For forecast horizons greater than one, even optimal h-steps ahead forecasts would be expected to have forecast errors that follow a moving average of order $h - 1$ (see Harvey et al., 1997). Hence, mixing 1 to h step-ahead forecasts in a single pool could give rise to some distortions. As a result of this option, this paper presents a richly detailed description of forecast properties at the country level, which comes, however, at the expense of the power of the tests, which could be oversized, given the small sample available at country level. This problem is overcome by also presenting country-pooled data for each forecast horizon.

2.2 *Methodology*

The focus of the approach followed in this paper on the budget process determines several aspects of the testing procedure almost 'automatically', including the definition of the outcomes used to calculate the forecast error under analysis. The forecast error (e) is defined as the actual value minus the forecast value. Following an increasingly consensual practice in the literature, we take as the actual values (outcomes) not the final revised series, but a 'real-time' (second) estimate of the outcome, i.e. the estimate for the year ahead published in the autumn by the EC, which might differ from the revised final figures.[3,4] Given the focus on the budget process in the European Union, this approach is the most suitable for testing for forecast accuracy because it might be too demanding for forecasters to predict what the first available estimates were unable to pick up. Moreover, this real-time data reduces the problem of methodological revisions occurring after the fiscal year and possibly skewing results, and more importantly it is the data used by the EC in the monitoring of fiscal policy. As mentioned by Artis and Marcellino (2001) the use of first released data is also 'most interesting from a policy perspective'. Moreover, the data released in the following autumn corresponds to the 2nd report of the Excessive Deficit Procedure, which is expected to incorporate all the information (half-finalised) on the accounts of the general government, but not all subsequent revisions in the government accounts, and on the GDP estimates.[5]

Each EU country must present an annual update of its SGP (or a convergence programme for those outside the euro area) by December.[6] The SGP contains predictions for major economic variables, including GDP growth and public finances, for the current year (t) and at least the next 3 years ($t + 3$). We collected all such forecasts and took them as the official forecasts made in year t for the years t, $t + 1$, $t + 2$ and $t + 3$ ($t = 1998, \}, 2008$).[7] We took as a counterpart of such official forecasts the EC Autumn forecast, which is presented in November. Since the national SGPs are usually presented near the deadline in November/December of each year, it might be assumed that they are based on the same information set, especially with respect to world growth expectations,

commodities prices, interest rates, etc., enabling a direct comparison between the national SGP forecast and the EC forecast.[8]

Regarding the structure of the empirical results, first, in the general descriptive statistics of forecast accuracy, mean forecast error (ME), mean absolute error (MAE) and root mean squared error (RMSE) are calculated as follows:

$$\text{ME} \quad \frac{1}{N}\sum_{i=1}^{N} e_{i,t+h}, \quad \text{MAE} \quad \frac{1}{N}\sum_{i=1}^{N} \left|e_{i,t+h}\right|, \quad \text{RMSE} \quad \sqrt{\frac{1}{N}\sum_{i=1}^{N} e_{i,t+h}^2}$$

where N is the number of observations for the forecasts made in period t for period $t + h$. An optimal forecast should present no bias (a null ME). Weak efficiency also requires forecast errors to be uncorrelated over time.

Since we have competing forecasts (SGP and EC forecasts), a formal test of equal forecast accuracy is carried out. That is to say, two variants of the Diebold and Mariano (1995) test are performed with the small sample correction proposed by Harvey et al. (1997), yielding the modified Diebold-Mariano (mDM) test statistic under a quadratic loss function (mean squared errors). In the first variant, the alternative to the null of equal forecasts is different forecasts; the second variant is a unilateral test in which the alternative is that one forecast is better than the other, one after the other.[9]

The next step was to compute formal forecast encompassing tests. Such tests derive from the forecast combination literature. Closely following Clements and Harvey (2009), it can be said that a combination of h-steps-ahead forecasts, f_{1t+h} and f_{2t+h}, designed to improve the predictive accuracy of the quantity y_{t+h}, is given by

$$f_{ct+h} \quad (1+0) f_{1t+h} \quad 0 f_{2t+h} \tag{1}$$

with forecast errors $e_{it} = y_t - f_{it}$ (i = 1, 2). This formulation assumes that the individual forecasts are unbiased. Yet, in practice the available forecasts may be biased, presenting a non-zero mean forecast error, and might not be efficient either.[10] Relaxing the assumptions about the forecasts and allowing the possibility of biased and inefficient forecasts, the implicit assumption that the combination weights add up to one is relaxed, and we get the general formulation:

$$f_{ct+h} \quad \mathrm{D} \quad \mathrm{E}_1 f_{1t+h} \quad \mathrm{E}_2 f_{2t+h} \tag{2}$$

In this setup, the concept of forecast encompassing relates to whether or not one forecast encapsulates all the useful predictive information contained in a second forecast. Formally, using a squared error loss function as above, f_{1t+h} is said to encompass f_{2t+h} if, in a linear combination of the two forecasts, f_{2t+h} optimally receives zero weight, so that combining f_{1t+h} with f_{2t+h} does not lead to a reduction in the mean squared forecast error. Hence, f_{1t+h} encompasses f_{2t+h} in (1) if the optimal value of 0 is zero. Still following Clements and Harvey (2009) there are three alternative definitions of forecast encompassing that could be given a regression interpretation as follows. The more general (Fair–Shiller) formulation states that f_{1t+h} encompasses f_{2t+h} implies ü = 0 in the regression:

$$\text{FE(1)}: \quad y_{t+h} \quad \mathrm{D} \quad \mathrm{E}_1 f_{1t+h} \quad \mathrm{E}_2 f_{2t+h} \quad \mathrm{H}_t$$

Imposing the restrictions $\beta = 0$ and $\omega_1 + \omega_2 = 1$ (Nelson, Granger and Newbold), encompassing is defined by $\theta = 0$ in the regression:

$$\text{FE(2)}: \quad e_{1t\ h} \quad \theta\left(e_{1t\ h} + e_{2t\ h}\right) \quad \varepsilon_{t\ h}$$

Assuming f_{1t+h} to be efficient, i.e. imposing $\beta = 0$ and $\omega_1 = 1$ in FE(1) (Chong and Hendry), encompassing is defined by $\theta = 0$ in the regression:

$$\text{FE(3)}: \quad e_{1t\ h} \quad \theta f_{2t\ h} \quad \varepsilon_{t\ h}$$

In the empirical application, we took the alternative hypothesis to be one-sided ($\omega_2 > 0$) in FE(1), in order to rule out the possibility of negative combination weights. We first take the most straightforward approach and regress the equations by OLS and test the null. However, this approach might not be robust to the properties of the forecast errors.[11] Hence, we also calculate an mDM test for the more general formulation FE(1) (not reported), which, in general, gives rise to the same conclusions. For all such testing procedures, the small sample size at country level requires care in the interpretation of the test statistics.

2.3 Empirical results

2.3.1 Impact of errors in growth forecast for the budget balance forecasts

Firstly, it is quite relevant to determine to what extent the deviation of actual economic growth from the official forecasts explains the forecast errors in the official budget balances forecasts.[12] EC (2007) concluded that the main risks to budgetary projections were "(i) optimistic macroeconomic projections, (ii) slippages of government expenditures [...]". Following Strauch et al. (2009), the forecast error for the budget balance is regressed on a constant and on the growth forecast error for the pool of EU-15 countries. The results, segmented by the different forecast horizons, are shown in Table 1.

Table 1 Impact of SGP growth forecast errors on the budgetary forecast errors – pool of EU-15 countries

	Dependent variable: SGP budgetary forecast errors					
Time horizon	e_{growth}	*No. of degrees freedom*	*F-test* e_{growth}*= 0.547 (p-value)*	*LM test no AR2 (p-value)*	*F-test (p-value)*	R^2
T	0.246** (0.11)	146	8.21 (0.0)	3.26 (0.19)	12.1 (0.0)	55.4%
t + 1	0.487*** (0.07)	132	0.739 (0.39)	10.39 (0.0)	7.5 (0.0)	46.0%
t + 2	0.605*** (0.09)	116	0.38 (0.53)	19.03 (0.0)	6.5 (0.0)	45.8%
t + 3	0.457*** (0.13)	100	0.457 (0.50)	34.51 (0.0)	4.3 (0.0)	39.1%
Pooled	0.547*** (0.05)	497	–	67.6 (0.0)	5.7 (0.0)	40.6%

*, **, *** denote statistical significance at the 10%, 5% and 1% level.

Note: Estimation based on fixed effects by individual country. The standard errors and the *p*-values for the tests are also presented in parenthesis.

