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Directorate General for Economic and Financial Affairs

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The track record of the Commission's forecasts - an update[1]

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Abstract

This paper has updated the assessment of the Commission's forecasts' track record from 1999 by extending the observation period from 1969-1997 to also take into account the forecasts and outcome for the years 1998-2005. This update has also included some further tests on e.g. informational efficiency and undertaken a comparison with the forecasts of other international institutions and those of market participants. Variables have been chosen and data processed in a broadly similar manner compared to the study of 1999 to ensure comparability to the greatest degree possible.

Overall, the Commission's forecasts continue to dispose a reasonable track record. Forecasts for the EU generally seem to be unbiased, efficient and display a high success rate for directional accuracy. The same holds true for the outlook for most Member States, although there are individual examples to the contrary. Moreover, in view of the importance of the international environment in explaining past forecast errors, it is reassuring to note that the forecasts for the largest non-EU countries generally seem to perform well. Finally, the Commission's forecasts' track record for GDP is broadly comparable with the ones of Consensus, the IMF and the OECD.

Key words: forecasts; projections; economic outlook; GDP; growth
JEL classification codes: E17; E27; E37

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COUNTRY ABBREVIATIONS

BE Belgium
DK Denmark
DE Germany
Irl Ireland
EL Greece
ES Spain
FR France
IT Italy
Lux Luxembourg
NL the Netherlands
AT Austria
PT Portugal
SF Finland
SE Sweden
UK the United Kingdom
EU European Union
EA euro area

1. INTRODUCTION

The track record of the Commission was first examined in the economic paper no. 137 of 1999 by F. Keereman. Based on both a set of traditional tests for examining the quality of predictions, he argued that the Commission forecasts disposed a reasonable track record, see Box 1. In particular, it was stressed that there was no strong evidence of the Commission presenting an overly optimistic short-term outlook of the EU economy.

Box 1: Main conclusion from the original study of the Commission's track record from 1999

The paper argues that the Commission forecasts dispose of a reasonable track record. Most of the traditional tests for examining the quality of predictions are passed in a satisfactory way. The comparisons with forecasts made by the IMF, OECD and national forecast institutes are not unfavourable for the European Commission. In particular it is found that there is no strong evidence of presenting an overly optimistic picture of the economy in the Commission short-term forecasts. The rosy gloss which, according to some, sometimes hangs over the Commission forecasts is related to some form of cycle denial. This could maybe lead to an optimistic bias further ahead in the future, but applying this to the short-term forecasts of the European Commission is unjustified.

The purpose of this update is to examine whether the ex-post accuracy of the Commission's fully-fledged projections has changed in recent years. This is done by extending the observation period from 1969-1997 to take into account the forecasts and outcome for the years 1998-2005.

To ensure comparability with the initial testing, variables have been chosen and data processed in a broadly similar manner as done in 1999. The focus has been on those tests where the results are likely to change with a longer sample period. Some further tests have also been carried out on e.g. informational efficiency to exploit the methodological progress made lately and further deepen the analysis on how well the forecasts perform (see, for instance, Timmermann (2006)). A comparison with the forecasts of other international institutions and those of market participants have also been carried out. In addition, bootstrapping has been used in this update for the tests for unbiasedness and absence of serial correlation to reduce the risks of misleading results, especially in view of the small sample sizes for some of the Member States and for the euro area.

It should be noted from the outset that there may be many reasons behind forecast errors going beyond the ability of the forecaster. They can *inter alia* be influenced by problems stemming from data availability, stability and volatility or from the realism of the external assumptions on which the forecast is based. The latter has proved to explain up to about 60% of the forecast error in EU year-ahead forecasts for GDP and inflation in an earlier study (Keereman (2003)). In particular, the assessment of world GDP and trade is important, while erroneous assumptions on oil prices affect the inflation outlook. The assumptions on budgetary policy are also crucial in this respect, where the practise is to incorporate only those policy measures adopted by the authorities or, at least, known in sufficient detail. Moreover, it cannot be excluded that the Commission's forecasts for e.g. general government net lending for some Member States have, at times, provoked a (desirable) policy reaction, which thereby makes the forecast out-of-date. Conclusions on how well the forecasts perform for individual countries and variables must therefore be drawn with due care.

This note is structured in the following way: the next section recalls how forecasting has evolved in the Commission and its current set-up. The third section presents the variables,

the dual focus on the EU aggregate and it's Member States and, finally, the distinction between forecasts for the "current year" and the "year ahead" as the forecast error may differ over the forecast horizon. The fourth section presents the methods used to test the accuracy of the Commission's forecasts. The main results are presented in the fifth section, before conclusions are drawn in the last section. The detailed outcome by Member State and the full comparison with the results of 1999 are presented in the subsequent annexes.

2. FORECASTING AT THE EUROPEAN COMMISSION

An important impetus to forecasting stems from the early 1960's, when the Conjunctural Policy Committee offered a forum for discussion of the national budgets of the Member States together with the directorate general responsible for economic and financial affairs at the European Commission[2] (DG II at the time). These discussions were based on the different national budgets and their underlying forecasts, while DG II presented the overall view and gave comments on the national submissions. However, since the Commission did not do forecasts on its own and as each country followed national practices, had different external assumptions etc., comparability was low and the aggregated overview probably inconsistent. Subsequently, a working group was created with a view to enhancing comparability with representatives of both DG II and the Member States.

Following different steps, degree of consultation and coverage, DG II started to produce a full set of forecasts in parallel to the Member States from 1973 onwards. In order to limit the normative element of the projections, it started to only take into account those policy measures decided upon or known in sufficient detail in 1974 (in contrast to many Member States at the time). Such forecasts based on an unchanged policy assumption became the rule thereafter and are known as "probabilistic" or "positive" forecasts. As an exception, DG II made both "normative" and "positive" forecasts in 1976 and 1977, although clearly distinguishing between the two. Soon thereafter, the forecasts of DG II also became the basis for the discussion in the Working Group on Economic Budgets and the national experts were invited to comment upon them.

The aim of the forecasts was initially to provide support to the preparation of the national budgets. It has gradually shifted to become the basis for the discussions on policy co-ordination in general at the Community level.[3] These discussions take place in both the Economic Policy Committee (replacing the Conjunctural Policy Committee) and in the Monetary Committee, which later transformed into today's Economic Financial Committee. The forecasts have been made public since the spring of 1982.

At present the Commission produces two fully-fledged short-term macroeconomic forecasts every year, which are widely used as a basis for economic policy analysis. For instance, following the recent reform of the Stability and Growth Pact and related regulations, the forecasts play an important role in the Commission's budgetary surveillance.[4] See also Box 2

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2 The European Union (EU) and European Commission were only introduced with the Maastricht Treaty (1993), but are used throughout this study for reasons of simplicity, even if it would be more appropriate to refer to the European Economic Community (EEC) and its Commission for the period before 1993.

3 C.f. the Council decision of 18 February 1974 on the attainment of a high degree of convergence of the economic policies of the Member States of the European Community (74/120/EEC).

4 For example: Council regulation (EC) 1467/97 of July 1997 on speeding up the implementation of the excessive deficit procedure as amended by Council regulation (EC) No 1055/2005 of 27 June 2005

for a brief overview of the different types of forecasts currently produced by the Commission.

Box 2: A brief overview of the Commission's different types of short-term forecasts and projections

The Commission produces *short-term macroeconomic forecasts* twice a year. In 2007, these are published in early May and early November. These fully-fledged forecasts concentrate on the Member States, the euro area and the EU, but also include the outlook for the candidate countries as well as some non-EU countries. The forecast covers the current year and next of a total of 180 variables and is the result of several iterative rounds. The forecasts are not based on a centralised econometric model. Instead, they result from the analysis made by country desks, each of which uses statistical methods to varying degrees. The forecasts are checked for mutual consistency, in particular as regards trade flows. The EU and euro-area variables are not directly forecast, but obtained by aggregation.

Starting in 2006 and in between the fully-fledged forecasts *interim forecasts* are produced, in which an update of real GDP growth and inflation is estimated for the seven largest Member States and for the current year only. The interim forecasts are largely prepared using indicator-based models.

In addition, DG ECFIN runs a *dynamic factor model* on a monthly basis to make a projection of euro-area GDP growth for the coming quarters. This is done by distilling the relevant "factors" driving the euro-area business cycle from some 2.000 time series for the euro-area countries and is published as a model outcome on DG ECFIN's web site.[5]

Although the coverage in terms of countries and variables has increased over the years, the structure of the fully-fledged forecast rounds remains largely stable since the early 1980's (see Colasanti et al. (1982)).

- A forecasting exercise lasts about two months and involves more than 60 members of staff.
- The forecasts are prepared and discussed in three iterations elaborating the preliminary, provisional and final sets of forecasts.
- The main forecasting work is carried out by the country desks using a judgmental approach.
- The forecasts are prepared on a set of external assumptions that reflect the market expectations at the time of the forecast. To shield the assumptions from possible volatility during one specific trading day, averages from a 10-day reference period is used for exchange and interest rates as well as for oil prices.
- It is a bottom-up process where the EU and euro-area variables are not directly forecast, but obtained by aggregation. However, plausibility tests of the (sum of the) forecasts are undertaken vis-à-vis area-wide statistics and the results of econometric

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specifies that "[…] the excess of the reference value shall be considered temporary if budgetary forecasts as provided by the Commission indicate that the deficit will fall below the reference value following the end of the unusual event or the severe economic downturn." (Art. 2) and that "[…] The Council shall assess the existence of unexpected adverse economic events with major unfavourable consequences for government finances against the economic forecast in its recommendation" (Art. 3 (5)) or "[…] in its notice" (Art. 5 (2)). Traditionally the forecast in the notice is the fully-fledged forecast by the Commission.

5 The original bridge equation (c.f. P. Grasmann and F. Keereman 2001) was recently replaced by a dynamic factor model (c.f. D. Grenouilleau 2006).

model simulations using e.g. DG ECFIN's QUEST model (Roeger and in't Veld (1997)).

- The QUEST model can also be used to calibrate alternative scenarios, quantifying e.g. the impact if one of the identified risks was to materialise. This was last done in the autumn 2006 forecast presenting the economic implications for the EU of a more marked correction of the US housing market.[6]

- Other econometric models are also used in a systematic way, e.g. when introducing a fan-chart in the spring 2007 economic forecast. It provided a quantification of the risks identified to the outlook in terms of possible deviations from the central scenario.

- Special attention is devoted to ensure consistency in trade flows for goods and services at the level of the Member State, the euro-area, the EU and the world (Jones (1983), Kieler (1995)).

The forecasts continue to be prepared in close co-operation with the Member States, both in bilateral meetings during e.g. fact-finding missions and in the multilateral meeting between national experts and DG ECFIN in EPC's Working Group on Economic Forecasts. This is done on the basis of the provisional forecast. Following these discussions and other new information, the final version of the forecasts is prepared. Furthermore, the methodology for calculating potential output and the output gap has been agreed with Member States in the EPC and endorsed by the Ecofin Council. These estimates allows for an assessment of the cyclical stance of the economy and of the structural stance of fiscal policies in accordance with the Stability and Growth Pact.

The forecasts are usually made public in a press conference by the Commissioner in charge of economic and financial affairs. He/she also informs the European Commission, i.e. the College of Commissioners, of the forecast, often together with a further information note on the forecasts' implication for budgetary surveillance. However, the forecasts are not adopted by the College and must be seen as technical work by one of the Commission's services. The forecasts are also presented to the European Parliament.

3. VARIABLES, AGGREGATES AND DATA

3.1. Variables

To ensure comparability with the initial testing of the track record of the Commission's forecasts, variables have been chosen and data processed in a broadly similar manner as done in 1999.

Of the 180 variables forecast by the Commission, six variables were tested that, taken together, should give a reasonable verdict of the accuracy of the forecasts:

Real GDP growth and *inflation* were chosen for the key role they play in economic analysis in general. An important further test on the Commission's ability to correctly assess the economic development was done by including the most volatile of the demand

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6 Economic forecasts-Autumn 2006, Box 2.3 in European Economy no. 5 (European Commission, Directorate-General for Economic and Financial Affairs).

components: *total investment*. The testing has been done on annual changes (not levels) for these variables.

Three other variables were selected in view of their importance for the policy debate: the *unemployment rate* as a share of the labour force, the *general government balance* as a percentage of GDP and the *current account* / GDP ratio.

The definition of the variables may have altered over time, which could lead to a difference between the forecast and the outcome that should not necessarily be described as a forecast error. However, no attempt has been made to correct for this.

3.2. Aggregates

The focus is on both *the Member States* and *the EU aggregate*. Following the successive enlargement, the EU has grown from six to 27 Member States at present. Keereman's 1999 study reflects the variable composition of the EU. This implies that the weight of the founding Member States gradually decreased when the number of Member States increased. The 1999 study did include all 15 Member States following the 1995 enlargement, although Austria, Finland and Sweden were not examined individually due to a shortage of data to allow for any meaningful testing.

The three countries that joined in 1995 as well as the euro area have now been added to the testing. Due to the small sample size the ten recently-acceded Member States (RAMSs) that joined in 2004 have not been examined, nor included in the EU aggregate. This also follows from a greater concern about their data availability, stability and quality. The EU thus continues to refer to the EU15 for 2004 and 2005. Nor have the two most recently-acceded Member States, Bulgaria and Romania that joined this year, been included in this study since the observation period is only extended to 2005.

3.3. Data

Keereman selected two types of forecasts (and their respective outturn data) to capture how the forecast error may differ over the forecast horizon. The *current-year forecast* is concerned with the quality of the outlook carried out in the beginning of the year for that year, while the *year-ahead forecast* deals with the following year. The current-year forecasts are taken from the spring forecasts, whereas the year-ahead forecasts come from the autumn forecasts.[7]

Similarly, a choice was made for the selection of the outturn data, where the realisation for the current-year forecasts are so-called "first available estimates" presented in the spring forecast in the following year (i.e. the outcome for year t is taken from the spring forecast in t+1), while the outturn data for the year-ahead forecast refer to the so-called "first settled estimates" presented in the autumn forecast following the year to be forecast (the outturn for year t+1 is taken from the autumn forecast in year t+2).

It should be noted that selection of forecast and outturn data is not without importance since it could influence both the size of the forecast error and its interpretation. Although there is no single universally accepted definition, a certain common practise has developed over the

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7 From 1971 to 1989, the Commission prepared three forecasts a year, when the spring and autumn forecasts were complemented with either a summer or a winter outlook.

years.[8] It takes e.g. note of the fact that a swift confirmation of the forecast may be more important for the shorter-term forecast (that of the current year), while a more precise measure can be used for the year-ahead outlook.