As expected, the impact of growth forecast errors on budgetary forecast errors is smaller for the current period, given that the SGPs are submitted at the end of the current year, resulting in a single quarter of GDP growth left to forecast. However, for the one- to the three-periods-ahead there is a large impact of growth forecast errors: for each percentage point of deviation in the growth forecast, the actual budgetary balance is found to deviate by at least 0.5% of GDP from the level officially planned (with a maximum of 0.6% found for period $t + 2$).[13] Such values are in line with the usual sensitivity of the budget balance to the economic cycle, which is 0.43 for the EU-15, according to the EC's estimate. Pooling all forecast horizons leads to an estimate of 0.55%.[14,15]

2.3.2 General descriptive statistics

The empirical results of the general descriptive statistics for both the SGP and EC forecasts are shown in Tables A1–A4. A negative mean error (ME) means that there is over-prediction (optimism), meaning that the forecast indicated a better output growth or a better budget balance (or a smaller deficit) than the actual outcome.

For the *current period*, the mean error of *GDP growth forecasts* in SGPs is, in general, relatively small and statistically not different from zero, denoting no forecast bias, except for Greece, France and Portugal at the 10% significance level. Moreover, no serial correlation up to order two is usually detected. The RMSE is larger than the MAE, but the difference between the two measures is not great enough to point to large forecast errors, with the possible exception of the UK. These results are not surprising given that national SGPs are submitted near the end of the current year, already benefiting from the third quarter growth estimates, which reduces the forecasting exercise to the current 4th quarter. The *EC Autumn forecast* for the current year also exhibits small mean errors, with a statistically significant positive (under-prediction) bias for Greece, Spain and Finland, countries that in fact performed better than forecast. *For the pool of EU-15 countries*, the mean error (0.02) in SGP growth forecasts is not statistically different from zero. However, in the case of the EC forecast there is a bias towards pessimistic growth forecasts for the pool of countries at the 5% significance level, with the EC forecast having a mean error of 0.12. The RMSE of the EC growth forecast is, however, very similar to the SGP forecasts.

The SGP forecasts regarding the *budget balance for the current period* present a larger mean error (in absolute terms), but ten EU countries present a cautious estimate for the budget developments in the year of presentation of the SGP update. Only Greece presents a statistically significant over-prediction bias for the budget balance. The pool of EU-15 countries presents a positive statistically mean error (0.38), confirming this cautious approach. A smaller (0.20) but still significant cautious bias is also present in the *EC balance forecast* for the pool of EU countries.

Regarding the *one-year-ahead ($t + 1$) SGP growth forecasts,* the mean errors are in general negative, with Italy, Portugal and France presenting a statistically significant bias towards optimism. For the pool of EU-15 countries, the SGP forecasts present an optimistic bias (at the 10% significance level). The EC forecast in general performs better, showing some evidence towards over-prediction for Italy and Portugal (at the 10% level), nevertheless presenting a smaller absolute mean error than the respective national government forecast. For mean errors for the *budget balance* variable of the SGP, forecasts for eight countries are found to be negative (optimistic forecasts), but only in the case of Greece this bias is statistically significant at the 5% level. Of the seven

countries that under-predict the budget balance (pessimistic forecast), Luxembourg, Sweden and Finland present a statistically significant and large mean error i.e. also present in the EC forecast (albeit with a smaller mean error). The EC forecasts show a negative mean error for 6 countries.

For the *period* $t + 2$, 12 out of the 15 countries present a *growth forecast* larger than the outcomes in their respective SGPs, with Portugal, Italy and France showing a large and statistically significant negative mean error. Ireland's forecast presents a small mean error, but its RMSE indicates that large positive and negative errors cancel each other out overtime. The *EC forecast* presents a negative mean error for all countries but Greece, and also a statistically significant optimistic bias for growth forecasts for Portugal, Italy and France (albeit smaller than the respective national SGP forecasts). The forecasts for the pool of EU-15 countries show a statistically significant optimistic bias, showing a mean error of –0.45 in the case of SGP forecasts and a –0.6 mean error in the case of the EC forecasts.

With respect to the *budget balance forecasts for the period* $t + 2$, a total of 8 out of the EU-15 countries show a negative mean error in their national SGPs, with such optimistic bias being statistically significant for Greece, France, Italy and Portugal. On the other hand, Finland and, to a lesser extent, Luxembourg present a pessimistic statistically significant bias. The pool of EU-15 countries has a mean error of –0.18, which is not statistically different from zero. The *EC forecast* is unbiased, presenting a negative mean error for seven countries and a positive mean error for the other eight.[16] For the pool of EU-15 countries there is a null mean error in the EC forecast.

For the *period* $t + 3$, there are no EC forecasts. SGP growth forecasts for all countries but Finland present a negative mean error, with France, Italy and Portugal having a statistically significant optimistic bias (at the 1% level), with Portugal and Italy showing the largest absolute deviation (–2.3 and –1.9 respectively). The pool of EU-15 countries shows a statistically significant mean error of –0.75. The SGP *budget balance forecasts* for the three-years-ahead horizon present a negative mean error (optimistic forecasts) in nine countries, of which five are statistically significant (Greece, France, Italy, Portugal and the UK) (Table A5). These countries show very large (absolute) mean errors for their budget balances: –3.6% of GDP in Greece; –2.3% in Portugal; –2.11% in Italy and –1.78% of GDP in France. Such large deviations, very close to the reference level for the deficit, reveal the difficulties those countries are experiencing in effectively attaining their fiscal goals over a medium-term horizon while presenting fiscal plans for the longer horizon which are clearly optimistic. For the pool of EU-15 countries the mean error is –0.77% of GDP, which is statistically significant at the 1% significance level.

Next, following the approach of Artis and Marcellino (2001), we compute a *simple measure to select which forecast performs better in terms of the general descriptive statistics*, selecting the forecast that had the largest number of smaller values in terms of absolute mean error, MAE and RMSE. For instance, for a given country if the SGP forecasts indicate the smaller MAE and the smaller RMSE, it is the selected 'winner'. This simple procedure selects the EC forecast as the better *output growth* forecast for the period $t + 1$ in 73% of the 15 EU countries (the EC forecast also performs better for the pool of countries). The percentage decreases to 67% for the current period and to 47% for the period $t + 2$. Hence, there seems to be room for improving the accuracy of the EC growth forecast for its longer horizon ($t + 2$). With regard to the *budget balance*, *the EC forecast performs better* than SGP forecasts for 47%, 67% and 60% of the countries for the periods t, $t + 1$ and $t + 2$, respectively, using this simple criterion.

Furthermore, the EC forecast is found to perform better for the budget balance for all forecasting horizons for the pool of EU-15 countries.

2.3.3 Formal comparison of competing forecasts

The next step was the *mDM test for the equality of forecasts* (Tables A6–A8). Given the very small sample at the country level, the test results should be read with extreme care since, as previously argued, they could be oversized. The null of equality vs. different forecasts is tested for first. Overall, the results point to the forecasts being equal, with a slight preponderance of better results for the EC forecasts for the year-ahead horizon.

The final step was the computation of the forecasting encompassing tests FE(1), FE(2) and FE(3). As before, a simple measure was used to select as the 'winning forecast' the one i.e. chosen by more of the six tests involved. A tie between national and EC forecasts is dominant for all forecast horizons. Yet, *for the pool of EU-15 countries, the EC forecast is a clear winner for all forecast horizons and for both variables, except for the current period growth forecast.* This finding is consistent with Artis and Marcellino (2001), who concluded that those EC budget balance forecasts have a general advantage (in forecast encompassing tests) whose forecast errors could not be explained by other forecasts made by international organisations.[17] Strauch et al. (2009) also concluded that the information content of EC forecasts encompasses national programmes projections, which the authors found to be a counter-intuitive result, since the information set available to the EC is a subset of the information available to the national governments.

2.3.4 Summary of the differences in the forecasting accuracy of competing forecasts at the country level

With regard to forecasting accuracy, the previous description showed that *there are considerable differences at the country level, and over different forecast horizons*, which call for some caution in the use of (over-)pooled samples, i.e. samples pooled over countries and overtime periods, as done in some of the previous literature.[18]

Table 2 summarises the combination of countries/forecast horizon for which the EC forecast is found to perform better in terms of the general descriptive statistics (mean error, MAE and RMSE), and to encompass the SGP forecast or tie with it using the forecast encompassing tests FE(1) to FE(3). For *GDP growth forecasts*, the EC forecast is found to outperform the respective SGP forecasts for all forecast horizons for France, Italy and Portugal. For the period ahead ($t + 1$), the EC forecast is found to be better than official forecasts for Germany, the Netherlands, Sweden, Spain, the UK, Greece, Ireland, Luxembourg and for the pool of EU-15 countries, in addition to the previously mentioned countries (i.e. for a total of 11 countries). This is a relevant conclusion for the forecast accuracy of the EC Autumn forecasts, since the year-ahead horizon is probably the most important time horizon in the budget process, because this is the period for which corrective action could be immediately taken to correct any deviation of fiscal outcomes from the medium-term fiscal plans. As Beetsma et al. (2009) put it, plans in the annual budget law contribute more to any observed fiscal adjustment than medium-term fiscal projections that lack a clear legal status.[19]

Table 2 Countries for which the EC forecast performs better in terms of general descriptive statistics and encompasses or ties with SGP forecasts (FE-OLS tests)

	Forecast made in period t for period					
Variable	*t + 1, t + 2*	*t*	*t, t + 2*	*t, t + 1*	*t + 1*	*t + 1, t + 2*
GDP growth	FR, IT, PT	DK	FI	DE, NL, SE	ES, UK, Pool	EL, IE, LU
Budget balance	BE, DK, FR, IT, Pool	UK	IE	DE	LU, FI	EL, PT, SE

Note: If consideration was given only to the general descriptive statistics, disregarding forecast encompassing tests, table would also include Germany for the budget balance variable for *t* + 2, and Spain for the GDP growth variable for period *t*.

With regard to the budget balance, the EC forecast is found to outperform for Belgium, Denmark, France, Italy and the pool of EU-15 countries for all forecast horizons. For the period-ahead horizon (*t* + 1), in addition to the previous countries, the EC forecast is also found to perform better than the respective SGP forecasts for Germany, Luxembourg, Finland, Greece, Portugal and Sweden (i.e. for a total of ten countries).

This result is in line with ECB (2004) findings. Using data from the SGPs submitted between 1999 and 2003, the ECB (2004) concluded that only around half of the EU Member States have had no significant bias in their budget forecasts. Furthermore, the ECB pointed out that countries with deficits close to or above the 3% of GDP reference value generally offered considerably more optimistic budget forecasts than other countries. Greece, Portugal, France, Germany and Italy were found to have the largest optimistic forecast biases, with a deviation for the deficit greater than 1.25% of GDP.

2.3.5 Extension to the case of the IMF's forecasts

Next, the IMF's forecasts were taken as a benchmark. The IMF releases two regular forecast exercises during the year, and their forecast horizon covers the current period and the year ahead. To enable comparison with SGP forecasts, we took the IMF Autumn (October) forecast, which is closest in time to the presentation of national SGP forecasts. The sample covers the forecasts made from 1998 to 2007.[20]

Table A2 has the results for the descriptive statistics of the IMF forecast errors. The IMF forecasts for the current year, for both GDP growth and the budget balance, generally show a positive mean error, meaning that they tend to be pessimistic. A statistically significant positive mean error for the case of GDP growth forecasts is found for Ireland, Greece, Spain, Finland and for the pool of countries. A pessimistic budget balance forecast for the current year is found for the pool of countries and for Luxembourg, Spain, Austria, Finland and Sweden. On the other hand, a statistically significant bias towards optimism is found for Greece.

For the year-ahead growth forecast, only for Italy was there a statistically significant bias at the 5% level (for optimism). For the pool of 15 countries the mean error is –0.23, but it is not statistically different from zero.[21] For the budget balance forecast, a statistically significant bias was found at the 5% level for Luxembourg, Finland, Sweden and Austria on the pessimistic side, and for Greece a large error (–1.68) on the optimistic side. It should be said in relation to this that the mean error of the IMF budget balance

forecast for the year-ahead period is very close to the corresponding mean error of the national SGP forecast.

The IMF budget balance forecasts are based on officially announced budgets, adjusted for differences between the national authorities and the IMF staff regarding macroeconomic assumptions and projected fiscal outcomes.[22] The results show that the methodology used by the IMF was not able to filter out optimistic national government budget forecasts.[23] The EC forecasts, in contrast, are based wholly on staff projections, fully incorporating the EC's own growth forecasts and benefiting from a closer knowledge of fiscal developments in EU countries. This is largely due to its supervisory role of fiscal policies under the Stability and Growth Pact, factors which probably explain its better track record.

After recomputing the simple measure to select which of the forecasts performs better in terms of the general descriptive statistics, it can be concluded that the addition of the IMF forecast does not greatly change the previous results: the IMF forecast is selected as the best forecast for the current year's growth for Portugal, and for the year-ahead growth for Ireland and Sweden (replacing the EC forecast).[24] In relation to the budget balance forecast, the IMF forecast is only selected for Belgium, and for the current period.

Overall, the forecasts produced by the two international organisations for the year-ahead horizon perform better in terms of presenting a smaller absolute mean error than national SGP forecasts in two-thirds of the cases.

With regard to the formal tests of forecast encompassing, as before, there is a tie between the IMF and the SGP forecasts, and between the IMF and the EC forecast.[25] As before, such results should be read with care, since the small number of observations might explain the inability of the tests to discriminate between the different forecasts.

3 Policy implications and conclusions

The present high public debt levels recorded in the EU at a time of increased spending pressures caused by ageing populations will require credible fiscal plans that aim at restoring fiscal sustainability. The use of unbiased growth forecasts is a crucial element in enhancing the credibility of medium-term fiscal plans. If official GDP growth forecasts are biased towards optimism, governments may appear to be planning more stringent fiscal objectives than is actually the case. Jonung and Larch (2006) concluded that "optimistic growth projections supported adequate deficit targets in the planning phase of the budget and downplayed the need for fiscal consolidation, while the worse-than-expected outcome ex-post was attributed to circumstances beyond the control of the government".[26] Hence, *getting GDP forecasts right will be quite important to bring down the debt levels*.

This paper shows that for the EU-15 economies a 1% deviation in actual output growth from the national officially forecasted value, leads to a deviation of the budget balance from planned of at least 0.5% of GDP (0.6% of GDP for two-period-ahead fiscal plans).

Jonung and Larch (2006) argued for the preparation of growth forecasts for the budget process at the national level to be delegated to independent national authorities. This paper, however, investigates whether the use of supranational growth forecasts instead of those of the national governments would reduce the optimistic bias. This required a detailed comparative analysis of the accuracy of the national governments'

growth (and budget balances) forecasts with those made by the EC and the IMF. The analysis considered three different forecast horizons (current period, one-year-ahead, two-years-ahead and three-years-ahead) for the period 1998–2008. A direct comparison is made with the competing EC's forecasts (up to the two-years-ahead forecast horizon). A comparison is also made with IMF forecasts.

The evidence on the relative performance of the EC growth forecast is rather mixed. The use of the mDM test for the equality of forecasts generally points to the equality of the predictive power of both forecasts, with a slight preponderance of better results for the EC forecasts for the year-ahead horizon. Yet, *for the pool of EU-15 countries, the EC forecast is a clear winner for all forecast horizons, except for the current period growth forecast*. A simple summary of the results of three variants of forecast encompassing tests provides further evidence for equal predictive power (at the disaggregated country level). However, given the small sample size at country level, the results of these formal statistical tests should be read with care. And so, resorting to a simple summary based on the descriptive statistics of forecasting accuracy (ME, MAE and RMSE), it is possible to conclude that the accuracy of EC forecasts is not uniform across countries or forecast horizons. Thus, different patterns emerge at the country level: for France, Italy and Portugal, the EC growth forecast is found to perform better than their national forecasts for all forecast horizons.

Taking into account the conclusions of all the tests mentioned above, for the one-year-ahead horizon, the EC growth forecast is found to be better than official forecasts for almost three quarters of the EU-15 countries (France, Italy, Portugal Germany, the Netherlands, Sweden, Spain, the UK, Greece, Ireland and Luxembourg), and also for the pool of EU-15 countries. This is a relevant conclusion since the period-ahead horizon is probably the most important time horizon for the budget process, because corrective action can be taken immediately to avoid any deviation of fiscal outcomes from the medium-term fiscal plans. For the current period, the 'success' rate of the EC forecast falls to 67%, and is further reduced to 47% when the two-years-ahead horizon is considered, which signals room for improvement in the accuracy of the EC forecast for its longer horizon ($t + 2$). Nevertheless, the EC forecast appears to be a good benchmark for all forecast horizons.

All in all, at the disaggregated country/forecast-horizon level there is some weak evidence supporting the view that in order to reduce the forecast bias, national governments should use the EC forecasts when preparing their SGPs. But there is evidence supporting the view that countries could be forced to justify any large (optimistic) deviation from the EC forecasts, which would serve as benchmark.