It could of course be argued that it would be more appropriate to compare the forecast with the final data. However, in view of the sizeable revisions that occur over the years as a result of new information and of methodological changes, final data are based on a different information set than that available to the forecaster. The interpretation of the forecast error would therefore be far from clear-cut. However, it is important for policy makers to be aware that preliminary information, which is needed to allow for a timely policy reaction under e.g. the Stability and Growth Pact, may still be subject to large revisions, often several quarters after the publication of the first estimate, and that these revisions differ across countries.[9]

4. METHODS USED FOR ASSESSING THE ACCURACY OF THE COMMISSION'S FORECASTS

There are many different ways of assessing the quality of a forecast going beyond the desire that its forecast errors are minimised. Indeed, the size of a forecast error may not appear overly problematic, within reasonable limits, as long as it is not systematic. For instance, the forecasts should be unbiased (thus no systematic over- or under prediction of a variable) and the errors uncorrelated.

It must be recalled that shorter data samples for some of the Member States are a concern that may aggravating cross-country comparisons. Small samples may also cause violations of the standard distributional assumptions, which may produce misleading conclusions from asymptotic tests. To deal with this issue we designed a bootstrap experiment that is described below.

In line with the 1999 study we define the forecast errors as follows:

$e_{t,t} = y_{t,t} - y_t$ for the current year, and

$e_{t+1,t} = y_{t+1,t} - y_{t+1}$ for the year ahead;

where $y_{t,t}$ and $y_{t+1,t}$ are the forecasts made at t for period t and t+1 respectively. y_t is the realisation for year t, and y_{t+1} is the one for year t+1.

The following sub-sections describe the statistics calculated, and the econometric tests performed in order to assess the accuracy of the Commission's forecasts.

4.1. Summary statistics for data sample and forecast errors

Before turning to the statistical techniques for testing non-model based forecasts, some elementary statistics will be provided to give a first indication of the data sample and how the forecasts perform:

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[8] See, for instance, the evaluations carried out on IMF's World Economic Outlook by Kenen and Schwarz in 1986, Artis in 1996 or Timmermann in 2006.

[9] Godo Mora L. and J. Nogueira Martins (2007)

The *standard deviation* (STD) of the realisations is a measure of the variables volatility, recalling that the more volatile a variable is, the more difficult it usually is to predict.

The *mean error* (ME) is given by ME = $\frac{1}{T}\sum_{t=1}^{T} e_{t,t}$ for the current year, and by ME = $\frac{1}{T}\sum_{t=1}^{T} e_{t+1,t}$ for the year ahead. It is a rough indicator of the quality, since positive and negative forecast errors would offset each other and thus limit the size of the error. The ME is, however, useful as a first indication of a possible bias in a forecast.

The *mean absolute error* (MAE) is a more accurate measure of forecast accuracy. It is defined as MAE = $\frac{1}{T}\sum_{t=1}^{T}\left|e_{t,t}\right|$ for the current year, and MAE = $\frac{1}{T}\sum_{t=1}^{T}\left|e_{t+1,t}\right|$ for the year ahead. Thus by treating negative errors as positive ones, errors can no longer cancel each other out.

The *root mean squared error* (RMSE) is an alternative measure of the relative size of the forecast error, which takes into account the fact that large forecast errors are usually considered more harmful than small differences. Formally, RMSE = $\sqrt{\frac{1}{T}\sum_{t=1}^{T} e_{t,t}^2}$ for the current year, and RMSE = $\sqrt{\frac{1}{T}\sum_{t=1}^{T} e_{t+1,t}^2}$ for the year ahead.

A *percentage of positive forecast errors* close to 50 per cent would be an indication of weakly efficient forecasts.

4.2. A comparison with naïve forecast techniques

It is also important to assess the performance of the forecasts compared to other prediction techniques. The study of 1999 compared the value of the Commission's forecasts to naïve or easily available alternatives, namely a "no change forecast," i.e. a random walk, and an "average forecast," i.e. an average over the whole series of the realisations. The statistics presented, called *THEIL1*[10] and *THEIL2*, show the ratio of the RMSE of the Commission's forecasts to the RMSE of the "no change" and "average" forecasts, respectively. In this update a further comparison was added, called *THEIL2**, where the Commission's outlook was compared to a so-called recursive-mean forecast. This was done since the overall mean is a theoretical concept that can only be calculated ex-post at the end of the sample period, whilst the recursive mean can be calculated at the time of each forecast. The results of the three THEIL statistics suggest in the case of a ratio below one that the Commission's forecasts outperform the naïve ones.

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10 It should be noted that for the current year, the "no change forecast" uses the latest available realisation, while for the year-ahead outlook it is based on the latest available forecast (i.e. the spring forecast for the current year). Thus, the forecast error for the "no change forecast" is defined as $e_{t,t} = y_{t-1} - y_t$ for the current year, and as $e_{t+1,t} = y_{t,t} - y_{t+1}$ for the year ahead.

4.3. Persistence of forecast errors

It is important to ensure that once a forecast error is made, it does not feed into the next forecasts. As a first check for correlation in the forecast errors, and thus for rejection of the weak efficiency hypothesis we present autocorrelation coefficients up to three lags. Their significance is tested using the Ljung-Box test. A p-value below 0.05 indicates that the null hypothesis of absence of autocorrelation in the forecast errors is rejected at the 5% level of significance.

4.4. Absence of bias

The report tested for the *absence of bias* since some forecasters, particularly public national or international forecasters, are frequently accused of presenting overly optimistic predictions. One important finding of the original study was thus the absence of a bias in the Commission's short-term forecasts. Unbiasedness is tested by running the following simple regression:

$$e_{t,t} = \alpha + \varepsilon_t \quad (1)$$

for the current year, and

$$e_{t+1,t} = \alpha + \varepsilon_{t+1} \quad (2)$$

for the year ahead; where ε is assumed to be a zero-mean normally distributed error term. The null hypothesis $H_0 : \alpha=0$ is then tested with a simple t-test. As in the original report, the test was additionally carried out for two sub-periods, the first until 1982 and the second starting in 1983 (which is when the current forecast procedures were established), in order to test for a possible change in bias in the two sub-periods. A p-value below 0.05 would imply the occurrence of a bias or (in the case of the additional test) a change in bias between the two periods statistically significant at the 5% level.

4.5. Efficiency tests

Forecasts are deemed efficient if all information available at the time of the forecast is used.

4.5.1. Weak efficiency

As a first step and as in the 1999 paper we initially test for weak efficiency by assuming that the information available is equal to the forecast itself. The test is carried out with the traditional realisation-forecast equation (Mincer and Zarnowitz (1969)):

$$y_t = \alpha + \beta y_{t,t} + \varepsilon_t \quad (3)$$

for the current year, and

$$y_{t+1} = \alpha + \beta y_{t+1,t} + \varepsilon_{t+1} \quad (4)$$

for the year ahead. We then employ an F-test for the joint null hypothesis, Ho: $\alpha = 0$ and $\beta = 1$. If the null is not rejected, the forecasts are said to be weakly efficient. It should be recalled, however, that serial correlation may be present in the residuals, which would affect inference. The *Durbin-Watson statistic* is therefore presented to give an indication of this problem (if DW is low). Alternatively, it could be checked by looking at the *persistence of forecast errors* (see section 4.3).

Secondly, as a complement to the tests for unbiasedness and weak efficiency with Mincer-Zarnowitz regressions, this update introduced a further test for weak efficiency, where the forecast error is regressed on a constant and on the lagged error, i.e.

$$e_{t,t} = \alpha + \beta e_{t-1,t-1} + \varepsilon_t \quad (5)$$

for the current year, and

$$e_{t+1,t} = \alpha + \beta e_{t,t-1} + \varepsilon_{t+1} \quad (6)$$

for the year ahead. Tests are made on the coefficients both separately (t-tests) and jointly (F-test). Numbers below 0.05 would imply the occurrence of bias and/or serial correlation in the former case, and a rejection of the weak efficiency hypothesis in the latter case.

A bootstrap experiment

In order to obtain more robust conclusions from inference we designed a bootstrap experiment that was applied on regressions 5 and 6, specifically on the individual tests for unbiasedness and for absence of serial correlation. The advantage of bootstrapping is that we can avoid the normality as well as any other distributional assumption as inference will be based on the constructed empirical distribution functions of the statistics of interest. The technique that was used is the residual bootstrap[11], where the residuals of the original regression are resampled instead of the original data themselves (see MacKinnon (2006)).

In order to simplify the presentation we focus on the year-ahead forecast errors (equation 6). The description is virtually the same for the current year. Also, we describe the procedure only for the serial correlation coefficient, but again nothing changes for the bias coefficient. After running the original regression, we obtain the residuals, say $\hat{\varepsilon}^{i}_{t+1}$, where i = 1,…,T. Then, we resample from these residuals and we get a new draw of size T, say $\hat{\varepsilon}^{i*}_{t+1}$. Using this new draw we obtain recursively a bootstrap sample for the forecast error, $e^{i*}_{t+1,t}$. We now rerun regression (6) using the bootstrap sample, and we obtain a bootstrap estimate $\hat{\beta}^{*}$ of β as well as its standard error $se_{\hat{\beta}^{*}}$. Finally, we calculate the bootstrap t-statistic centred at the original estimate, that is: $t^* = (\hat{\beta}^{*} - \hat{\beta})/se_{\hat{\beta}^{*}}$. This procedure is repeated 10,000 times, producing 10,000 bootstrap t-statistics t^*_j, where j = 1,…, 10,000. We have thus obtained an empirical distribution function for t. Thereafter, the original statistic t is compared with the bootstrap statistics t^*_j in order to calculate a bootstrap p-value for the test that β = 0. The rule for calculating the bootstrap p-value is the following: p-value = $2\min[\frac{1}{B}\sum_{j=1}^{B} I(t^*_j \le t), \frac{1}{B}\sum_{j=1}^{B} I(t^*_j > t)]$, where I is the indicator function, and B is the number of bootstrap replications, that is 10,000. This is a two-sided nonsymmetrical test.

[11] For supportive evidence on the choice of the bootstrap technique, see annex C.

4.5.2. Informational efficiency

This update also introduced several further efficiency tests, albeit for the outlook for GDP and inflation only. These stronger efficiency tests focus on whether information available at the time of the forecast was fully exploited, thus they could be described as tests for informational efficiency.[12] We start with a test where we examine whether the forecast error can be predicted by the forecasts of some key variables. First, the forecast error is regressed on the prediction of EU GDP growth. The estimated equation is as follows:

$$e_{t,t} = \alpha + \beta z_{t,t} + \varepsilon_t \quad (7)$$

for the current year, and

$$e_{t+1,t} = \alpha + \beta z_{t+1,t} + \varepsilon_{t+1} \quad (8)$$

for the year ahead; where z denotes the forecast of EU real GDP growth. The null hypothesis is $H_0 : \beta = 0$.

Thereafter, we regress the forecast error of the different Member States on the prediction of German GDP growth, French GDP growth, Italian GDP growth and UK's GDP growth. The regression therefore is the following:

$$e_{t,t} = \alpha + \beta^1 z^1_{t,t} + \beta^2 z^2_{t,t} + \beta^3 z^3_{t,t} + \beta^4 z^4_{t,t} + \varepsilon_t \quad (9)$$

for year t, and

$$e_{t+1,t} = \alpha + \beta^1 z^1_{t+1,t} + \beta^2 z^2_{t+1,t} + \beta^3 z^3_{t+1,t} + \beta^4 z^4_{t+1,t} + \varepsilon_{t+1} \quad (10)$$

for year t+1 ; where z^1, z^2, z^3 and z^4 are the four GDP forecasts for Germany, France, Italy and the United Kingdom. In the case of GDP growth, we exclude from the regressors the country whose forecast error is to be explained. We test both the individual significance of the β's (t-tests) and their joint significance with an F-test.

A second informational efficiency test checks whether forecast errors can be predicted by past realisations. Therefore, for the current year we have:

$$e_{t,t} = \alpha + \beta y_{t-1} + \varepsilon_t \quad (11)$$

However, for the year-ahead outlook the second lag of the realisations has to be used as the first estimate of the fourth quarter National Accounts of the previous year will only be available in the first quarter of the following year. This is thus the information that the forecaster has available at the time of the forecast. Hence,

$$e_{t+1,t} = \alpha + \beta y_{t-1} + \varepsilon_{t+1} \quad (12)$$

The null is again: H_0: $\beta = 0$.

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[12] Timmermann performed similar tests in his 2006 study.

4.6. Directional accuracy

Besides these quantitative tests, qualitative tests on the *directional accuracy* are also useful to assess how well a forecaster performs, i.e. by testing if the direction of a change is predicted correctly. Indeed, this may be more important than the forecast value of e.g. GDP growth. We obtain the standard contingency table of failures and successes (see, for instance, Diebold and Lopez (1996), p.257), and we report the total success rate, which should exceed 50% as a minimum. A test of independence between the direction of change of the outturns and of the forecasts is also performed. A number below 0.05 would imply that directional changes in the outturn are not independent from that of the forecast at the 5% level.

4.7. A comparison with other forecasters

A comparison was also made with other fully elaborated forecasts from the IMF, the OECD and those published by Consensus (which present the mean outlook of a number of private-sector forecasters on a monthly basis), although only for GDP due to data availability. Forecasts and realisations of the other institutions were selected in the same manner as for the Commission.[13]

First of all, the statistics presented in sections 4.1, 4.2 and 4.6 are now calculated for the alternative forecasts as well as for the Commission's forecasts at the sample size that corresponds to that of the rival forecasts. Furthermore, we present the proportion of positive differentials between the Commission's forecasts and the competing forecasts as an indication of whether there is a systematic difference between the different sets of forecasts. This will be the case if the proportion deviates significantly from 0.50.

The tests for unbiasedness (equations 1 and 2) and weak efficiency (equations 5 and 6) are again carried out, always at the same sample size as that of the rival forecasts.

Moreover, we are now able to perform another informational efficiency test in order to see whether the forecast of the other institution was fully taken into account. For every country we thus regress the Commission's forecast error on the alternative forecast, say y*. Therefore,

$$e_{t,t} = \alpha + \beta\, y^*_{t,t} + \varepsilon_t \qquad (13)$$

for the current year, and

$$e_{t+1,t} = \alpha + \beta\, y^*_{t+1,t} + \varepsilon_{t+1} \qquad (14)$$

for the year ahead. The null hypothesis is as usual $H_0 : \beta = 0$.