Along the same line of reasoning, the time span of the EC macroeconomic forecasts/projections could also be extended to cover at least one more year: the EC forecasts only cover up to the two-years-ahead horizon, while SGP updates should present macroeconomic forecasts and fiscal goals for the next three years. The practice by nine member countries of successively postponing the goal of attaining their respective MTOs, as revealed by the presence of negative mean errors in their national forecasts for the budget balance for the longer horizon, means that the lack of a EC forecast for the three-years-ahead forecast horizon is quite costly. Hence, the Commission should at least provide some guidelines, since this omission makes it harder for the (general) public, and for the Commission itself, to assess the degree of realism of the national governments' fiscal plans for the longer SGP forecast horizon.

Acknowledgements

This paper has benefited from very useful comments from two anonymous referees and from participants at the INFER workshop on 'Sustainable Public Finances in a Turbulent Global Economy', 29–30 September 2009, University of Klagenfurt, Klagenfurt, Austria. All remaining errors or omissions are solely my responsibility. The author also acknowledges financial support provided by the Portuguese Foundation for Science and Technology (FCT), under research grant PPCDT/EGE/60069/2004.

References

Artis, M. and Marcellino, M. (2001) 'Fiscal forecasting: the track record of the IMF, OECD and EC', *Econometrics Journal*, Vol. 4, No. 1, pp.20–36.

Beetsma, R., Giuliodori, M. and Wierts, P. (2009) 'Planning to cheat: EU fiscal policy in real time', *Economic Policy*, Vol. 24, No. 60, pp.753–804.

Clements, M.P. and Harvey, D.I. (2009) 'Forecast combination and encompassing', in T.C. Mills and K. Patterson (Eds.), *Palgrave Handbook of Econometrics*. Basingstoke: Palgrave Macmillan, pp.169–198.

Diebold, F.X. and Mariano, R.S. (1995) 'Comparing predictive accuracy', *Journal of Business and Economic Statistics*, Vol. 13, pp.253–263.

ECB (2004) *Monthly Bulletin*, Box 9.

European Commission (2007) 'Public finances in EMU – 2007', European Economy No. 3, Brussels: European Commission.

Forni, L. and Momigliano, S. (2004) 'Cyclical sensitivity of fiscal policies based on real-time data', *Applied Economics Quarterly*, Vol. 50, No. 3, pp.299–326.

Harvey, D.I., Leybourne, S. and Newbold, P. (1997) 'Testing the equality of prediction mean squared errors', *Int. J. Forecasting*, Vol. 13, No. 2, pp.281–291.

Jonung, L. and Larch, M. (2006) 'Improving fiscal policy in the EU: the case for independent forecasts', *Economic Policy*, Vol. 21, No. 47, pp.491–534.

Marinheiro, C.F. (2008) 'The stability and growth pact, fiscal policy institutions and stabilization in Europe', *International Economics and Economic Policy*, Vol. 5, Nos. 1–2, pp.189–207.

Melander, A., Sismanidis, G. and Grenouilleau, D. (2007) 'The track record of the commission's forecasts – an update', European Economy, European Commission Economic Papers No. 291, Brussels: European Commission.

Nogueira, M.J. and Gordo Mora, L. (2007) 'How reliable are the statistics for the stability and growth pact?' European Economy Economic Paper No. 273, Brussels: European Commission, Directorate-General for Economic and Financial Affairs.

Orphanides, A. and van Norden, S. (2002) 'The unreliability of output-gap estimates in real time', *Review of Economics and Statistics*, Vol. 84, No. 4, pp.569–583.

Strauch, R., Hallerberg, M. and von Hagen, J. (2004) 'Budgetary forecasts in Europe – the track record of stability and convergence programmes', ECB Working Paper No. 307, Frankfurt: European Central Bank.

Strauch, R., Hallerberg, M. and von Hagen, J. (2009) 'How forms of fiscal governance affect fiscal performance', in M. Hallerberg, R. Strauch and J. von Hagen (Eds.), *Fiscal Governance in Europe*. Cambridge, UK: Cambridge University Press.

Timmermann, A. (2007) 'An evaluation of the World Economic Outlook forecasts', *IMF Staff Papers*, Vol. 54, No. 1, pp.1–33.

Vogel, L. (2007) 'How do the OECD growth projections for the G7 economies perform? A post-mortem', OECD Economics Department Working Paper No. 573, 30, Paris: OECD.

Notes

[1] See also Forni and Momigliano (2004) and Marinheiro (2008), *inter alia*, for an application of real-time data to fiscal policy.

[2] Strauch et al. (2009) have only compared the accuracy of national forecasts with the EC forecasts in the context of forecast encompassing.

[3] Nogueira and Gordo Mora (2007) analysed the amount of revisions in deficit and debt data reported by national authorities to the EC and concluded that there is evidence suggesting that the size of deficits may have an impact on the way statistical offices revise data.

[4] For example, the actual figure for GDP growth in the year 2000 corresponds to the estimate made in the autumn of 2001. The exception is 2008 for which we use the first estimate published in the spring of 2009.

[5] As pointed out by a referee, a comparison with final data might be revealing too, since it could be the government forecasts were good forecasts of the final revised data but the second release was too pessimistic. However, as pointed out by the same referee, this is unlikely to be true.

[6] For convenience, we will use SGP to designate both the SGPs and the convergence programmes.

[7] The focus on the budget process, and its timing, leads us to depart from Artis and Marcellino (2001) in the definition of the current year forecast: we stick to the official SGP forecasts (presented in November/December of year t for year t), while Artis and Marcellino (2001) considered the current year forecasts as those published in May of year t for year t.

[8] Some countries presented SGP updates before November. However, some of the annual updates referring to year t were only submitted in the course of the next year ($t + 1$), which introduces a bias towards increased accuracy of current year forecasts, since the year of reference was already completed (i.e. in such cases the published numbers are not a true forecast but a first estimate). This occurred principally in the first years of the sample period, or when there were government changes occurring near the end of the fiscal year, and again in the 2008 update of SGPs, which were presented by January 2009, due to the anticrisis plan launched by the EC in December 2008.

[9] The mDM test includes a correction for serial correlation, considering a lag of 1, and not $h + 1$, due to the small number of observations at the country level for each forecast horizon. The exception is for Austria ($t + 2$), for the budget balance, where no correction for autocorrelation is made. For panel (country-pooled) results, for each time horizon, a window to take into account the panel structure is used, relying on the N-dimension to provide consistency, making use of 'clustered standard error calculations'. Since the t-dimension is relatively small, correcting for arbitrary correlation patterns is possible, with the calculation being performed in WinRATS, with 'robust errors' and 'lwindow = panel' as options.

[10] A generic forecast is said to be Mincer-Zarnowitz efficient if $\beta = 0$ and $\gamma = 1$ in a regression $y_t = \alpha + \gamma f_t + \varepsilon_t$, which implies that the forecast and the forecast error are uncorrelated.

[11] The usual assumption of an identically and independently distributed regression error ε_t is not plausible for forecasts at horizons greater than one, since even optimal forecasts in this setting would be expected to have errors that follow a moving-average process of order $h - 1$. Some forecast errors may also be non-normally distributed, which indicates conditional heteroskedasticity in the regression FE(2), resulting in oversized tests if conventional t-tests are used.

[12] This paper makes use of (raw) budget balances relative to GDP instead of cyclically adjusted balances, since the former are relevant for evaluating compliance with the 3% deficit ceiling set in the treaty and receive much public attention, while the latter are dependent on the output gap estimation, deserve less public attention and have only explicitly been taken into account since the 2005 reform of the Stability Pact.

[13] However, the estimates are not free from serially correlated errors.

[14] Those values compare with an estimate of 0.46 found by Strauch et al. (2009) for the period 1998–2004 for the pooling of countries and forecast horizons.

[15] Only the estimate for the current period is found to be statistically different from the estimate that pools all forecast horizons.

[16]There is only some evidence pointing to a bias in the EC forecast for Greece and Luxembourg at the 10% significance level.

[17]The authors did not make a comparison with national official forecasts.

[18]Strauch et al. (2009) argue that looking at country performance for each projection horizon would have drastically reduced the number of observations and therefore might not lead to reasonable results. According to the authors,

> "Since the projection horizon is standardized to three years ahead according to the stipulations of the Stability and Growth Pact and censoring of data at the end of the sample period affects all countries similarly, we should not incur any systematic mistakes when pooling observations over projection horizons."

[19]Contrary to Beetsma et al. (2009) and other literature, this paper does not try to find out the determinants of the differences between fiscal plans and fiscal outcomes or to relate these differences to institutional variables. Instead it has focused on the issue of the impact of growth forecast bias on fiscal outcomes.

[20]Contrary to the previous sections where the sample for the current period horizon covers the period 1998–2008, here the IMF's current year forecasts made in October 2008 for the year of 2008 are not considered since SGP forecasts for 2008 were only released in January 2009. Although the IMF also produced an interim forecast update in January 2009, it was only for a few large countries.

[21]The IMF forecast for the deficit for the pool of countries presents serial correlation problems of order two.