We then move to tests for equal forecast accuracy, forecast encompassing and forecast combinations. First, we apply the test proposed by Diebold and Mariano (1995) for equal forecast accuracy. The statistic of interest is the mean of the differential between the square of the Commission's forecast errors and the square of the competing institution's forecast errors (e*). For the current year we estimate the equation:

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[13] We gratefully thank T. Harjes at the IMF and L. Vogel at the OECD for their kind help in providing the Commission with their respective forecast and realisation data.

$$d_{t,t} = \alpha + \varepsilon_t \quad (15)$$

where $d_{t,t} = (e_{t,t})^2 - (e^*_{t,t})^2$. Respectively, for the year ahead:

$$d_{t+1,t} = \alpha + \varepsilon_{t+1} \quad (16)$$

where $d_{t+1,t} = (e_{t+1,t})^2 - (e^*_{t+1,t})^2$. The null hypothesis ($H_0 : \alpha=0$) is tested with use of the small sample correction proposed by Harvey et al. (1997). P-values lower than 0.05 indicate that the hypothesis of equal forecast accuracy is rejected at the 5% level of significance.

If we modify d as $d_{t,t} = (e_{t,t} - e^*_{t,t})\, e_{t,t}$ for the current year, and as $d_{t+1,t} = (e_{t+1,t} - e^*_{t+1,t})\, e_{t+1,t}$ for the year ahead, the Diebold and Mariano test becomes then a test for forecast encompassing, i.e. to test whether the information contained in the other forecast is effectively included in that of the Commission. The null hypothesis of $\alpha=0$ is tested against the alternative of $\alpha>0$. Under the null hypothesis the forecasts of the Commission are said to encompass the ones of the alternative forecaster. We again apply a small sample correction as suggested in Harvey et al. (1998).

Following Timmermann (2006), we also run regressions of the realisations on the two competing forecasts. For the current year we have:

$$y_t = \alpha + \beta_1 y_{t,t} + \beta_2 y^*_{t,t} + \varepsilon_t. \quad (17)$$

Similarly for the year ahead:

$$y_{t+1} = \alpha + \beta_1 y_{t+1,t} + \beta_2 y^*_{t+1,t} + \varepsilon_{t+1}. \quad (18)$$

We then test the individual significance of β_1 and β_2 to see how much weight one should put on each of the two rival forecasts in order to obtain a combination that increases the optimality of the forecast. The test can also be seen as a test for forecast encompassing: if $\beta_1 =1$ and $\beta_2 =0$ the Commission's forecasts encompass the alternative ones, while the opposite is true if $\beta_1 =0$ and $\beta_2 =1$.

Finally, we present RMSEs from the following forecast combination: $y_{t,t} + a(y_{t,t} - y^*_{t,t})$ for the current year, and $y_{t+1,t} + a(y_{t+1,t} - y^*_{t+1,t})$ for the year ahead. These are then compared to the original RMSEs of the Commission. As in Timmermann (2006), we assign different values to a (from -0.5 to -0.25, 0.1, 0.25 and 0.5) in order to examine whether the Commission's forecasts could be improved by moving closer to or further away from the alternative forecasts.

5. RESULTS OF THE ACCURACY TESTS

This section will present the key results obtained when updating the accuracy tests for the Commission's forecasts from 1999.

5.1. Summary statistics for forecast error

Summary statistics of the forecast errors for GDP, inflation and general government deficit are presented in Tables 1-3 below, while the complete set of results alongside the original ones is included in the table annexes.

5.1.1. GDP

The forecast error for GDP for the EU as a whole and as measured by the *ME* has increased somewhat, from 0.08 percentage point (pp.) for the current year to 0.11 pp, see table A1 in annex A. For the year-ahead outlook, the ME has also increased marginally (up to 0.34 from 0.32 pp.), see table A2. The ME could suggest the occurrence of a bias in the forecasts for several countries, positive in some cases and negative in others, that broadly offset each other, at least for the current-year forecast. The only marked change in the ME when adding the period 1998-2005 to the observation period is the increase in the ME for Portugal, where e.g. the ME for the year-ahead outlook increased from 0.10 to 0.41 pp. However, it should be noted that the ME continues to be larger for some other Member States, notably for Ireland (-0.76 pp.) and Italy (+0.70 pp.).

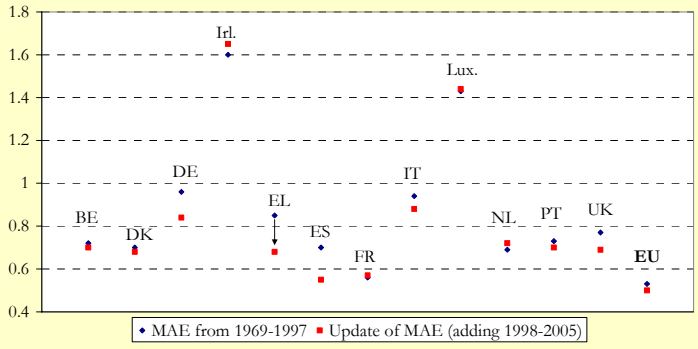
Table 1: Forecast errors for GDP

		ME		MAE		RMSE	
	Sample	current year	year ahead	current year	year ahead	current year	year ahead
Belgium	69/05	-0.05	0.25	0.70	1.14	0.87	1.53
Denmark	73/05	0.14	0.20	0.68	0.94	0.88	1.23
Germany	69/05	0.09	0.41	0.84	1.21	1.13	1.63
Ireland	73/05	-0.57	-0.76	1.65	2.24	1.98	2.63
Greece	81/05	-0.12	-0.11	0.68	0.87	0.87	1.23
Spain	86/05	-0.20	-0.13	0.55	0.79	0.77	1.06
France	69/05	0.03	0.30	0.57	0.88	0.74	1.20
Italy	69/05	0.43	0.70	0.88	1.29	1.22	1.75
Luxembourg	69/05	-0.63	-0.08	1.44	2.03	1.95	2.71
Netherlands	69/05	-0.02	0.02	0.72	1.08	0.92	1.36
Austria	95/05	0.15	0.36	0.50	0.71	0.71	0.95
Portugal	86/05	0.24	0.41	0.70	0.95	0.87	1.19
Finland	95/05	0.16	-0.07	0.96	1.27	1.31	1.59
Sweden	95/05	-0.09	0.22	0.58	0.80	0.82	1.06
United Kingdom	73/05	0.01	0.25	0.69	1.07	0.89	1.38
European Union	69/05	**0.11**	**0.34**	**0.50**	**0.86**	**0.72**	**1.23**
euro area	98/05	0.28	0.46	0.38	0.69	0.53	0.86

Turning to a more telling estimate of the forecast error, the *MAE*, the error declined from 0.53 pp. to 0.50 pp. for the current year for the EU when extending the observation period. The forecast error for the year-ahead projection has also improved, from 0.94 pp. to 0.86 pp. for the EU when extending the coverage, see table A4.

The forecast error for real GDP growth continues to be clearly smaller for the aggregate than for the individual countries. From tables A3-A4 and Graph 1 it can be seen that the forecast error has improved for most countries in this update, but also that differences remain sizeable across Member States. Especially some of the smaller Member States have markedly higher forecast errors and have not always improved when the outcome of eight further years was added.

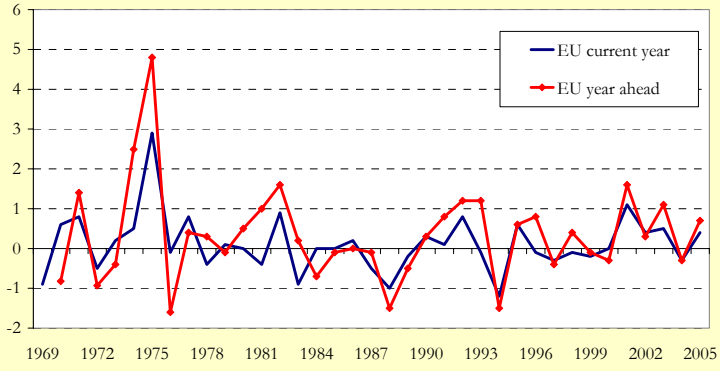
Graph 1: MAE improved for allmost all countries
(current-year GDP outlook)



Judging from Graph 2, the overall impression is that accuracy has improved over time. However, this is partly an effect from the sizeable forecast errors in the 1970's around the oil price crises. One may therefore expect that the forecast error *on average* should decline over time, although this may not necessarily represent an improved performance *per se* when the years 1998-2005 was added to the analysis. There is also a tendency that the ME increases and becomes significant, while the MAE declines for some Member States, suggesting that in these cases one gets it "more precisely wrong".

With a view to better understanding whether the forecast error has gradually declined, table A5-A6 presents the MAE by country and sub-periods. Adding this dimension, it becomes clear that the forecast error for GDP on average has clearly declined for Germany, Greece, Spain and the United Kingdom in the most recent years and for both the "current-year" and the "year-ahead" projections. In other cases, the MAE has increased in the period 1998-2005, although still below the levels of the 1970's. Nevertheless, in the cases of Ireland and the Netherlands, the MAE for the last period exceeds that of the 1970s for the current-year outlook. Similarly, for Luxembourg in its year-ahead forecast, the MAE is at its highest ever. For the EU as a whole, the MAE has decreased somewhat to 0.38 pp in 1998-2005 (down from 0.44 pp. in the previous period from 1990 to 1997) for the current-year outlook. The MAE decreased more strongly for the year-ahead forecast (down to 0.60 pp. from 0.85 pp.).

Graph 2: Development of MAE over time
GDP outlook for the EU



Measured by the *RMSE*, the forecast error for the current-year GDP prediction has declined from 0.77 pp. to 0.72 pp. for the Union as a whole. The improvement is marginally stronger for the year-ahead outlook, where the RMSE decreases from 1.33 pps. to 1.23 pps. for the EU. Again, differences are sizeable across countries and the forecast error for the aggregate is smaller than for most individual Member States, see tables A3-A4 in annex A.

It should be recalled that conclusions must be drawn with due care when looking at cross-country comparisons. Data availability and stability continues to differ, even if the situation has improved over time. The underlying distribution of the data series also varies. An attempt to control for volatility across countries and periods has been made within DG ECFIN suggesting that, once volatility is controlled for, the MAE of the current-year GDP forecast only improved significantly for Greece and Ireland in the most recent period[14].

5.1.2. Inflation

The forecast error for inflation measured by the *ME* at the EU level remained unchanged at 0.02 pp. for the current-year forecasts when adding 1998-2005 to the observation period. For the year-ahead projection, the ME declined from -0.31 to -0.23 pp. for the EU. This may still suggest a certain tendency to underestimate inflation for t+1 forecasts for several Member States, albeit less so than in the past.

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14 Acknowledging results from internal work by P. Cardoso at DG ECFIN.

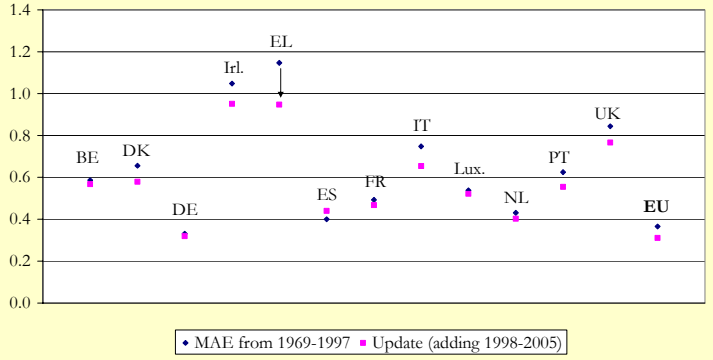
Table 2: Forecast errors for inflation

		ME		MAE		RMSE	
	Sample	current year	year ahead	current year	year ahead	current year	year ahead
Belgium	69/05	-0.02	0.01	0.57	1.02	0.71	1.56
Denmark	73/05	-0.18	-0.39	0.58	1.14	0.73	1.90
Germany	69/05	0.10	0.01	0.32	0.69	0.42	0.88
Ireland	73/05	0.01	-0.33	0.95	1.83	1.32	2.73
Greece	81/05	-0.11	-0.69	0.95	1.22	1.36	1.96
Spain	86/05	-0.28	-0.41	0.44	0.56	0.57	0.76
France	69/05	0.04	-0.37	0.47	0.94	0.72	1.47
Italy	69/05	-0.14	-1.11	0.65	1.42	0.93	2.49
Luxembourg	69/05	0.02	-0.18	0.52	1.27	0.67	1.63
Netherlands	69/05	-0.04	0.15	0.40	0.68	0.54	0.90
Austria	95/05	0.13	0.21	0.44	0.37	0.48	0.54
Portugal	86/05	-0.41	-0.83	0.56	1.04	0.74	1.71
Finland	95/05	-0.11	0.32	0.47	0.92	0.52	1.11
Sweden	95/05	-0.01	0.45	0.35	0.64	0.40	0.77
United Kingdom	73/05	0.17	-0.23	0.77	1.47	1.22	2.27
European Union	69/05	**0.02**	**-0.23**	**0.31**	**0.81**	**0.44**	**1.33**
euro area	98/05	-0.08	-0.17	0.15	0.29	0.21	0.35

Measured by the *MAE*, the forecast error for inflation in the EU decreased somewhat from 0.37 pp. to 0.31 pp. when updating the tests. For the year-ahead outlook, the MAE declined from 0.99 pp. to 0.81 pp.

Again, the forecast errors clearly differ in absolute levels across Member States and it is easier to predict the aggregate than individual Member States. However, these differences between countries appear somewhat smaller than those for GDP (at least for the "current-year" forecasts), c.f. Table 2 and Graph 3.

Graph 3: MAE improved for allmost all countries
(current-year inflation outlook)



Similar to the evolution of the forecast error for GDP measured by MAE and individual Member State, forecast errors were markedly larger in general in the 1970's than in more recent years. The *average* forecast error should therefore decline over time, although this may not necessarily represent an improved performance in the period now added to the analysis.

Following the comparison in tables A5-A6, which presents the MAE by country and different sub-periods, it becomes clear that the forecast error for inflation has indeed declined for Greece, Italy and Portugal in the most recent years for both the "current-year" and the "year-ahead" projections. For several other countries, the MAE decreased for only part of the forecast horizon and in some cases it increased in the period 1998-2005, although still clearly lower than e.g. in the 1970's. For the EU as a whole, the MAE has fallen to 0.11 pp. (down from 0.16 pp. in the 1990-1997) for the current year and has remained largely unchanged for the year-ahead projection (from 0.26 pp. to 0.23 pp.).

The *RMSE* for the EU also declined somewhat, from 0.49 pp. to 0.44 pp. for the current year. For the year-ahead projection, the RMSE for the EU fell from 1.51 pps. to 1.33 pps.

This improvement is broad-based, reflecting decreasing RMSEs across all Member States when extending the observation period.

5.1.3. Total investment

The forecast error for total investment measured by *ME* increased somewhat for the current-year projections, from 0.58 pp. to 0.65 pp. for the EU. This seems to be explained by, in particular, a sizeable increase of the ME in the case of Germany (from 0.60 pp. to 1.08 pp.), whilst noting that the ME is still larger for several other Member States. For the year-ahead outlook the ME for the EU remained stable (up by 0.01 to 0.79 pp.). Although sizeable differences can be noted at the Member State level extending beyond Germany, they largely off-set each other at the aggregated level. Given the volatility of investment growth, it comes as no surprise that the forecast errors are generally larger than those for GDP growth.

A similar development of the forecast error holds looking at the aggregated *MAE*. While the forecast error rose for the current-year prediction when extending the observation period (from 1.14 pps. to 1.24 pps.), it remained largely stable for the year-ahead forecast (up by 0.03 to 1.77 pps.). At the Member State level, the MAE ranges from around 1.5 pps. for the forecast for France to more than 3 pps in the cases of Denmark, Ireland, Greece, Luxembourg, Portugal and Sweden for the current-year outlook. A substantial fall was noted as regards Spain where the MAE declined from 3.24 pps. to 2.43 pps. The differences were even larger for the year-ahead forecast, where a French MAE of less than 2 pps. is markedly smaller than e.g. those of Denmark, Ireland and Luxembourg that all exceed 5 pps.

The forecast error also rose somewhat when measured by the *RMSE* for the current-year prediction (up from 1.63 pps. to 1.72 pps.), while it improved slightly for the year-ahead projection (down from 2.51 pps. to 2.45 pps.). A cross-country comparison would again reveal the impressive track record as regards the French outlook in comparison to those of most other Member States, even if the error clearly improved for Greece, Spain and Luxembourg (current year) and for Denmark, Ireland and Spain (year ahead).

5.1.4. Unemployment rate

Turning to the outlook for the unemployment rate, the *ME* remains small (from -0.5 pp. to 0.03 pp. for the current-year and 0.2 to 0.10 for the year-ahead outlook) when extending the sample period. This would also be true for around half of the Member States. For the other half of the countries, the errors are larger and appear more persistent, with the exception of Portugal where the forecast error was almost halved for the year-ahead projection.

Measured by the *MAE*, the forecast error declined slightly for the current-year outlook for the EU (down from 0.28 pp. to 0.23 pp.), while it remained unchanged further out (down by 0.01 to 0.51 pp.). At the country level, the error range is markedly more compressed (from 0.38 pp. for Luxembourg to 1.34 pps. for Spain in the year-ahead projection) and remains relatively stable in this update.

A certain improvement can be noted for both forecast years when measuring the error by the *RMSE*, with the error declining by 0.09 pp. to 0.32 (current-year) and by 0.05 to 0.75 pp. (year-ahead). This would suggest that although the absolute error remained largely constant for the year-ahead projection, unusually large errors were avoided in the more recent years. The improvement noted over the forecast period appears broad-based across countries.

5.1.5. *General government balance*

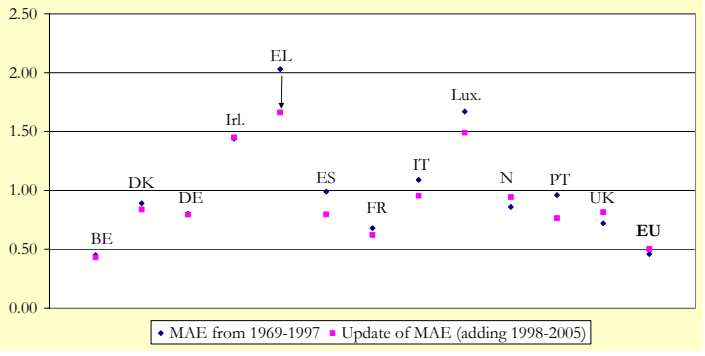
The *ME* for the general government balance increased somewhat for the current-year projection (from -0.02 to -0.08 pp.), while it declined for the year-ahead forecast (down from 0.16 to 0.12 pp.). With the exception of Spain and Portugal, where the MEs were markedly reduced, the errors remained largely unchanged, see tables A3-A4.

Table 3: Forecast errors for general government balance

		ME		MAE		RMSE	
	Sample	current year	year ahead	current year	year ahead	current year	year ahead
Belgium	69/05	0.12	0.35	0.43	1.09	0.61	1.50
Denmark	73/05	-0.10	0.01	0.84	1.59	1.22	1.97
Germany	69/05	-0.16	-0.09	0.79	1.03	0.97	1.29
Ireland	73/05	-0.33	-0.08	1.45	2.15	1.84	2.54
Greece	81/05	0.54	0.97	1.66	2.25	2.14	2.77
Spain	86/05	0.05	0.16	0.80	0.89	1.07	1.28
France	69/05	-0.06	0.07	0.62	0.71	0.86	1.01
Italy	69/05	0.15	0.46	0.95	1.36	1.39	1.73
Luxembourg	69/05	-0.65	-1.27	1.49	2.18	1.86	2.52
Netherlands	69/05	-0.30	-0.19	0.94	1.24	1.18	1.50
Austria	95/05	-0.09	-0.44	0.51	0.69	0.67	0.83
Portugal	86/05	-0.29	-0.04	0.77	1.21	1.02	1.60
Finland	95/05	-0.47	-0.53	0.87	1.00	1.09	1.25
Sweden	95/05	-1.16	-1.16	1.25	1.38	1.38	1.56
United Kingdom	73/05	0.03	0.37	0.82	1.38	1.08	1.64
European Union	69/05	**-0.08**	**0.12**	**0.50**	**0.71**	**0.63**	**0.89**
euro area	98/05	-0.11	0.03	0.51	0.66	0.65	0.81

Looking at the absolute error, the *MAE* rose marginally for both the current-year and the year-ahead projections at the aggregated level (by 0.04 to 0.5 pp. and by 0.02 to 0.71 pp., respectively). At the country level, the MAE improved somewhat for most countries and more clearly in the cases of Greece, Spain, Luxembourg and Portugal for the current-year outlook, see also Graph 4.

Graph 4: MAE improved somewhat for most countries
(current-year general government balance outlook)



A similar pattern can be found when looking at the error measured by the *RMSE*, which rose slightly for both years. The RMSE increased from 0.56 to 0.63 pp. for the current-year and from 0.87 to 0.89 pp. for the year-ahead outlook for the EU, despite a clear improvement noted in some cases (notably for Greece, Spain, Italy, Luxembourg and Portugal).

5.1.6. *Current account balance*

Lastly, the forecast error for the current account balance measured by the *ME* remains minor at the aggregated level. It declined slightly for the current year (from -0.08 to -0.03 pp.), while it rose marginally for the year-ahead outlook (from -0.01 to 0.04 pp.). The error is larger for several of the Member States and has not always improved (c.f. Greece, Spain, Luxembourg and Portugal).

The *MAE* remained broadly unchanged for the EU (up by 0.02 for both years to 0.33 pp. and 0.51 pp., respectively). Also at the Member State level differences were in most cases relatively small, disregarding a sizeable increase for Luxembourg.

Also measured by the *RMSE* changes to the forecast error were minor (up by 0.01 to 0.42 pp. for the current-year outlook and unchanged at 0.68 pp. further out). Again, besides the outlook for Luxembourg and also Portugal, differences at the country level were relatively small.

5.2. A comparison with naive forecast techniques

It goes without saying that predicting the future is by definition difficult and all macroeconomic forecasts contain errors. One alternative way of measuring the value of the Commission's forecasts is to compare them with other, easily available alternative forecasts.

The RMSE of the Commission's forecast was therefore compared to the RMSE of either the "no change" (THEIL1), the "average" (THEIL2) or the "recursive-mean forecast" (so-called THEIL2*), see tables A3-A4 in annex A. Although deteriorating for the year-ahead outlook, the ratio always remained below one at the aggregate level. This would imply that the Commission's forecasts outperform the naïve ones for all the variables and over both forecast years.

For the current-year projections, the forecast errors are about half or less the size than those from the naïve forecasts for all variables except the current account balance (where the ratio is around ⅔). For the year ahead, the errors are generally between ½ and ¾ of the naïve ones, besides the current-account projection with a ratio of around 0.9. This would suggest that using naïve forecasts for the current account would not generate forecast errors markedly larger than those calculated from the Commission's forecasts, although it could be recalled that errors are generally small in size.

At the Member-State level, some ratios very close to or above 1 have been recorded. These typically refer to the smaller Member States and particularly the year-ahead outlook for the current-account balance.

5.3. Persistence of forecast errors

Te test for persistence of forecast errors or serial correlation are reported upon in Tables A7-A8 in annex A. The aim is to avoid any systematic correlation between prediction errors, thus ensuring that once an error is made it is not fed into the next forecast.

The tests for serial correction have been carried out for up to three lags. At the aggregated level, there are no cases of persistence in forecast errors for the current-year outlook. The results with the year-ahead forecast are somewhat less satisfactory where serial correlation was noted for inflation, investment, unemployment and the current account balance. The outlook for real GDP growth and government balance did not display such persistence in its errors. These results largely confirm the original set of tests. However, when extending the observation period, persistence in the forecast errors of the current account balance now also proved statistically significant.

At the Member-State level, serial correlation among the current-year forecast errors is largely absent, with the exception of the GDP-forecast for Portugal and the unemployment outlook for Luxembourg. For the year-ahead prediction, on the other hand, several countries display serial correlation, in particular for smaller Member States and as regards

unemployment and inflation, but also for investment, government balances and the current account.

5.4. Unbiasedness

In order to test whether the Commission's forecasts are systematically over or under estimating a variable, tables A9 and A10 in Annex A display the presence or absence of bias. For real GDP growth, inflation and general government balances some of the key results are summarised in tables 4-6 below.

Taking into account the results for all variables, forecasts about the EU do not appear to be too rosy (with the exception of investment growth), while the outlook for some Member States seem somewhat too optimistic (such as Italy and Portugal) or too pessimistic (e.g. Ireland and Luxembourg).

As regards *GDP*, there appears to be no bias for the EU as a whole. Although the p-value is clearly lower for the year-ahead forecast; it is still above the threshold where a bias would be statistically significant at the 5% level. It is noteworthy, though that the GDP outlook for Italy and Luxembourg appear to have a systematic bias that is significant once the observation period has been extended with the years 1998-2005. In the case of Italy, GDP is overestimated by 0.43 pp. for the current year and 0.70 pp. for the year t+1, while the GDP forecast for Luxembourg is underestimated by 0.63 pp. for the current year.

With a view to better understanding the biases documented above some further tests were undertaken. Looking at results from a test for weak efficiency, which can be decomposed into bias and serial correlation, the presence of a bias was confirmed for Italy, both with and without bootstrapping (see tables A13-A14). This was not the case for Luxembourg, where the apparent bias appears to originate from a problem of serial correlation, see also table 4. This suggests that rather than being systematically pessimistic about real GDP growth for Luxembourg, errors (once made) seem likely to persist. The complementary test also confirmed the results noted in 5.3 on persistence of forecast error for Portugal in the current-year outlook. The test of a possible persistence of forecast error also turned significant for the projections for Ireland and Spain in the alternative test. Similarly, in the case of France, the weak efficiency test indicates a certain positive bias for the French outlook (+0.38 pp. for the year-ahead forecast).

Table 4: Forecast error for GDP - Tests for Unbiasedness and Weak Efficiency

	Bias (unbiasedness test)		Bias (weak eff. test)		Serial corr. (weak eff. test)	
	α (ME)	Signif. α=0	α	Signif. α=0	β	Signif. β=0
Current-year forecast						
Belgium	-0.05	0.72	-0.01	0.94	0.21	0.13
Denmark	0.14	0.36	0.09	0.57	0.06	0.58
Germany	0.09	0.62	0.17	0.33	0.01	0.80
Ireland	-0.57	0.10	-0.54	0.17	0.02	0.75
Greece	-0.12	0.50	-0.19	0.26	0.06	0.59
Spain	-0.20	0.26	-0.14	0.47	0.32	0.053
France	0.03	0.83	0.06	0.61	0.21	0.12
Italy	0.43	0.03	0.46	0.04	-0.14	0.47
Luxembourg	-0.63	0.048	-0.41	0.26	0.27	0.047
Netherlands	-0.02	0.92	0.00	0.99	0.18	0.18
Austria	0.15	0.50	0.06	0.78	0.12	0.40
Portugal	0.24	0.23	0.18	0.45	0.44	0.02
Finland	0.16	0.70	0.08	0.80	-0.20	0.66
Sweden	-0.09	0.73	-0.08	0.82	-0.01	0.73
United Kingdom	0.01	0.95	0.00	1.00	-0.22	0.27
European Union	**0.11**	**0.37**	**0.14**	**0.19**	**-0.06**	**0.84**
euro area	0.28	0.15	0.31	0.24	0.02	0.59
Year-ahead forecast						
Belgium	0.25	0.34	0.25	0.33	0.17	0.21
Denmark	0.20	0.36	0.13	0.60	0.09	0.48
Germany	0.41	0.13	0.47	0.07	-0.06	0.81
Ireland	-0.76	0.10	-0.72	0.11	0.30	0.03
Greece	-0.11	0.66	-0.21	0.45	-0.01	0.86
Spain	-0.13	0.62	0.02	0.90	0.35	0.03
France	0.30	0.13	0.38	0.04	0.01	0.79
Italy	0.70	0.01	0.58	0.054	0.10	0.40
Luxembourg	-0.08	0.86	-0.06	0.92	0.07	0.52
Netherlands	0.02	0.94	0.06	0.78	0.04	0.70
Austria	0.36	0.22	0.37	0.19	-0.28	0.42
Portugal	0.41	0.14	0.41	0.18	0.25	0.15
Finland	-0.07	0.89	-0.17	0.79	-0.14	0.85
Sweden	0.22	0.52	0.32	0.36	-0.27	0.48
United Kingdom	0.25	0.31	0.11	0.66	0.25	0.07
European Union	**0.34**	**0.09**	**0.38**	**0.054**	**-0.02**	**0.95**
euro area	0.46	0.18	0.71	0.14	-0.44	0.35

Note: α (unbiasedness test): coefficient in regressions (1) and (2).

α, β (weak efficiency test): coefficients in regressions (5) and (6).

Bootstrap p-values are reported for the weak efficiency test

Numbers below 0.05 indicate the presence of bias / serial correlation at the 5% significance level.

See also tables A9-A10 and A13-A14.

At the aggregated level, the *inflation* outlook appears unbiased. At the Member-State level, however, the situation deteriorated somewhat in so far that two more countries now display a tendency to systematically underestimate inflation for the current and/or the year ahead (which was not the case in the 1999 report). Spain and Portugal underestimated inflation by 0.28 pp. and 0.41 pp., respectively, for the current year, while the corresponding forecast error for the year ahead was roughly twice as large (-0.41 pp. and -0.83 pp.). Sweden, on the other hand, seems to overestimate inflation for the year-ahead outlook (0.45 pp.), while Italy continues to display a significant bias in underestimating the year-ahead inflation outlook with 1.11 pps.