[22]See the latest IMF World Economic Outlook of October 2009, which also adds that

> "The medium-term fiscal projections incorporate policy measures that are judged likely to be implemented. In cases where the IMF staff has insufficient information to assess the authorities' budget intentions and prospects for policy implementation, an unchanged structural primary balance is assumed, unless otherwise indicated."

[23]The authors are grateful to an anonymous referee for this point.

[24]As a result of the reduction in the sample for the current year period up to 2007, the national SGP growth forecasts are found to be better than the EC forecasts for Finland, Sweden and the UK. The same happens with France for the current year budget balance forecast.

[25]These results are not shown due to space constraints but are available upon request.

[26]According to the authors, "a rosy medium-term outlook underpinning budgetary projections has served as a means to avoid or postpone the adoption of comprehensive reforms and politically costly reforms".

Appendix

A general statistics

Table A1 Forecast errors for the current period

	SGP forecast					*EC autumn forecast*					
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*
GDP growth											
BE	10	0.08	0.20	0.23	*0.05*	11	0.09	0.25	0.36	*0.00*	SGP
DK	11	0.05	0.55	0.66	*0.61*	11	0.07	0.35	0.37	*0.79*	EC
DE	11	−0.01	0.27	0.36	*0.33*	11	−0.06	0.19	0.27	*0.86*	EC
EL	11	0.14*	0.19	0.25	*0.85*	11	0.25**	0.26	0.37	*0.83*	SGP
ES	11	0.08	0.19	0.23	*0.13*	11	0.14**	0.15	0.22	*0.80*	EC
FR	11	−0.15*	0.20	0.27	*0.30*	11	0.04	0.22	0.25	*0.06*	EC
IE	11	0.46	1.08	1.20	*0.13*	11	0.64	1.42	1.72	*0.40*	SGP
IT	11	0.01	0.30	0.44	*0.89*	11	−0.09	0.18	0.24	*0.95*	EC
LU	11	0.06	1.21	1.52	*0.13*	11	0.35	1.28	1.58	*0.37*	SGP
NL	11	−0.27	0.70	1.02	*0.86*	11	0.19	0.39	0.55	*0.82*	EC
AT	10	−0.04	0.34	0.39	*0.67*	11	0.09	0.36	0.42	*0.57*	SGP
PT	11	−0.17*	0.25	0.30	*0.53*	11	−0.11	0.22	0.30	*0.02*	EC
FI	11	0.19	0.50	0.67	*0.54*	11	0.38**	0.49	0.58	*0.62*	EC
SE	11	−0.22	0.40	0.59	*0.09*	11	−0.14	0.32	0.38	*0.50*	EC
UK	11	0.11	0.17	0.31	*0.95*	11	0.00	0.20	0.24	*0.59*	EC
Pool	*163*	*0.02*	*0.44*	*0.68*	*0.00*	*165*	*0.12***	*0.42*	*0.69*	*0.07*	*SGP*
Budget balance											
BE	10	−0.07	0.41	0.77	*0.88*	11	−0.04	0.44	0.75	*0.80*	EC
DK	10	3.35***	3.35	3.66	*0.23*	11	0.62**	0.80	1.04	*0.44*	EC
DE	11	0.33	0.44	0.74	*0.71*	11	0.24*	0.38	0.46	*0.30*	EC
EL	11	−0.79**	0.81	1.19	*0.60*	11	−0.82**	0.87	1.22	*0.78*	SGP
ES	11	0.09	0.27	0.34	*0.66*	11	0.19	0.34	0.41	*0.74*	SGP
FR	11	−0.05	0.19	0.24	*0.45*	11	0.05	0.17	0.21	*0.99*	EC
IE	11	−0.34	0.85	1.63	*0.95*	11	−0.22	1.16	1.55	*0.99*	EC

Table A1 Forecast errors for the current period (continued)

	SGP forecast					*EC autumn forecast*					
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*
Budget balance											
IT	11	0.07	0.40	0.54	*0.77*	11	0.04	0.31	0.41	*0.73*	EC
LU	11	1.65***	1.65	1.89	*0.34*	11	1.62***	1.76	2.08	*0.66*	SGP
NL	11	0.38	0.76	0.85	*0.48*	11	0.30	0.79	0.89	*0.16*	SGP
AT	10	0.16*	0.26	0.28	*0.66*	11	0.29*	0.36	0.55	*0.80*	SGP
PT	10	+0.11	0.37	0.67	*0.93*	11	+0.05	0.55	0.79	*0.83*	SGP
FI	11	0.43	0.68	0.94	*0.12*	11	0.39	0.79	1.08	*0.15*	SGP
SE	11	0.46**	0.59	0.72	*0.42*	11	0.55**	0.62	0.81	*0.45*	SGP
UK	11	0.41	0.59	1.07	*0.30*	11	+0.15	0.38	0.46	*0.27*	EC
Pool	*162*	*0.38****	*0.77*	*1.31*	*0.00*	*165*	*0.20****	*0.65*	*0.97*	*0.01*	*EC*

*, **, *** denote statistical significance of the mean error at the 10%, 5% and 1% level, significantly.

Note: ME stands for mean error of the forecast; MAE for mean absolute error and RMSE for root mean square error. 'Pv no AR(2)' stands for *p*-value of the LM test (*F*-variant) for the null of no serial correlation up to order 2. The 'Winner' column depicts the forecast that performs better in terms of smaller absolute ME, smaller MAE and smaller RMSE (the forecast that performs better in the larger number of criteria is selected).

BE – Belgium; DK – Denmark; DE – Germany; EL – Greece; ES – Spain; FR – France; IE – Ireland; IT – Italy; LU – Luxembourg; NL – The Netherlands; AT – Austria; PT – Portugal; FI – Finland; SE – Sweden; UK – The United Kingdom.

Table A2 Forecast errors for the period $t + 1$

	SGP forecast					*EC autumn forecast*					
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*
GDP growth											
BE	9	+0.17	0.99	1.08	*0.72*	10	+0.26	0.96	1.14	*0.39*	SGP
DK	10	+0.15	0.93	1.18	*0.85*	10	+0.24	0.98	1.19	*0.85*	SGP
DE	10	+0.38	1.00	1.15	*0.94*	10	+0.28	0.96	1.16	*0.91*	EC
EL	10	0.08	0.54	0.63	*0.92*	10	0.21	0.49	0.55	*0.81*	EC
ES	10	+0.15	0.59	0.76	*0.65*	10	0.03	0.57	0.76	*0.73*	EC
FR	10	+0.68*	0.92	1.13	*0.60*	10	+0.42	0.68	0.85	*0.21*	EC
IE	10	0.52	2.20	2.76	*0.37*	10	0.41	2.17	2.82	*0.45*	EC
IT	10	+1.01**	1.27	1.48	*0.57*	10	+0.74**	0.98	1.20	*0.45*	EC
LU	10	0.30	3.02	3.47	*0.19*	10	0.15	2.71	3.27	*0.44*	EC
NL	10	+0.22	1.09	1.35	*0.64*	10	+0.23	1.07	1.29	*0.96*	EC
AT	9	+0.14	0.70	0.95	*0.75*	10	+0.17	0.73	0.97	*0.79*	SGP

Table A2 Forecast errors for the period $t + 1$ (continued)

	SGP forecast					*EC autumn forecast*					
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*
GDP growth											
PT	10	+0.96**	1.08	1.41	*0.57*	10	+0.75*	0.99	1.26	*0.67*	EC
FI	10	+0.01	1.35	1.69	*0.62*	10	+0.03	1.41	1.71	*0.53*	SGP
SE	10	+0.31	1.29	1.58	*0.82*	10	+0.34	1.14	1.50	*0.83*	EC
UK	10	+0.12	0.65	0.76	*0.68*	10	+0.20	0.64	0.76	*0.20*	EC
Pool	*148*	*+0.23**	*1.18*	*1.61*	*0.07*	*150*	*+0.19*	*1.10*	*1.54*	*0.03*	*EC*
Budget balance											
BE	9	+0.24	0.71	0.98	*0.81*	10	0.02	0.64	0.81	*0.43*	EC
DK	10	0.89*	1.27	1.66	*0.39*	10	0.59	0.99	1.42	*0.56*	EC
DE	10	0.22	1.07	1.27	*0.68*	10	0.43	0.99	1.25	*0.86*	EC
EL	10	+1.83**	1.93	2.55	*0.23*	10	+1.37**	1.79	2.20	*0.08*	EC
ES	10	+0.04	1.00	1.71	*0.39*	10	0.06	1.14	1.78	*0.20*	SGP
FR	10	+0.39	0.63	0.84	*0.08*	10	+0.26	0.66	0.81	*0.59*	EC
IE	10	+0.45	2.19	2.74	*0.96*	10	+0.97	2.37	2.89	*0.93*	SGP
IT	10	+0.54	1.04	1.14	*0.39*	10	+0.14	0.76	0.89	*0.21*	EC
LU	10	2.01***	2.09	2.53	*0.71*	10	2.00***	2.08	2.39	*0.42*	EC
NL	10	0.63	1.44	1.72	*0.08*	10	0.60	1.52	1.76	*0.07*	SGP
AT	9	0.21	0.34	0.41	*0.82*	10	0.48**	0.56	0.70	*0.89*	SGP
PT	10	+0.61	0.97	1.48	*0.55*	10	+0.35	0.93	1.31	*0.67*	EC
FI	10	0.96**	1.14	1.42	*0.93*	10	0.92**	1.08	1.43	*0.99*	EC
SE	10	1.04**	1.50	1.63	*0.26*	10	0.85**	1.15	1.33	*0.05*	EC
UK	10	+0.01	1.17	1.70	*0.64*	10	+0.40	1.38	1.66	*0.51*	SGP
Pool	*148*	*0.13*	*1.24*	*1.71*	*0.00*	*150*	*0.16*	*1.20*	*1.63*	*0.00*	*EC*

Note: see Table A1.