Complementary information from the test for weak efficiency confirms the biases noted for the Spanish and Italian inflation outlook (also when using bootstrapping). However, it is not proven at the 5% significance level that this would be the case for Portugal or Sweden,

where at least the Portuguese problem appears to originate from serial correlation. In fact, the alternative test suggest that most countries as well as the EU aggregate display serial correlation for their year-ahead inflation outlook.

Table 5: Forecast error for inflation - Tests for Unbiasedness and Weak Efficiency

	Bias (unbiasedness test)		Bias (weak eff. test)		Serial corr. (weak eff. test)	
	α (ME)	Signif. α=0	α	Signif. α=0	β	Signif. β=0
Current-year forecast						
Belgium	-0.02	0.89	-0.01	0.93	0.10	0.42
Denmark	-0.18	0.16	-0.14	0.27	-0.01	0.88
Germany	0.10	0.14	0.09	0.23	0.06	0.57
Ireland	0.01	0.96	0.09	0.69	-0.28	0.09
Greece	-0.11	0.70	-0.09	0.74	0.10	0.44
Spain	-0.28	0.02	-0.31	0.01	-0.28	0.21
France	0.04	0.74	0.08	0.46	-0.13	0.49
Italy	-0.14	0.38	-0.10	0.56	0.17	0.19
Luxembourg	0.02	0.83	0.01	0.91	0.13	0.29
Netherlands	-0.04	0.70	-0.03	0.78	-0.12	0.55
Austria	0.13	0.41	0.07	0.75	0.13	0.39
Portugal	-0.41	0.01	-0.34	0.06	0.24	0.14
Finland	-0.11	0.52	-0.19	0.32	-0.04	0.91
Sweden	-0.01	0.94	-0.06	0.70	-0.11	0.91
United Kingdom	0.17	0.44	0.25	0.18	-0.01	0.92
European Union	**0.02**	**0.74**	**0.04**	**0.62**	**0.11**	**0.36**
euro area	-0.08	0.35	-0.14	0.054	-0.15	0.62
Year-ahead forecast						
Belgium	0.01	0.96	-0.05	0.81	0.31	0.03
Denmark	-0.39	0.25	-0.29	0.23	-0.31	0.02
Germany	0.01	0.93	0.04	0.79	0.48	0.00
Ireland	-0.33	0.50	0.09	0.85	0.37	0.01
Greece	-0.69	0.09	-0.52	0.19	0.35	0.02
Spain	-0.41	0.01	-0.38	0.04	0.12	0.39
France	-0.37	0.13	-0.34	0.16	0.14	0.25
Italy	-1.11	0.01	-0.96	0.01	0.18	0.17
Luxembourg	-0.18	0.51	-0.15	0.55	0.53	0.00
Netherlands	0.15	0.33	0.08	0.63	0.29	0.04
Austria	0.21	0.21	0.21	0.28	0.02	0.61
Portugal	-0.83	0.03	-0.34	0.47	0.54	0.00
Finland	0.32	0.37	0.09	0.83	0.28	0.16
Sweden	0.45	0.045	0.30	0.37	0.28	0.15
United Kingdom	-0.23	0.58	0.11	0.68	0.39	0.00
European Union	**-0.23**	**0.31**	**-0.16**	**0.47**	**0.37**	**0.01**
euro area	-0.17	0.21	-0.28	0.13	-0.19	0.76

Note: α (unbiasedness test): coefficient in regressions (1) and (2).

α, β (weak efficiency test): coefficients in regressions (5) and (6).

Bootstrap p-values are reported for the weak efficiency test.

Numbers below 0.05 indicate the presence of bias / serial correlation at the 5% significance level.

See also tables A9-A10 and A13-A14.

Turning to the most volatile of demand components: *investment*, there is a tendency to overestimate investment growth by 0.65 pp. in the EU for the current-year outlook, while a possible bias for the year-ahead prediction proved not statistically significant (albeit only just). Moreover, for the current year, the mean error has increased slightly once the observation period was extended and the results are more robust, i.e. it is statically significant at a lower level. A bias in investment growth is also noted for a few Member States individually, which are significant at the 5% level. Investment growth is overestimated by more than 1 pp. in Germany and Italy for the current year and by more

than 1½ pps. in Greece and Italy for the year ahead. These results were broadly confirmed in the complementary test for weak efficiency.

As regards *unemployment*, the aggregated forecast is unbiased and only in the case of Ireland is the bias significant (of an overestimation of 0.34 pp. for the current-year forecast and 0.58 pp. for the year ahead), which was not the case in the original report. Similarly, the outlook for Spain and Portugal also deteriorated, although they still pass the statistical test at the 5% level. Judging from the test for weak efficiency, only the bias in the Irish current-year forecast was confirmed.

For *government balances*, the EU outlook displays no bias, while Luxembourg and Sweden both have a tendency for a relatively sizeable underestimation (-0.65 pp. and -1.27 pps. for Luxembourg and -1.16 pps. for both years as regard Sweden). This result is only confirmed as regards Luxembourg in the supplementary test carried out for weak efficiency. On the other hand, this alternative test suggests a tendency to underestimate the general government balances also in the Netherlands, Austria and Finland (see table 6).

It must be recalled, however, that the use of the non-policy-change assumptions (especially for the year-ahead outlook) where only those policy measures are taken into account that are known in sufficiently detail when forecasting the general government balance, may have an impact on the forecast error and bias.

The *current account* outlook is generally without any presence of a bias except for Greece, where the balance is overestimated by 0.68 pp. for the current year and by 0.86 pp. for the year ahead (with an overestimation for the year-ahead outlook for Portugal just passing the 5% significance test). The complementary test for weak efficiency also pointed to a problem of a bias in the case of Greece, although not significant at the 5% level.

Table 6: Forecast error for general government balance - Tests for Unbiasedness and Weak Efficiency

	Bias (unbiasedness test)		Bias (weak eff. test)		Serial corr. (weak eff. test)	
	α (ME)	Signif. α=0	α	Signif. α=0	β	Signif. β=0
Current-year forecast						
Belgium	0.12	0.27	0.08	0.43	0.21	0.14
Denmark	-0.10	0.67	-0.08	0.79	0.27	0.08
Germany	-0.16	0.32	-0.13	0.40	-0.01	0.92
Ireland	-0.33	0.32	-0.43	0.22	-0.06	0.83
Greece	0.54	0.23	0.66	0.19	0.04	0.65
Spain	0.05	0.85	0.01	0.95	-0.06	0.98
France	-0.06	0.68	-0.01	0.99	0.05	0.61
Italy	0.15	0.51	0.19	0.43	-0.21	0.24
Luxembourg	-0.65	0.045	-0.90	0.01	-0.25	0.16
Netherlands	-0.30	0.12	-0.38	0.053	0.01	0.81
Austria	-0.09	0.67	-0.27	0.10	-0.18	0.46
Portugal	-0.29	0.22	-0.07	0.80	0.25	0.12
Finland	-0.47	0.16	-0.79	0.02	-0.50	0.08
Sweden	-1.16	0.00	-0.55	0.45	0.59	0.01
United Kingdom	0.03	0.86	0.00	0.98	0.26	0.07
European Union	**-0.08**	**0.44**	**-0.04**	**0.69**	**0.09**	**0.44**
euro area	-0.11	0.66	-0.06	0.92	0.28	0.12
Year-ahead forecast						
Belgium	0.35	0.17	0.37	0.13	0.16	0.23
Denmark	0.01	0.98	-0.03	0.95	0.54	0.00
Germany	-0.09	0.67	-0.08	0.72	-0.04	0.93
Ireland	-0.08	0.87	-0.16	0.75	0.30	0.04
Greece	0.97	0.09	0.48	0.46	0.45	0.01
Spain	0.16	0.60	0.13	0.66	0.33	0.06
France	0.07	0.69	0.09	0.57	0.28	0.047
Italy	0.46	0.11	0.42	0.20	0.11	0.38
Luxembourg	-1.27	0.00	-1.15	0.02	0.16	0.24
Netherlands	-0.19	0.46	-0.11	0.69	0.40	0.01
Austria	-0.44	0.08	-0.64	0.02	-0.14	0.72
Portugal	-0.04	0.91	-0.06	0.89	0.18	0.28
Finland	-0.53	0.17	-0.65	0.18	-0.10	0.98
Sweden	-1.16	0.01	-0.88	0.21	0.24	0.22
United Kingdom	0.37	0.21	0.21	0.54	0.26	0.07
European Union	**0.12**	**0.44**	**0.13**	**0.39**	**0.10**	**0.43**
euro area	0.03	0.93	0.13	0.85	0.14	0.38

Note: α (unbiasedness test): coefficient in regressions (1) and (2).

α, β (weak efficiency test): coefficients in regressions (5) and (6).

Bootstrap p-values are reported for the weak efficiency test

Numbers below 0.05 indicate the presence of bias / serial correlation at the 5% significance level.

See also tables A9-A10 and A13-A14.

5.5. Efficiency tests

5.5.1. Weak efficiency

A forecast is deemed efficient if it has exploited the data set used in the forecast fully. The results from the updated weak efficiency test are presented in tables A11-A12. A low probability value for the joint F-test (i.e. < 0.05) would suggest that the forecast is correlated with its error and that the forecast could thus be improved by exploiting this information. However, serial correlation in the error term could aggravate hypothesis testing and the results should therefore be interpreted with due caution. The Durbin Watson statistic and the

results in the two preceding sections indicate that this could indeed be the case for inflation and, in particular, unemployment.

Overall, the *GDP* forecasts appear to be weakly efficient. However, weak efficiency for the outlook for Portugal and Italy appears to have deteriorated and the null hypothesis could no longer be accepted (thereby reinforcing the original set of results where they just passed the 5% significance test). Broadly similar results are obtained in the complementary test for weak efficiency presented in tables A13-A14, but where also Luxembourg (current year) and Ireland (year ahead) seem inefficient.

Turning to *inflation*, the forecasts appear to be efficient at the aggregated level and for most individual countries. However, this appears not to be the case for Spain, Italy and Portugal where the probability values have fallen below the 0.05 threshold when extending the observation period. As regards the current-year outlook, these results were only confirmed in the alternative test for weak efficiency for Spain and Portugal. The interpretation for the tests on the year-ahead projections appears more doubtful. Most countries as well as the EU appear not to be weakly efficient, reflecting *inter alia* frequent problems of serial correlation.

Regarding the remaining variables, efficiency generally seems to have deteriorated with the exception of the general government balance. Efficiency seems particularly doubtful as regards investment and unemployment for the EU as a whole. The same holds true for several, mostly smaller Member States and also as regards the government and current account balances, although not to the same degree. Similar results were obtained in the complementary testing for weak efficiency.

5.5.2. Informational efficiency

This update also introduces further efficiency tests to control if all publicly available information at the time of the forecast was fully exploited (which could thus go beyond the data set actually used in the forecast).

In view of the increased inter-linkages between the European economies and more synchronised business cycles, the forecast error of each Member State is regressed on the GDP outlook for the EU as a whole as well as for the four largest Member States.

The results suggest that the forecast for EU GDP growth could have been better exploited for, at least, the Greek and Portuguese *GDP outlook*, see tables A15-A16. The forecast errors for GDP as regards Italy, Austria and Portugal could also have been reduced by taking into account to a greater extent the GDP outlook for Germany, France, Italy and/or the United Kingdom.

The impact of economic activity on inflation is well known. It appears as if the forecast error for *inflation* could also have been reduced by better exploiting the forecasts for GDP at the EU level or those for the largest economies. For the current-year prediction this seems particularly important for Ireland and Italy, while for the year-ahead outlook this would be true for both more than half of the Member States and the EU aggregate.

An additional test for informational efficiency controls for the importance of the past outcome (i.e. the forecast error is regressed on the lagged realisation). As regards real GDP growth, the past outcome generally seems to have been reflected (with Italy being the sole exception), see tables A17-A18. On the other hand, the past outcome for inflation could

have been better incorporated as regards Denmark, Spain, Italy, the Netherlands and for the euro area and the EU as a whole.

5.6. Directional accuracy

Besides assessing the forecast in a quantitative manner as regards the size of the error, the occurrence of biases etc. it may be as important to ensure that the direction of change is correct. For a good understanding of the economic situation and outlook it is key for a forecaster to correctly predict whether growth is accelerating, remaining constant or decelerating.

When testing if the direction of change is correct, the success rates are clearly better for the current-year forecasts made in the beginning of each year. At the aggregated level, these range from 81 to 92%, see tables A19-A20. Also at the Member-State level, success rates are generally high for GDP and inflation (between 80-90% in most cases), while the range is larger for the other variables. In particular, the low (and declining) directional accuracy as regards the unemployment rate for Greece and the general government balance for Ireland must be seen as disappointing.

Turning to the year-ahead predictions, the success rate amounts to some 70-80% for GDP, inflation, investment and unemployment for the EU. However, it has declined to less than ⅔ for the general government and current account balances. The picture at the Member-State level is also mixed. Significant improvements are noted for some variables for e.g. Spain, France, Luxembourg and Portugal, while it has deteriorated in other cases, such as Ireland or for the other variables, for Spain and Portugal. Although a success rate at around 50 or below for general government balances for Ireland, Luxembourg and the United Kingdom could clearly be a source of concern, it could also follow from the usual unchanged policy assumption, i.e. by only taking those measures into account that have been adopted by the authorities or are known in sufficient detail (which is not always the case as regards the end of the year budgets).

5.7. The international context

The outlook for the EU and its Member State cannot be assessed in isolation. In view of the increased specialisation in a globalised world, developments in Europe are clearly affected by the forecast for other developed and developing economies. Indeed, an earlier evaluation suggests that up to 60% of the forecast error for GDP and inflation in the EU can be explained by the external assumptions together with the international economic environment, where especially the assessment of world GDP and trade appears important.[15]

The forecast for the EU is based on an outlook for GDP in and trade with the rest of the world. Although these predictions are generally prepared in a more succinct way, close to fully-fledged forecasts are elaborated for the three Candidate Countries, the US, Japan and, more recently, also for China. The forecasts for these economies are also presented alongside the country-sections for the Member States in the forecast document.

The international outlook and the implications of the technical assumptions for oil prices, exchange and interest rates are, above all, discussed in an internal scene-setter meeting ahead of the first forecast iteration. Possible revisions to the global outlook and the technical assumptions are communicated to all forecast participants ahead of subsequent iterations.

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15 Keereman (2003).

The forecast error measured by MAE is somewhat larger for the US' and Japanese GDP forecasts than that of the EU as a whole (of around ¾ and 1 pp., respectively, compared to ½ pp. for the current-year predictions), see table A22. The outlook for at least the US thereby compares relatively well to those of the larger Member States, being e.g. worse than the current-year MAE for France and the United Kingdom, but better than those for Germany and Italy. Moreover, the relative difference between the RMSE and the MAE is smaller suggesting that fewer sizeable forecast errors have been made for the GDP forecasts for the US and Japan.

Judging from a similar set of tests on how well the forecasts for these larger non-EU economies perform, there appears to be a certain persistence in the forecast error for Japan for the current year, see table A23, while the forecasts generally seem unbiased, efficient and display a high success rate of directional accuracy, see tables A24-A27.

Particular attention is paid to the trade variables and, especially, to export market developments. Although the forecast error for export and import volumes into the EU is clearly higher (with a current-year MAE at around 2 and 2¼ pps., respectively) than those for the EU or the largest non-EU economies, the forecast for the trade variables generally perform well in terms of absence of statistically significant serial correlation and bias; the forecasts appear efficient and have a high success rate of directional accuracy. However, the efficiency tests for export and, in particular, import prices were not fully satisfactory.

6. A COMPARISON WITH OTHER FORECASTERS

6.1. Consensus

The forecast errors generally seem larger for the forecasts prepared by Consensus, whether measured by ME, MAE or RMSE, see table B1. This could possibly be explained by the timing advantage the Commission may have from a later presentation date, since the Consensus presents forecasts prepared by different market participants up to a certain date every month. The comparison with naïve forecasts also reflects favourably for the Commission's forecast, for which the THEIL statistics generally are lower.

When testing for directional accuracy, the Commission seems to outperform Consensus in most cases, with Germany and Italy (current year only) as noteworthy exceptions.

Looking at the share of positive forecast differentials in table B2, a first indication of systematic difference between the two sets of forecasts can be seen in two cases: Italy and Finland.

Table B3 displays the country-specific bias and its significance for the respective GDP forecasts, where both forecasters perform equally well (bad). Both had the same four instances of biases, namely for Ireland, Greece, Italy and Portugal and as regards both forecast years.

As regards the weak efficiency test, see table B4, the two sets of forecasts perform in almost similar manner, with weak efficiency rejected for the outlook of Ireland, Greece, Italy and Portugal for both years. However, some differences can be noted when looking at the individual coefficients. In particular, in the efficiency test for Portugal, the Commission's projection seems to have a bias, while the forecast of Consensus suffers from serial correlation.

Turning to the results from regressions (13) and (14), only in the case of the year-ahead outlook for Austrian GDP could the Commission forecast be improved by better taking into account the information contained in the Consensus outlook, see table B5.

In the tests for equal forecast accuracy as expressed in regressions (15) and (16), the null is rejected for Ireland (current-year outlook) and Portugal (year ahead). In view of the negative sign of the mean differential, this would suggest that the Commission's squared errors are lower and hence its forecast better performing, see table B6.

Using the same regressions (i.e. 15 and 16), but modifying d as follows: $d_{t,t} = (e_{t,t} - e^*_{t,t}) e_{t,t}$ for the current year, and as $d_{t+1,t} = (e_{t+1,t} - e^*_{t+1,t}) e_{t+1,t}$ for the year ahead, the test now becomes one on forecast encompassing. From table B7 it can be seen that in the case of the current-year forecast for the Netherlands, the null is rejected and the Commission has thus not encompassed the Consensus outlook.

Based on the regressions (17) and (18), the Commission seems to encompass the information included in the Consensus forecast in the outlook for a number of smaller Member States, e.g. as regards the Greek and Irish outlook, see table B8. However, it can be seen that for a number of countries, both sets of forecasts can be useful. Indeed, in the case of some of the year-ahead forecasts, both sets of forecasts contain relevant information.

Finally, table B9 presents the RMSE from the forecast combinations. An improvement could be obtained for Ireland (current year) and Portugal (year ahead) by giving a negative weight to the forecast by Consensus.

Overall, it appears as if the Commission outlook scores as well as the forecast made by Consensus, although noting that there are some differences at the country-specific level.

6.2. IMF

The forecast errors generally seem larger for the forecasts prepared by the IMF, whether measured by ME, MAE or RMSE, see table B1, especially for the year-ahead outlook. However, the Irish forecast seems to be an exception over both forecast years. Again, this difference in performance could partly be explained by the timing advantage. The comparison with naïve forecasts results in generally lower THEIL statistics for the Commission.

The Commission also seems to outperform the IMF in most cases when testing for directional accuracy, particularly for the year-ahead forecasts, but with the exception of the outlook for Greece and Ireland (both for the year ahead only).

Turning to the test for unbiasedness, see table B11, the performance appears largely similar with a bias noted for the same countries, with the year-ahead outlook for Germany being the sole exception. There the IMF's forecast is significantly biased (by 0.85 pp.), whereas the Commission's outlook appears unbiased.

The weak efficiency test presented in table B12 reveals a similar performance for the Commission and the IMF when looking at the joint test (F-statistics). Again, the year-ahead outlook for Germany is an exception, where the IMF outlook is not weakly efficient, originating from both a bias and a serial-correlation problem.

Testing for informational efficiency, see regressions (13) and (14) with results presented in table B13, the year-ahead Commission outlook for Austrian, Belgian, Greek and French

GDP growth could be improved by better taking into account the information contained in the IMF's outlook.

Following the test for equal forecast accuracy (c.f. regressions (15) and (16)), the null is never rejected and thus the competing forecasts appear equal. Once modified, the results of regression (15) and (16) indicate that the Commission does not encompass the IMF's forecast for Ireland for both the current year and the year ahead.

The Commission seems to encompass the information included in the competing forecast in the outlook for a number of Member States, see table B16. As with Consensus, it can be seen that for a number of countries, such as the year-ahead projections for Belgium and France, both sets of forecasts can be useful.

The RMSE from the forecast combinations, presented in table B17, suggest that a certain improvement could be obtained for the outlook for France and Portugal (both year ahead) by giving a negative weight to the IMF's forecast.

Overall, the size of the forecast errors and the results from the different accuracy tests suggest that the Commission's forecast perform at least as well as those of the IMF. This conclusion follows, in particular, from the IMF's weaker performance as regards the year-ahead outlook for Germany.

6.3. OECD

In contrast to the comparisons with Consensus and the IMF, the forecast errors generally seem larger for the outlook prepared by the Commission when compared with the OECD for the current year, see table B18. However, this is likely to be explained to a certain extend by the timing factor with the OECD's forecasts being released around one month after those of the Commission. Results are more mixed for the year ahead, where the two sets of forecasts seem to perform equally. The same appears true for the success rates of directional accuracy.

The share of positive forecast differentials, see table B19, gives a first indication of systematic difference between the two set of forecasts for Italy, Austria and Finland for the current year.

Table B20 presents the results for the test for unbiasedness, where the OECD outperforms the Commission. A bias occurs in the Commission's current-year forecast for Ireland and Luxembourg as well as in the year-ahead outlook for Ireland, France and Italy, while a bias is only present in the OECD's year-ahead prediction for Ireland.

Similarly, the Commission's current-year outlook also reveals problems with the test for weak efficiency for Ireland and Luxembourg, presented in the joint test (F-statistics) in table B21. For the year ahead, both institutions appear not weakly efficient as regards the Irish outlook, while for the OECD, the weak efficiency hypothesis was also rejected for the Portuguese forecast. Judging from the individual coefficients, the Commission's current-year predictions suffer from both bias (Ireland and Italy) and serial correlation (Italy, Luxembourg and Portugal), whereas the OECD's forecast errors are serially correlated for Spain and Portugal only. The Commission's forecasts perform better for the year ahead, where the occurrence of a bias is limited to France and Italy (only marginally), with serial correlation noted for Spain. The OECD, on the other hand, appears to have more of a problem with serial correlation for the year-ahead predictions (i.e. for Ireland, Spain, Portugal and the United Kingdom).

As regards informational efficiency, the Commission's forecasts could be improved by better taking into account the information in the OECD's forecasts for Ireland (current year) and Portugal (both years), see table B22.

Based on the test for equal forecast accuracy, the null is only rejected for the current-year outlook for Finland, see table B23.

The Commission does not encompass the information in the OECD's forecast in the outlook for the current-year predictions for most Member States, see table B24. The score for the year-ahead outlook is better, but the Commission does not encompass the OECD's forecasts for Germany and Greece.

The OECD encompasses the information included in the outlook for Belgium, Denmark, Germany, Ireland and the Netherlands, see table B25. For the year-ahead prediction, the Commission encompasses the information in the Belgian and French forecasts, while the opposite is true for Greece.

An improvement could be obtained for the current-year outlook for Germany, and to a lesser degree also for some other countries, by increasing the weight of the OECD's forecast.

Taken together, the Commission's forecast does not appear to perform as well as those of the OECD, especially for the current year (whilst recalling that the impact of the timing advantage is likely to be most important for the ongoing year). However, results are mixed for the year ahead with the relative performance appearing almost equal.

7. CONCLUSIONS

This paper has updated the assessment of the Commission's forecasts' track record from 1999 by extending the observation period from 1969-1997 to also take into account the forecasts and outcome for the years 1998-2005. This update has also included some further tests on e.g. informational efficiency and undertaken a comparison with the forecasts of other international institutions and those of market participants. To ensure comparability to the greatest degree possible, variables have been chosen and data processed in a broadly similar manner compared to the study of 1999.

Before turning to results of the statistical tests for non-model based forecasts, some error statistics are presented to give a first picture of how the forecast performs. The forecast error, whether measured by the ***mean absolute error (MAE)*** or the ***root mean squared error (RMSE)***, has generally improved somewhat for the EU as a whole when extending the observation period. Measured by the MAE for real GDP growth, it decreased by 0.03 pp. to 0.5 pp. for the current-year forecast and by 0.08 pp. to 0.86 for the year ahead. This implies that the Commission's forecasts for GDP growth has, on average, proven to be 0.5 pp. too high/low for the current year. Measured by the RMSE, the forecast error declined from 0.77 pp. on average to 0.72 pp. for the current-year predictions and from 1.33 pps. to 1.23 pps. for the year-ahead outlook.

The forecast error continues to be smaller for the aggregate than for the individual country. This reflects e.g. the fact that, at the aggregated level, overly optimistic forecasts for some countries may be offset by more pessimistic projections for others. The MAE improved for almost all countries when extending the observation period, although sizeable differences remain across Member States. Especially some of the smaller Member States have higher forecast errors. Several reasons could explain this, such as difficulties with data availability, stability and volatility. However, it could also reflect a higher degree of openness of the

country. Smaller countries are often more exposed to the international economic environment, which has proven to be an important source of forecast error in the past.

In view of the sizeable forecast errors that occurred during the 1970's reflecting e.g. the oil price crises, a certain improvement of the forecast error should perhaps be expected when the observation period is extended. Changes to the macroeconomic regime have generally also contributed to greater stability. Moreover, GDP growth rates have declined over time.

Indeed, when comparing the MAE for the years added in this update with those of the earlier decades, the MAE declined to 0.38 pp. for the current-year and to 0.60 pp. for the year-ahead projections for the EU as a whole. A similar development can be observed for most, but not all, Member States. A marked improvement can be noted for the outlook for Germany, Greece, Spain and the United Kingdom for both the current-year and the year-ahead forecasts, although to a degree reflecting their initial starting position. The recent deteriorating for the current-year outlook for France may therefore be less noteworthy than the exceptionally good performance (in comparison with the outlook for the other countries) over the whole period.

The Commission's fully-fledged forecasts cover a great number of variables where, besides real GDP growth, the track record is also assessed as regards the forecasts for inflation, investment, the unemployment rate, the general government balance and the current account balance. Looking at these other variables, the MAE clearly improved for the inflation forecast for the EU, it remained largely unchanged for unemployment, general government and the current account balances, while it increased somewhat for investment (being the most volatile of demand components).

Based on a set of traditional tests for examining the quality of the Commission's forecast, the original paper of 1999 argued that "*the Commission's forecasts dispose a reasonable track record*" with most tests passed in a satisfactory way. Although some of the updated test results are mixed, this overall assessment still appears valid.

When extending the observation period, there seem to be no evidence for a ***bias*** in the forecast for the EU as a whole, thus no systematic over- or underestimation could be detected in the Commission's forecast with the exception of investment growth. However, the outlook for some of the Member States appears to be too optimistic (such as Italy and Portugal) or too pessimistic (e.g. Ireland and Luxembourg).

The GDP outlook for Italy and Luxembourg appear to have a systematic bias that is significant once the observation period has been extended with the years 1998-2005. In the case of Italy, GDP is overestimated by 0.43 pp. for the current year and 0.70 pp. for the year t+1, while the GDP forecast for Luxembourg is underestimated by 0.63 pp. for the current year. However, judging from the results from a test for weak efficiency, the presence of a bias was only confirmed for the Italian GDP forecast, while the bias for Luxembourg appears to originate from a problem of serial correlation. This suggests that rather than being systematically too pessimistic about real GDP growth for Luxembourg, errors (once made) seem likely to persist. It cannot be excluded that the upward bias of the Italian GDP forecast could partly be explained by an overestimation of potential growth, in view of the assumption often used in year-ahead forecasts that growth approaches potential. Similarly, sizeable down (up) ward correction in potential growth for Germany (Ireland) may have contributed to a certain tendency of a bias, albeit they are not significant at the 5%-level.

A test is carried out as regards the ***persistence of forecast errors*** with a view to avoiding systematic correlation between prediction errors, i.e. to ensure that once an error is made it

is not fed into the next forecast automatically. The outlook for real GDP growth and government balance does not display persistence in its error for the EU outlook, while serial correlation was noted for the year-ahead EU forecast for inflation, investment, unemployment and the current account balance. These results thereby largely confirm the original set of results (with the exception of the current account outlook, where the serial correlation now also proved statically significant).

At the Member-State level, serial correlation among the current-year forecast errors is largely absent, with the exception of the GDP-forecast for Portugal and the unemployment outlook for Luxembourg. For the year-ahead prediction, on the other hand, several countries display serial correlation, in particular for smaller Member States and as regards unemployment and inflation.

Forecasts are deemed efficient if all information available is used. The updated test for ***weak efficiency*** (i.e. on ensuring that the information in the data set used in the forecast was fully exploited) suggest that the forecasts remain efficient at the aggregated level for real GDP growth, inflation and general government balances. However, efficiency is more doubtful as regards investment (current year), unemployment (both forecast years) and the current account balance (year ahead).

For the individual Member States, efficiency for the GDP outlook for Portugal and Italy has deteriorated and the hypothesis of inefficiency could no longer be rejected. Complementary efficiency tests also prove the forecasts for Luxembourg (current year) and Ireland (year ahead) to be inefficient. Similarly, the inflation outlook appears efficient for most Member States, besides Spain, Italy and Portugal. These results were confirmed in the complementary efficiency tests carried out as regards the current-year forecasts for Spain and Portugal, while the interpretation of the tests on the year-ahead predictions is less clear-cut. For most countries as well as the EU the hypothesis of weak efficiency was rejected as regards the inflation outlook. This is more easily detected when bootstrapping is used in view of the test's greater power.