Table A3 Forecast errors for the period $t + 2$

	SGP forecast					*EC autumn forecast*					
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*
GDP growth											
BE	8	+0.81*	1.09	1.26	*0.98*	9	+0.69	1.18	1.38	*0.36*	SGP
DK	9	0.09	1.13	1.31	*0.94*	9	+0.46	1.19	1.51	*0.58*	SGP
DE	9	+0.54	1.35	1.52	*0.55*	9	+0.82	1.38	1.63	*0.32*	SGP
EL	9	0.03	0.66	0.81	*0.53*	9	0.23	0.63	0.70	*0.64*	EC
ES	9	+0.18	0.80	0.97	*0.20*	9	+0.26	0.86	1.03	*0.17*	SGP
FR	9	+0.83**	0.97	1.18	*0.59*	9	+0.87**	0.93	1.15	*0.90*	EC

Table A3 Forecast errors for the period $t + 2$ (continued)

	SGP forecast					*EC autumn forecast*					
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*
GDP growth											
IE	9	+0.16	2.02	3.00	*0.69*	9	+0.51	1.58	2.48	*0.78*	EC
IT	9	+1.42***	1.44	1.80	*0.40*	9	+1.14**	1.28	1.58	*0.50*	EC
LU	9	+0.46	3.12	3.61	*0.40*	9	+0.68	3.06	3.51	*0.21*	EC
NL	9	+0.34	1.08	1.34	*0.80*	9	+0.96	1.44	1.93	*0.28*	SGP
AT	8	+0.20	0.78	0.88	*0.80*	9	+0.41	0.86	1.06	*0.51*	SGP
PT	9	+1.72***	1.79	2.10	*0.83*	9	+1.40***	1.56	1.79	*0.88*	EC
FI	9	0.31	1.67	1.87	*0.74*	9	+0.08	1.61	1.90	*0.50*	EC
SE	9	+0.19	1.06	1.42	*0.84*	9	+0.46	1.17	1.48	*0.69*	SGP
UK	9	+0.40	0.56	0.80	*0.08*	9	+0.54	0.88	1.04	*0.64*	SGP
Pool	*133*	*+0.45****	*1.31*	*1.78*	*0.01*	*135*	*+0.60****	*1.31*	*1.74*	*0.00*	*SGP*
Budget balance											
BE	8	+0.43	0.80	1.11	*0.72*	9	+0.02	0.78	0.92	*0.44*	EC
DK	9	0.96	1.58	1.94	*0.16*	9	0.52	1.39	1.70	*0.13*	EC
DE	9	+0.24	1.98	2.13	*0.02*	9	0.22	1.80	2.03	*0.10*	EC
EL	9	+2.62**	2.84	3.53	*0.22*	9	+1.81*	2.17	2.94	*0.03*	EC
ES	9	0.07	1.16	1.78	*0.26*	9	0.24	1.36	1.95	*0.32*	SGP
FR	9	+1.00**	1.13	1.55	*0.06*	9	+0.52	1.14	1.41	*0.13*	EC
IE	9	+0.61	2.79	3.50	*0.96*	9	+1.48	2.57	3.36	*0.95*	EC
IT	9	+1.23**	1.77	1.91	*0.70*	9	+0.03	1.17	1.41	*0.86*	EC
LU	9	1.73*	2.38	2.84	*0.13*	9	1.97*	2.77	3.12	*0.26*	SGP
NL	8	0.24	1.66	1.91	*0.11*	9	0.16	2.16	2.50	*0.01*	SGP
AT	8	0.00	0.40	0.50	*0.07*	9	0.37	0.99	1.21	*0.81*	SGP
PT	9	+1.33**	1.58	1.97	*0.61*	9	+0.49	1.33	1.61	*0.49*	EC
FI	9	1.44**	1.49	2.16	*0.35*	9	1.17	1.63	2.19	*0.52*	SGP
SE	9	0.98	1.84	2.02	*0.29*	9	0.69	1.67	1.92	*0.65*	EC
UK	9	+0.53	1.67	2.20	*0.76*	9	+1.04	2.09	2.60	*0.19*	SGP
Pool	*132*	*+0.18*	*1.69*	*2.22*	*0.00*	*135*	*0.00*	*1.67*	*2.17*	*0.00*	*EC*

Note: see Table A1.

Table A4 Forecast errors for the period $t + 3$

	GDP growth(SGP)					*Budget balance (SGP)*				
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*
BE	7	+0.60	0.91	1.05	*0.73*	7	+0.69	0.91	1.26	*0.65*
DK	8	+0.28	1.05	1.33	*0.33*	8	1.14	1.81	2.09	*0.42*
DE	8	+0.89*	1.18	1.36	*0.62*	8	+1.11	2.14	2.36	*0.01*
EL	8	+0.11	0.66	0.74	*0.89*	8	+3.56***	3.56	4.39	*0.03*
ES	8	+0.30	0.85	1.01	*0.36*	8	0.04	1.19	1.82	*0.41*
FR	8	+1.04***	1.04	1.27	*0.82*	8	+1.78***	1.83	2.19	*0.10*
IE	8	+0.86	1.64	2.69	*0.61*	8	+1.30	2.58	3.18	*0.87*
IT	8	+1.90***	1.90	2.10	*0.77*	8	+2.11***	2.11	2.49	*0.31*
LU	8	+1.45	2.48	2.91	*0.00*	8	0.79	2.71	3.13	*0.23*
NL	8	+0.67	1.04	1.34	*0.71*	7	0.06	1.86	2.07	*0.13*
AT	7	+0.40	0.89	0.97	*0.99*	7	+0.13	0.73	0.92	*0.51*
PT	8	+2.30***	2.30	2.53	*0.88*	8	+2.30***	2.30	2.68	*0.48*
FI	8	0.18	1.30	1.54	*0.96*	8	0.91	1.69	2.03	*0.09*
SE	7	+0.14	1.11	1.36	*0.80*	7	0.30	1.64	1.93	*0.71*
UK	8	+0.38	0.75	0.96	*0.28*	8	+1.45**	1.65	1.92	*0.51*
Pool	*117*	*+0.75 ****	*1.28*	*1.69*	*0.01*	*116*	*+0.77****	*1.94*	*2.46*	*0.00*

Note: see Table A1.