This update introduced further tests on ***informational efficiency*** to control if all publicly available information at the time of the forecast was fully exploited, which could thus go beyond the data set actually used in the forecast. The question could for instance be if the forecast error for the individual country could be reduced by e.g. better taking into account the GDP outlook for the EU as a whole or for the four largest Member States. Most countries score well also as regards this stronger efficiency test, although the forecast error for the Greek and the Portuguese GDP outlook could have reduced by better incorporating the EU GDP outlook. Similarly, errors may be reduced for the GDP outlook for Italy, Austria and Portugal by taking into account the forecast for the largest Member States to a greater extent.

A further efficiency test revealed that the past outcome of real GDP growth has generally been well reflected (with Italy as an exception), while the outcome for inflation could have been better incorporated as regards the outlook for Denmark, Spain, Italy, the Netherlands and for the EU as a whole.

Besides these quantitative tests, qualitative tests on the ***directional accuracy*** are also useful to assess how well a forecaster performs, i.e. by testing if the direction of a change is predicted correctly. Indeed, this may be more important than the forecast value of e.g. GDP growth. The success rates are clearly better for the current-year forecasts made in the beginning of each year. For the outlook of the EU as a whole, these range from 81-92%. Also for the country-specific forecasts, success rates ranges from 80-90% in most cases for

real GDP growth and inflation, while the range is larger for other variables. However, the success rates of the directional accuracy as regards the unemployment rate for Greece and the general government balance for Ireland remains low and are even declining further, partly explained by (a lack of) data availability and stability.

The success rate for the year-ahead predictions amounts to some 70-80% for the forecasts for GDP, inflation, investment and unemployment for the EU. However, it has declined to less than ⅔ for the general government and current account balances. The test results for the country-specific forecasts are also mixed, where significant improvements were noted in some cases, such as in the outlook for Spain, France Luxembourg and Portugal. In other cases it deteriorated. Although a success rate at around 50 or below for general government balances for Ireland, Luxembourg and the United Kingdom could clearly be a source of concern, it could also follow from the usual unchanged policy assumption, i.e. by only taking those measures into account that have been adopted by the authorities or are known in sufficient detail (which is not always the case as regards the end of the year budgets).

The so-called external assumptions (on commodity prices, interest and exchange rates) together with the international economic environment have proved to explain a substantial part of the forecast error for GDP and inflation in the EU in an earlier study. Especially the assessment of world GDP and trade appeared important. Particular attention has therefore been paid to how well the ***international context*** is forecasted.

The MAE is somewhat larger for the US and Japanese GDP forecasts than that of the EU as a whole, but appears broadly in line with those of the larger Member States. The difference to the RMSE seems lower, which would suggest that fewer sizeable forecast errors have been made for the GDP outlook for the US and Japan. Moreover, the forecasts for the largest non-EU countries generally seem unbiased, efficient and display a high success rate of directional accuracy, while there seem to be certain persistence in the forecast error for the current-year GDP outlook for Japan.

The forecasts for the trade variables also seem to perform well in terms of absence of statistically significant serial correlation and bias; the forecasts appear efficient and have a high success rate of directional accuracy. However, the forecast errors are generally larger and the efficiency tests for export and, in particular, import prices were not fully satisfactory.

The Commission's forecasts' track record is relatively reasonable when comparing them with those of the ***other international institutions*** and with market participants. Overall, it appears as if the Commission outlook scores as well as the forecast made by Consensus and slightly better than those of the IMF. This may partly reflect the timing of the forecast, with the Commission having an informational advantage. The main difference with the IMF is its weaker performance as regards the year-ahead outlook for Germany. On the other hand, the Commission's forecast does not appear to perform as well as those of the OECD, especially for the current year. However this could partly be explained by the fact that the OECD releases its forecast one month later and has therefore a certain data and timing advantage. However, results are mixed for the year ahead with the relative performance appearing almost equal between the Commission and the OECD.

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Please see separate reference list for Annex C on "bootstrap experiment can be used to obtain more robust conclusions from inference"

ANNEX A

Table A1: Basic characteristics of the sample data – current year

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
Sample	69/05	*69/97*	73/05	*73/97*	69/05	*69/97*	73/05	*73/97*	81/05	*81/97*	86/05	*86/97*	69/05	*69/97*	**69/05**	*69/97*
No of obs.	37	*29*	33	*25*	37	*29*	33	*25*	25	*17*	20	*12*	37	*29*	**37**	*29*
MV(F)	2.22	*2.22*	2.00	*1.99*	2.35	*2.56*	3.99	*3.34*	2.10	*1.35*	2.79	*2.68*	2.61	*2.70*	**2.48**	*2.55*
MV(R)	2.27	*2.35*	1.85	*1.86*	2.26	*2.52*	4.56	*3.82*	2.22	*1.42*	2.99	*2.90*	2.58	*2.73*	**2.37**	*2.47*
ME	-0.05	*-0.13*	0.14	*0.13*	0.09	*0.04*	-0.57	*-0.48*	-0.12	*-0.08*	-0.20	*-0.22*	0.03	*-0.03*	**0.11**	*0.08*
STD(R)	1.85	*2.01*	1.65	*1.81*	2.09	*2.23*	3.35	*3.03*	1.64	*1.37*	1.43	*1.78*	1.96	*2.13*	**1.71**	*1.88*
Inflation																
Sample	69/05	*69/97*	73/05	*73/97*	69/05	*69/97*	73/05	*73/97*	81/05	*81/97*	86/05	*86/97*	69/05	*69/97*	**69/05**	*69/97*
No of obs.	37	*29*	33	*25*	37	*29*	33	*25*	25	*17*	20	*12*	37	*29*	**37**	*29*
MV(F)	4.25	*4.99*	5.05	*5.96*	3.19	*3.66*	7.38	*8.68*	11.73	*15.86*	4.27	*5.32*	5.19	*6.22*	**5.34**	*6.31*
MV(R)	4.26	*4.89*	5.23	*6.25*	3.08	*3.58*	7.37	*8.57*	11.84	*15.83*	4.55	*5.51*	5.15	*6.25*	**5.32**	*6.29*
ME	-0.02	*0.10*	-0.18	*-0.29*	0.10	*0.08*	0.01	*0.11*	-0.11	*0.03*	-0.28	*-0.18*	0.04	*-0.02*	**0.02**	*0.02*
STD(R)	3.04	*3.14*	3.83	*3.87*	1.92	*1.89*	6.34	*6.85*	7.34	*5.27*	1.78	*1.67*	4.06	*3.92*	**3.30**	*3.09*
Investment																
Sample	69/05	*69/97*	73/05	*73/97*	69/05	*69/97*	73/05	*73/97*	81/05	*81/97*	86/05	*86/97*	69/05	*69/97*	**69/05**	*69/97*
No of obs.	37	*29*	33	*25*	37	*29*	33	*25*	25	*17*	20	*12*	37	*29*	**37**	*29*
MV(F)	2.65	*2.58*	1.80	*1.50*	2.85	*3.21*	4.49	*3.89*	4.84	*3.25*	5.16	*5.31*	2.58	*2.46*	**2.76**	*2.68*
MV(R)	2.60	*2.49*	1.47	*0.66*	1.78	*2.61*	3.95	*3.22*	3.42	*1.63*	5.26	*5.27*	2.26	*1.99*	**2.11**	*2.10*
ME	0.05	*0.09*	0.33	*0.83*	1.08	*0.60*	0.53	*0.67*	1.42	*1.62*	-0.10	*0.04*	0.32	*0.47*	**0.65**	*0.58*
STD(R)	5.01	*5.40*	8.73	*9.60*	4.78	*4.83*	7.38	*7.54*	6.20	*6.30*	6.05	*7.62*	3.71	*3.90*	**3.50**	*3.70*
Unemployment rate																
Sample	69/05	*69/97*	73/05	*73/97*	69/05	*69/97*	73/05	*73/97*	81/05	*81/97*	86/05	*86/97*	70/05	*70/97*	**69/05**	*69/97*
No of obs.	37	*29*	33	*25*	37	*29*	33	*25*	25	*17*	20	*12*	36	*28*	**37**	*29*
MV(F)	8.29	*8.42*	6.65	*7.22*	6.11	*5.35*	11.41	*13.32*	8.52	*7.97*	17.60	*20.24*	8.26	*7.81*	**7.75**	*7.51*
MV(R)	8.27	*8.38*	6.66	*7.24*	6.08	*5.31*	11.07	*13.01*	8.52	*7.79*	17.24	*20.03*	8.24	*7.80*	**7.72**	*7.56*
ME	0.02	*0.04*	-0.02	*-0.02*	0.03	*0.03*	0.34	*0.30*	0.00	*0.18*	0.36	*0.22*	0.02	*0.00*	**0.03**	*-0.05*
STD(R)	3.44	*3.87*	2.40	*2.48*	3.04	*2.99*	5.22	*4.43*	1.66	*1.51*	4.49	*2.74*	3.35	*3.65*	**3.27**	*3.67*
Government bal.																
Sample	71/05	*71/97*	77/05	*77/97*	69/05	*69/97*	74/05	*74/97*	82/05	*82/97*	86/05	*86/97*	69/05	*69/97*	**69/05**	*69/97*
No of obs.	35	*27*	29	*21*	37	*29*	32	*24*	24	*16*	20	*12*	37	*29*	**37**	*29*
MV(F)	-4.98	*-6.32*	-1.10	*-2.31*	-2.32	*-2.26*	-5.72	*-7.95*	-8.23	*-11.46*	-2.79	*-4.27*	-2.17	*-2.09*	**-3.34**	*-3.80*
MV(R)	-5.09	*-6.55*	-1.00	*-2.37*	-2.16	*-2.10*	-5.39	*-7.72*	-8.76	*-11.92*	-2.84	*-4.55*	-2.11	*-1.96*	**-3.25**	*-3.78*
ME	0.12	*0.23*	-0.10	*0.05*	-0.16	*-0.15*	-0.33	*-0.23*	0.54	*0.46*	0.05	*0.28*	-0.06	*-0.13*	**-0.08**	*-0.02*
STD(R)	3.81	*3.04*	3.57	*3.19*	1.81	*1.83*	6.08	*5.14*	5.82	*4.26*	2.54	*1.65*	1.74	*1.88*	**1.88**	*1.68*
Current account																
Sample	71/05	*71/97*	73/05	*73/97*	71/05	*71/97*	73/05	*73/97*	82/05	*82/97*	86/05	*86/97*	71/05	*71/97*	**71/05**	*71/97*
No of obs.	35	*27*	33	*25*	35	*27*	33	*25*	24	*16*	20	*12*	35	*27*	**35**	*27*
MV(F)	1.64	*0.77*	-0.83	*-1.59*	0.89	*0.84*	-1.15	*-1.53*	-3.69	*-3.51*	-1.72	*-1.20*	0.16	*-0.25*	**0.18**	*0.09*
MV(R)	1.61	*0.87*	-0.83	*-1.69*	1.10	*1.01*	-0.85	*-1.07*	-4.38	*-4.05*	-2.08	*-1.24*	0.11	*-0.17*	**0.22**	*0.17*
ME	0.03	*-0.09*	0.01	*0.10*	-0.20	*-0.17*	-0.30	*-0.46*	0.68	*0.54*	0.37	*0.04*	0.05	*-0.07*	**-0.03**	*-0.08*
STD(R)	3.00	*2.98*	2.72	*2.48*	1.86	*1.84*	4.84	*5.50*	2.03	*1.73*	2.24	*1.95*	1.39	*1.31*	**0.68**	*0.73*

F=forecast data; R=realisation data; MV=average mean value; ME= mean error (MV(F) – MV(R)): thus the mean error is equal to the mean forecast minus the mean realised average;
STD(R): standard deviation of realisation data