Table A5 Forecast errors for the IMF forecast

Horizon	*Current year*						*Year-ahead*					
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*
GDP growth												
BE	10	+0.38	0.88	1.76	*0.90*	SGP	10	+0.25	1.01	1.15	*0.71*	SGP
DK	10	0.26	0.52	0.61	*0.77*	EC	10	+0.22	1.02	1.28	*0.90*	SGP
DE	10	0.00	0.28	0.37	*0.39*	EC	10	+0.54	1.24	1.45	*0.84*	EC
EL	10	0.38***	0.42	0.50	*0.91*	SGP	10	0.47	0.65	0.78	*0.73*	EC
ES	10	0.24**	0.24	0.33	*0.97*	EC	10	0.02	0.68	0.76	*0.32*	EC
FR	10	+0.08	0.24	0.28	*0.38*	EC	10	+0.62	0.76	1.00	*0.65*	EC
IE	10	1.22**	1.40	1.81	*0.68*	SGP	10	0.36	1.98	2.56	*0.64*	IMF
IT	10	+0.12	0.24	0.33	*0.83*	EC	10	+0.92**	1.16	1.36	*0.66*	EC
LU	10	1.06	2.02	2.42	*0.33*	SGP	10	0.02	2.88	3.30	*0.46*	EC
NL	10	0.25	0.49	0.62	*0.97*	EC	10	+0.40	1.16	1.44	*0.83*	EC
AT	10	0.13	0.45	0.54	*0.89*	SGP	10	+0.25	0.95	1.10	*0.98*	SGP
PT	10	+0.11	0.17	0.27	*0.54*	IMF	10	+0.98*	1.12	1.40	*0.86*	EC

Table A5 Forecast errors for the IMF forecast (continued)

Horizon	*Current year*						*Year-ahead*					
Country	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*	*Nobs*	*ME*	*MAE*	*RMSE*	*Pv no AR(2)*	*'Winner'*
GDP growth												
FI	10	0.56**	0.82	0.91	*0.90*	SGP	10	0.06	1.44	1.70	*0.90*	SGP
SE	10	+0.05	0.45	0.52	*0.98*	SGP	10	+0.19	1.15	1.43	*0.93*	IMF
UK	10	0.10	0.24	0.40	*0.36*	SGP	10	+0.07	0.71	0.80	*0.41*	EC
Pool	*150*	*0.23***	*0.59*	*1.01*	*0.07*	*SGP*	*150*	*+0.23*	*1.19*	*1.58*	*0.75*	*EC*
Budget balance												
BE	10	0.12	0.44	0.60	*0.84*	IMF	9	0.21	0.88	1.15	*0.37*	EC
DK	10	0.77*	1.07	1.45	*0.31*	EC	10	0.95	1.39	1.78	*0.23*	EC
DE	10	0.21	0.53	0.65	*0.25*	EC	10	0.33	1.31	1.54	*0.56*	EC
EL	10	+1.21**	1.27	1.72	*0.16*	SGP	10	+1.68**	2.16	2.82	*0.03*	EC
ES	9	0.43***	0.46	0.52	*0.20*	SGP	8	0.13	1.28	1.84	*0.86*	SGP
FR	10	+0.04	0.36	0.41	*0.65*	SGP	10	+0.40	0.86	1.10	*0.69*	EC
IE	10	+0.01	1.27	1.61	*0.73*	Tie	10	+0.51	2.17	2.86	*0.98*	SGP
IT	10	0.06	0.46	0.53	*0.50*	EC	10	+0.10	1.08	1.24	*0.43*	EC
LU	10	2.00***	2.00	2.24	*0.08*	SGP	10	2.02***	2.74	3.14	*0.58*	EC
NL	10	0.58	1.04	1.15	*0.08*	SGP	10	0.76	1.72	2.00	*0.03*	SGP
AT	10	0.31**	0.43	0.48	*0.35*	SGP	9	0.37**	0.57	0.73	*0.20*	SGP
PT	10	0.29	0.83	0.99	*0.87*	SGP	10	+0.21	0.97	1.33	*0.74*	EC
FI	10	0.68**	0.98	1.10	*0.52*	SGP	10	1.15**	1.15	1.49	*0.43*	EC
SE	10	0.87**	1.01	1.25	*0.40*	SGP	10	0.96**	1.48	1.67	*0.10*	EC
UK	10	0.11	0.53	0.71	*0.16*	EC	10	+0.10	1.52	2.12	*0.43*	SGP
Pool	*150*	*0.34***	*0.84*	*1.15*	*0.00*	*EC*	*150*	*0.25*	*1.40*	*1.90*	*0.00*	*EC*

Note: See Table A1.

B Forecast encompassing tests

Table A6 Forecast encompassing tests for the current period

	p-Value mDM test for:				*FE(1)*		*FE(2)*		*FE(3)*		
	Better forecast				*Better forecast*		*Better forecast*		*Better forecast*		*FE overall*
Country	*Equality*	*SGP*	*EC*	*Concl.*	*SGP*	*EC*	*SGP*	*EC*	*SGP*	*EC*	*'winner'*
GDP growth											
BE	0.15	0.07	0.93	=	0.24	0.00	0.18	0.00	0.22	0.32	*SGP*
DK	0.01	0.99	0.01	*EC*	0.00	0.62	0.00	0.02	0.11	0.15	*EC*
DE	0.03	0.98	0.02	*EC*	0.01	0.16	0.01	0.29	0.97	0.40	*EC*
EL	0.04	0.02	0.98	*SGP*	0.60	0.01	0.14	0.00	0.05	0.01	*SGP*
ES	0.66	0.67	0.33	=	0.07	0.86	0.23	0.50	0.21	0.04	*SGP*

Table A6 Forecast encompassing tests for the current period (continued)

	p-Value mDM test for:				*FE(1)*		*FE(2)*		*FE(3)*		
		Better forecast			*Better forecast*		*Better forecast*		*Better forecast*		*FE overall*
Country	*Equality*	*SGP*	*EC*	*Concl.*	*SGP*	*EC*	*SGP*	*EC*	*SGP*	*EC*	*'winner'*
GDP growth											
FR	0.72	0.64	0.36	=	0.80	0.38	0.08	0.22	0.17	0.93	*Tie*
IE	0.09	0.04	0.96	*SGP (?)*	0.11	0.01	0.10	0.00	0.36	0.46	*SGP*
IT	0.23	0.89	0.11	=	0.00	0.99	0.00	0.88	0.49	0.59	*EC*
LU	0.27	0.14	0.86	=	0.65	0.62	0.82	0.37	0.75	0.34	*Tie*
NL	0.22	0.89	0.11	=	0.00	0.40	0.00	0.93	0.69	0.69	*EC*
AT	0.44	0.78	0.22	=	0.31	0.58	0.51	0.88	0.44	0.71	*Tie*
PT	0.73	0.64	0.36	=	0.74	0.18	0.32	0.41	0.14	0.46	*Tie*
FI	0.65	0.68	0.32	=	0.01	0.47	0.09	0.70	0.28	0.04	*Tie*
SE	0.29	0.86	0.14	=	0.02	0.55	0.00	0.46	0.69	0.28	*EC*
UK	0.65	0.67	0.33	=	0.25	0.00	0.01	0.10	0.75	0.81	*Tie*
Pool	*0.89*	*0.44*	*0.56*	=	*0.16*	*0.12*	*0.18*	*0.10*	*0.01*	*0.00*	*Tie*
Budget balance											
BE	0.70	0.35	0.65	=	0.49	0.35	0.86	0.63	0.60	0.96	*Tie*
DK	0.01	1.00	0.00	*EC*	0.00	0.55	0.00	0.13	0.00	0.82	*EC*
DE	0.41	0.80	0.20	=	0.00	0.78	0.00	0.28	0.79	0.02	*EC*
EL	0.73	0.36	0.64	=	0.88	0.62	0.91	0.48	0.08	0.03	*SGP*
ES	0.02	0.01	0.99	*SGP*	0.12	0.05	0.54	0.05	0.08	0.11	*SGP*
FR	0.65	0.68	0.32	=	0.19	0.91	0.11	0.65	0.43	0.54	*Tie*
IE	0.74	0.63	0.37	=	0.34	0.67	0.26	0.62	0.95	0.73	*Tie*
IT	0.13	0.93	0.07	=	0.02	0.62	0.02	0.79	0.72	0.41	*EC*
LU	0.73	0.36	0.64	=	0.13	0.01	0.42	0.11	0.10	0.20	*SGP*
NL	0.75	0.37	0.63	=	0.90	0.35	0.67	0.33	0.67	0.33	*Tie*
AT	0.23	0.12	0.88	=	0.75	0.00	0.30	0.00	0.12	0.39	*SGP*
PT	0.10	0.05	0.95	=	0.70	0.22	0.51	0.07	0.99	0.95	*Tie*
FI	0.22	0.11	0.89	=	0.05	0.01	0.12	0.03	0.14	0.20	*SGP*
SE	0.26	0.13	0.87	=	0.48	0.17	0.75	0.13	0.08	0.04	*SGP*
UK	0.30	0.85	0.15	=	0.00	0.01	0.00	0.11	0.09	0.04	*Tie*
Pool	*0.30*	*0.85*	*0.15*	=	*0.00*	*0.13*	*0.00*	*0.45*	*0.05*	*0.09*	*EC*

Note: *p*-Values for the tests.'=' means that the mDM null of the test for equality of forecasts is not rejected; 'EC' or 'SGP' denotes which forecast is found to perform better. In column (5), the '(?)' is added to the outcome of the test for the null of equal forecasts vs. one forecast being better than the other, if this test result conflicts with the test in column (2) (null of equality vs. different forecasts). The last column selects an overall 'winner' in forecast encompassing tests FE(1) to FE(3), computed as the forecast i.e. selected in a larger number of the six tests. 'Tie' denotes that both forecasts are selected in the same number of tests. FE(1)–FE(3) tests are based on OLS regressions for the countries. Robust standard errors, obtained by clustered standard error calculations, are used for the pool (panel) of countries.

Table A7 Forecast encompassing tests for the period $t + 1$

	p-Value mDM test for				*FE(1)*		*FE(2)*		*FE(3)*		
	Better forecast				*Better forecast*		*Better forecast*		*Better forecast*		*FE overall*
Country	*Equality*	*SGP*	*EC*	*Concl.*	*SGP*	*EC*	*SGP*	*EC*	*SGP*	*EC*	*'winner'*
GDP growth											
BE	0.18	0.09	0.91	=	0.70	0.57	0.50	0.16	0.60	0.42	*Tie*
DK	0.50	0.25	0.75	=	0.45	0.81	0.84	0.67	0.83	0.69	*Tie*
DE	0.93	0.47	0.53	=	0.46	0.51	0.83	0.72	0.23	0.30	*Tie*
EL	0.10	0.95	0.05	=	0.32	0.55	0.11	0.83	0.79	0.31	*Tie*
ES	0.90	0.55	0.45	=	0.82	0.55	0.59	0.74	0.62	0.89	*Tie*
FR	0.06	0.97	0.03	*EC (?)*	0.06	0.17	0.01	0.09	0.07	0.08	*EC*
IE	0.27	0.13	0.87	=	0.92	0.52	0.93	0.55	0.50	0.54	*Tie*
IT	0.05	0.98	0.02	*EC*	0.15	0.40	0.01	0.05	0.03	0.04	*EC*
LU	1.00	0.50	0.50	=	0.54	0.44	0.31	0.85	1.00	0.76	*Tie*
NL	0.62	0.69	0.31	=	0.41	0.79	0.39	0.98	0.62	0.47	*Tie*
AT	0.19	0.09	0.91	=	0.31	0.26	0.39	0.17	0.48	0.44	*Tie*
PT	0.03	0.99	0.01	*EC*	0.58	0.87	0.04	0.12	0.04	0.07	*EC*
FI	0.65	0.33	0.67	=	0.84	0.77	0.98	0.69	0.83	0.82	*Tie*
SE	0.28	0.86	0.14	=	0.19	0.11	0.32	0.78	0.47	0.32	*Tie*
UK	0.99	0.51	0.49	=	0.58	0.69	0.31	0.31	0.60	0.38	*Tie*
Pool	*0.08*	*0.96*	*0.04*	*EC (?)*	*0.00*	*0.84*	*0.00*	*0.97*	*0.29*	*0.21*	*EC*
Budget balance											
BE	0.02	0.99	0.01	*EC*	0.40	0.61	0.11	0.78	0.59	0.48	*Tie*
DK	0.20	0.90	0.10	=	0.08	0.15	0.08	0.52	0.11	0.38	*Tie*
DE	0.86	0.57	0.43	=	0.27	0.48	0.55	0.81	0.86	0.33	*Tie*
EL	0.17	0.92	0.08	=	0.70	0.96	0.04	0.18	0.10	0.29	*EC*
ES	0.22	0.11	0.89	=	0.35	0.33	0.57	0.31	0.15	0.34	*Tie*
FR	0.84	0.58	0.42	=	0.23	0.66	0.33	0.53	0.24	0.66	*Tie*
IE	0.48	0.24	0.76	=	0.69	0.92	0.99	0.34	0.72	0.41	*Tie*
IT	0.12	0.94	0.06	=	0.08	0.20	0.02	0.28	0.21	0.92	*EC*
LU	0.42	0.79	0.21	=	0.15	0.87	0.32	0.96	0.30	0.65	*Tie*
NL	0.67	0.34	0.66	=	0.86	0.70	0.84	0.49	0.11	0.11	*Tie*
AT	0.00	0.00	1.00	*SGP*	0.78	0.27	0.22	0.02	0.13	0.07	*SGP*
PT	0.23	0.88	0.12	=	0.01	0.02	0.10	0.42	0.43	0.97	*Tie*
FI	0.97	0.48	0.52	=	0.82	0.46	0.72	0.66	0.03	0.03	*Tie*
SE	0.02	0.99	0.01	*EC*	0.11	0.45	0.02	0.21	0.09	0.21	*EC*
UK	0.90	0.55	0.45	=	0.37	0.04	0.38	0.55	0.11	0.18	*SGP*
Pool	*0.07*	*0.97*	*0.03*	*EC (?)*	*0.00*	*0.33*	*0.00*	*0.83*	*0.00*	*0.26*	*EC*

Note: see Table A6.

Table A8 Forecast encompassing tests for the period $t + 2$

	p-Value mDM test for:				*FE(1)*		*FE(2)*		*FE(3)*		
	Better forecast				*Better forecast*		*Better forecast*		*Better forecast*		*FE overall*
Country	*Equality*	*SGP*	*EC*	*Concl.*	*SGP*	*EC*	*SGP*	*EC*	*SGP*	*EC*	*'winner'*
GDP growth											
BE	0.60	0.30	0.70	=	0.47	0.88	0.53	0.18	0.04	0.04	*Tie*
DK	0.62	0.31	0.69	=	0.20	0.17	0.95	0.14	0.93	0.55	*Tie*
DE	0.57	0.29	0.71	=	0.73	0.21	0.77	0.29	0.17	0.05	*SGP*
EL	0.23	0.89	0.11	=	0.30	0.24	0.14	0.81	0.95	0.51	*Tie*
ES	0.16	0.08	0.92	=	0.68	0.72	0.56	0.25	0.56	0.46	*Tie*
FR	1.00	0.50	0.50	=	0.30	0.45	0.54	1.00	0.03	0.01	*Tie*
IE	0.28	0.86	0.14	=	0.06	0.91	0.05	0.31	0.76	0.68	*EC*
IT	0.10	0.95	0.05	=	0.93	0.95	0.01	0.04	0.01	0.02	*Tie*
LU	0.74	0.63	0.37	=	0.97	0.44	0.51	0.89	0.49	0.33	*Tie*
NL	0.32	0.16	0.84	=	0.32	0.38	0.17	0.01	0.36	0.21	*SGP*
AT	0.59	0.30	0.70	=	0.91	0.90	0.99	0.57	0.53	0.48	*Tie*
PT	0.00	1.00	0.00	*EC*	0.22	0.38	0.01	0.06	0.01	0.01	*EC*
FI	0.91	0.45	0.55	=	0.75	0.13	0.82	0.58	0.77	0.77	*Tie*
SE	0.67	0.34	0.66	=	0.41	0.52	0.94	0.42	0.66	0.35	*Tie*
UK	0.42	0.21	0.79	=	0.94	0.35	0.86	0.05	0.15	0.17	*SGP*
Pool	*0.67*	*0.66*	*0.34*	=	*0.03*	*0.96*	*0.11*	*0.44*	*0.03*	*0.00*	*EC*
Budget balance											
BE	0.26	0.87	0.13	=	0.35	0.48	0.09	0.67	0.59	0.27	*Tie*
DK	0.28	0.86	0.14	=	0.35	0.14	0.13	0.60	0.24	0.68	*Tie*
DE	0.76	0.62	0.38	=	0.08	0.04	0.39	0.99	0.97	0.30	*SGP*
EL	0.07	0.96	0.04	*EC (?)*	0.77	0.79	0.03	0.15	0.33	0.86	*EC*
ES	0.27	0.14	0.86	=	0.21	0.42	0.34	0.13	0.06	0.34	*Tie*
FR	0.45	0.78	0.22	=	0.17	0.16	0.24	0.99	0.21	0.81	*Tie*
IE	0.66	0.67	0.33	=	0.06	0.10	0.40	0.77	0.64	0.05	*Tie*
IT	0.44	0.78	0.22	=	0.12	0.18	0.03	0.86	0.14	0.28	*EC*
LU	0.38	0.19	0.81	=	0.80	0.88	0.57	0.19	0.78	0.67	*Tie*
NL	0.20	0.10	0.90	=	0.18	0.38	0.15	0.02	0.01	0.23	*Tie*
AT	0.06	0.03	0.97	*SGP (?)*	0.12	0.03	0.58	0.01	0.19	0.62	*SGP*
PT	0.44	0.78	0.22	=	0.10	0.12	0.07	0.77	0.15	0.94	*Tie*
FI	0.79	0.40	0.60	=	0.20	0.18	0.85	0.64	0.16	0.27	*Tie*
SE	0.49	0.75	0.25	=	0.44	0.28	0.37	0.88	0.52	0.92	*Tie*
UK	0.47	0.24	0.76	=	0.31	0.09	0.66	0.10	0.44	0.29	*Tie*
Pool	*0.56*	*0.72*	*0.28*	=	*0.04*	*0.49*	*0.01*	*0.17*	*0.02*	*0.45*	*EC*

Note: see Table A6.