Table A1: Basic characteristics of the sample data – current year (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
Sample	69/05	*69/97*	69/05	*69/97*	69/05	*69/97*	95/05	86/05	*86/97*	95/05	95/05	73/05	*73/97*	98/05	**69/05**	*69/97*
No of obs.	37	*29*	37	*29*	37	*29*	11	20	*12*	11	11	33	*25*	8	**37**	*29*
MV(F)	2.52	*2.73*	2.41	*2.07*	2.26	*2.28*	2.04	2.58	*2.86*	3.61	2.37	1.84	*1.66*	2.14	**2.48**	*2.55*
MV(R)	2.08	*2.33*	3.04	*2.67*	2.28	*2.42*	1.88	2.34	*2.86*	3.45	2.46	1.83	*1.68*	1.86	**2.37**	*2.47*
ME	0.43	*0.39*	-0.63	*-0.60*	-0.02	*-0.14*	0.15	0.24	*0.00*	0.16	-0.09	0.01	*-0.01*	0.28	**0.11**	*0.08*
STD(R)	1.98	*2.13*	2.74	*2.74*	1.69	*1.67*	0.90	1.90	*1.88*	1.74	0.98	1.79	*2.03*	1.02	**1.71**	*1.88*
Inflation																
Sample	69/05	*69/97*	69/05	*69/97*	69/05	*69/97*	95/05	86/05	*86/97*	95/05	95/05	73/05	*73/97*	98/05	**69/05**	*69/97*
No of obs.	37	*29*	37	*29*	37	*29*	11	20	*12*	11	11	33	*25*	8	**37**	*29*
MV(F)	8.09	*9.70*	4.19	*4.85*	3.96	*4.41*	1.87	5.85	*8.02*	1.56	1.55	6.48	*7.96*	1.84	**5.34**	*6.31*
MV(R)	8.22	*9.79*	4.16	*4.73*	4.00	*4.42*	1.75	6.26	*8.40*	1.67	1.55	6.31	*7.85*	1.91	**5.32**	*6.29*
ME	-0.14	*-0.09*	0.02	*0.12*	-0.04	*-0.01*	0.13	-0.41	*-0.38*	-0.11	-0.01	0.17	*0.12*	-0.08	**0.02**	*0.02*
STD(R)	6.00	*5.87*	2.87	*2.98*	2.91	*3.12*	0.52	4.08	*3.99*	0.70	0.69	5.26	*5.16*	0.33	**3.30**	*3.09*
Investment																
Sample	69/05	*69/97*	69/05	*69/97*	69/05	*69/97*	95/05	86/05	*86/97*	95/05	95/05	73/05	*73/97*	98/05	**69/05**	*69/97*
No of obs.	37	*29*	37	*29*	37	*29*	11	20	*12*	11	11	33	*25*	8	**37**	*29*
MV(F)	2.62	*2.43*	2.55	*2.49*	1.62	*1.56*	3.02	5.24	*6.83*	6.63	5.14	1.86	*1.13*	2.94	**2.76**	*2.68*
MV(R)	1.46	*1.30*	3.38	*3.25*	1.58	*1.66*	2.03	4.69	*7.57*	4.49	3.92	1.20	*0.60*	1.83	**2.11**	*2.10*
ME	1.16	*1.13*	-0.84	*-0.76*	0.04	*-0.10*	0.99	0.55	*-0.73*	2.14	1.22	0.66	*0.53*	1.11	**0.65**	*0.58*
STD(R)	4.88	*5.35*	5.50	*5.71*	4.60	*4.89*	2.99	7.05	*6.22*	4.23	5.23	4.52	*4.70*	2.75	**3.50**	*3.70*
Unemployment rate																
Sample	69/05	*69/97*	75/05	*75/97*	69/05	*69/97*	95/05	86/05	*86/97*	95/05	95/05	73/05	*73/97*	98/05	**69/05**	*69/97*
No of obs.	37	*29*	31	*23*	37	*29*	11	20	*12*	11	11	33	*25*	8	**37**	*29*
MV(F)	8.94	*8.64*	2.08	*1.66*	6.37	*7.07*	4.15	6.17	*6.54*	11.18	7.00	7.55	*8.20*	9.28	**7.75**	*7.51*
MV(R)	8.93	*8.74*	2.08	*1.68*	6.13	*6.85*	4.27	5.86	*6.14*	11.15	7.29	7.48	*8.16*	9.08	**7.72**	*7.56*
ME	0.01	*-0.10*	0.01	*-0.02*	0.24	*0.23*	-0.12	0.31	*0.40*	0.03	-0.29	0.08	*0.04*	0.20	**0.03**	*-0.05*
STD(R)	3.51	*3.88*	1.16	*0.90*	3.81	*4.00*	0.43	1.37	*1.39*	3.07	1.92	2.92	*3.04*	0.91	**3.27**	*3.67*
Government bal.																
Sample	69/05	*69/97*	74/05	*74/97*	69/05	*69/97*	95/05	86/05	*86/97*	95/05	95/05	73/05	*73/97*	98/05	**69/05**	*69/97*
No of obs.	37	*29*	32	*24*	37	*29*	11	20	*12*	11	11	33	*25*	8	**37**	*29*
MV(F)	-7.26	*-8.64*	0.75	*0.70*	-2.90	*-3.40*	-2.11	-4.96	*-6.47*	1.12	-0.57	-2.61	*-3.16*	-1.89	**-3.34**	*-3.80*
MV(R)	-7.41	*-8.83*	1.41	*1.28*	-2.60	*-3.13*	-2.02	-4.68	*-5.89*	1.59	0.59	-2.64	*-3.32*	-1.78	**-3.25**	*-3.78*
ME	0.15	*0.19*	-0.65	*-0.58*	-0.30	*-0.27*	-0.09	-0.29	*-0.58*	-0.47	-1.16	0.03	*0.16*	-0.11	**-0.08**	*-0.02*
STD(R)	3.90	*3.09*	2.23	*2.12*	2.38	*2.28*	1.74	2.14	*1.65*	3.53	3.67	2.61	*2.21*	1.05	**1.88**	*1.68*
Current account																
Sample	71/05	*71/97*	71/05	*71/97*	71/05	*71/97*	95/05	86/05	*86/97*	95/05	95/05	73/05	*73/97*	98/05	**71/05**	*71/97*
No of obs.	35	*27*	33	*27*	35	*27*	11	20	*12*	11	11	33	*25*	8	**35**	*27*
MV(F)	0.07	*-0.08*	18.72	*20.34*	3.05	*2.52*	-1.22	-3.14	*-0.96*	5.13	3.13	-1.03	*-0.79*	0.89	**0.18**	*0.09*
MV(R)	-0.09	*-0.14*	18.30	*20.27*	3.09	*2.62*	-0.99	-3.39	*-0.58*	5.17	3.49	-0.84	*-0.63*	0.65	**0.22**	*0.17*
ME	0.15	*0.06*	0.43	*0.06*	-0.05	*-0.10*	-0.23	0.26	*-0.37*	-0.05	-0.36	-0.18	*-0.16*	0.24	**-0.03**	*-0.08*
STD(R)	1.70	*1.86*	14.56	*14.95*	2.11	*1.93*	1.94	4.13	*1.85*	1.63	2.15	1.60	*1.75*	0.51	**0.68**	*0.73*

F=forecast data; R=realisation data; MV=average mean value; ME= mean error (MV(F) – MV(R)): thus the mean error is equal to the mean forecast minus the mean realised average;
STD(R): standard deviation of realisation data

Table A2: Basic characteristics of the sample data – year ahead

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
Sample	70/05	*70/97*	74/05	*74/97*	70/05	*70/97*	74/05	*74/97*	82/05	*82/97*	87/05	*87/97*	70/05	*70/97*	**70/05**	*70/97*
No of obs.	36	*28*	32	*24*	36	*28*	32	*24*	24	*16*	19	*11*	36	*28*	**36**	*28*
MV(F)	2.37	*2.37*	2.19	*2.15*	2.52	*2.67*	3.93	*3.27*	2.23	*1.46*	2.89	*2.79*	2.73	*2.82*	**2.60**	*2.66*
MV(R)	2.12	*2.15*	1.99	*1.97*	2.11	*2.35*	4.70	*3.91*	2.35	*1.51*	3.02	*2.86*	2.42	*2.54*	**2.25**	*2.34*
ME	0.25	*0.21*	0.20	*0.18*	0.41	*0.36*	-0.76	*-0.64*	-0.11	*-0.04*	-0.13	*-0.07*	0.30	*0.29*	**0.34**	*0.32*
STD(R)	1.83	*1.99*	1.53	*1.70*	1.92	*2.06*	3.33	*3.17*	1.66	*1.37*	1.52	*1.91*	1.72	*1.88*	**1.58**	*1.74*
Inflation																
Sample	70/05	*70/97*	74/05	*74/97*	70/05	*70/97*	74/05	*74/97*	82/05	*82/97*	87/05	*87/97*	70/05	*70/97*	**70/05**	*70/97*
No of obs.	36	*28*	32	*24*	36	*28*	32	*24*	24	*16*	19	*11*	36	*28*	**36**	*28*
MV(F)	4.23	*4.98*	4.70	*5.55*	3.07	*3.51*	6.72	*7.88*	10.60	*14.34*	3.89	*4.86*	4.82	*5.76*	**5.13**	*6.06*
MV(R)	4.21	*4.88*	5.10	*6.07*	3.05	*3.59*	7.05	*8.20*	11.29	*15.25*	4.31	*5.22*	5.19	*6.24*	**5.36**	*6.37*
ME	0.01	*0.10*	-0.39	*-0.52*	0.01	*-0.08*	-0.33	*-0.32*	-0.69	*-0.91*	-0.41	*-0.35*	-0.37	*-0.48*	**-0.23**	*-0.31*
STD(R)	3.01	*3.09*	3.79	*3.91*	1.99	*1.93*	6.37	*6.95*	6.93	*4.82*	1.50	*1.30*	4.02	*4.03*	**3.38**	*3.18*
Investment																
Sample	70/05	*70/97*	74/05	*74/97*	70/05	*70/97*	74/05	*74/97*	82/05	*82/97*	87/05	*87/97*	70/05	*70/97*	**70/05**	*70/97*
No of obs.	36	*28*	32	*24*	36	*28*	32	*24*	24	*16*	19	*11*	36	*28*	**36**	*28*
MV(F)	2.96	*2.87*	2.39	*2.20*	2.96	*3.18*	4.66	*3.77*	5.42	*3.76*	5.24	*5.44*	2.97	*2.91*	**3.02**	*2.96*
MV(R)	2.06	*2.06*	1.54	*0.80*	1.81	*2.56*	4.09	*2.93*	3.75	*2.32*	5.45	*5.47*	2.24	*1.97*	**2.23**	*2.19*
ME	0.90	*0.80*	0.85	*1.41*	1.15	*0.61*	0.57	*0.85*	1.67	*1.44*	-0.21	*-0.04*	0.73	*0.94*	**0.79**	*0.78*
STD(R)	5.24	*5.81*	8.71	*9.71*	4.48	*4.47*	7.81	*8.14*	5.19	*5.18*	5.05	*6.33*	3.20	*3.24*	**3.06**	*3.18*
Unemployment rate																
Sample	71/05	*71/97*	74/05	*74/97*	71/05	*71/97*	74/05	*74/97*	82/05	*82/97*	87/05	*87/97*	71/05	*71/97*	**71/05**	*71/97*
No of obs.	35	*27*	32	*24*	35	*27*	32	*24*	24	*16*	19	*11*	35	*27*	**35**	*27*
MV(F)	8.65	*8.87*	6.79	*7.47*	6.35	*5.58*	11.73	*13.77*	8.53	*8.06*	17.15	*19.67*	8.37	*7.87*	**8.05**	*7.86*
MV(R)	8.41	*8.57*	6.80	*7.42*	6.30	*5.53*	11.15	*13.23*	8.91	*8.19*	16.85	*19.82*	8.35	*7.91*	**7.95**	*7.84*
ME	0.23	*0.31*	-0.01	*0.06*	0.05	*0.05*	0.58	*0.54*	-0.38	*-0.14*	0.30	*-0.15*	0.02	*-0.04*	**0.10**	*0.02*
STD(R)	3.20	*3.62*	2.04	*1.99*	2.77	*2.69*	5.18	*4.19*	1.37	*0.98*	4.63	*2.90*	3.13	*3.41*	**2.90**	*3.28*
Government bal.																
Sample	71/05	*71/97*	77/05	*77/97*	70/05	*70/97*	74/05	*74/97*	82/05	*82/97*	87/05	*87/97*	70/05	*70/97*	**70/05**	*70/97*
No of obs.	35	*27*	29	*21*	36	*28*	32	*24*	24	*16*	19	*11*	36	*28*	**36**	*28*
MV(F)	-4.60	*-5.80*	-1.12	*-2.34*	-2.33	*-2.26*	-5.49	*-7.78*	-7.82	*-10.87*	-2.65	*-4.10*	-2.11	*-2.03*	**-3.18**	*-3.67*
MV(R)	-4.95	*-6.31*	-1.13	*-2.48*	-2.24	*-2.20*	-5.41	*-7.73*	-8.79	*-11.67*	-2.81	*-4.64*	-2.18	*-2.05*	**-3.30**	*-3.83*
ME	0.35	*0.51*	0.01	*0.14*	-0.09	*-0.06*	-0.08	*-0.05*	0.97	*0.80*	0.16	*0.54*	0.07	*0.01*	**0.12**	*0.16*
STD(R)	3.80	*3.21*	3.56	*3.18*	1.63	*1.63*	6.12	*5.24*	5.52	*4.25*	2.61	*1.66*	1.70	*1.84*	**1.80**	*1.57*
Current account																
Sample	71/05	*71/97*	74/05	*74/97*	71/05	*71/97*	74/05	*74/97*	82/05	*82/97*	87/05	*87/97*	71/05	*71/97*	**71/05**	*71/97*
No of obs.	35	*27*	32	*24*	35	*27*	32	*24*	24	*16*	19	*11*	35	*27*	**35**	*27*
MV(F)	1.53	*0.63*	-0.46	*-1.13*	0.96	*0.93*	-1.11	*-1.39*	-3.78	*-3.65*	-1.95	*-1.60*	0.08	*-0.30*	**0.22**	*0.12*
MV(R)	1.57	*0.89*	-0.65	*-1.51*	1.14	*1.05*	-1.19	*-1.36*	-4.64	*-4.09*	-2.36	*-1.52*	0.11	*-0.08*	**0.18**	*0.12*
ME	-0.05	*-0.25*	0.19	*0.37*	-0.19	*-0.13*	0.08	*-0.04*	0.86	*0.44*	0.42	*-0.08*	-0.04	*-0.21*	**0.04**	*-0.01*
STD(R)	2.83	*2.85*	3.00	*2.90*	1.92	*1.89*	4.78	*5.50*	2.14	*1.68*	2.16	*1.74*	1.45	*1.39*	**0.74**	*0.80*

F=forecast data; R=realisation data; MV=average mean value; ME= mean error (MV(F) – MV(R)): thus the mean error is equal to the mean forecast minus the mean realised average;
STD(R): standard deviation of realisation data

Table A2: Basic characteristics of the sample data – year ahead (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
Sample	70/05	*70/97*	70/05	*70/97*	70/05	*70/97*	95/05	87/05	*87/97*	95/05	95/05	74/05	*74/97*	99/05	**70/05**	*70/97*
No of obs.	36	*28*	36	*28*	36	*28*	11	19	*11*	11	11	32	*24*	7	**36**	*28*
MV(F)	2.66	*2.85*	2.60	*2.27*	2.19	*2.16*	2.35	2.64	*2.84*	3.57	2.66	2.05	*1.92*	2.23	**2.60**	*2.66*
MV(R)	1.96	*2.19*	2.68	*2.17*	2.17	*2.26*	1.99	2.24	*2.74*	3.65	2.45	1.80	*1.64*	1.77	**2.25**	*2.34*
ME	0.70	*0.66*	-0.08	*0.11*	0.02	*-0.10*	0.36	0.41	*0.10*	-0.07	0.22	0.25	*0.28*	0.46	**0.34**	*0.32*
STD(R)	1.99	*2.16*	3.05	*2.94*	1.74	*1.76*	0.81	1.87	*1.91*	1.69	0.98	1.73	*1.96*	0.97	**1.58**	*1.74*
Inflation																
Sample	70/05	*70/97*	70/05	*70/97*	70/05	*70/97*	95/05	87/05	*87/97*	95/05	95/05	74/05	*74/97*	99/05	**70/05**	*70/97*
No of obs.	36	*28*	36	*28*	36	*28*	11	19	*11*	11	11	32	*24*	7	**36**	*28*
MV(F)	7.27	*8.73*	4.12	*4.76*	4.08	*4.58*	1.85	5.27	*7.23*	1.85	1.99	6.11	*7.53*	1.86	**5.13**	*6.06*
MV(R)	8.38	*10.05*	4.30	*4.87*	3.93	*4.37*	1.64	6.09	*8.29*	1.54	1.54	6.34	*7.95*	2.03	**5.36**	*6.37*
ME	-1.11	*-1.32*	-0.18	*-0.11*	0.15	*0.21*	0.21	-0.83	*-1.06*	0.32	0.45	-0.23	*-0.42*	-0.17	**-0.23**	*-0.31*
STD(R)	6.01	*5.81*	2.88	*3.02*	2.95	*3.18*	0.61	3.95	*3.90*	1.19	0.70	5.48	*5.43*	0.36	**3.38**	*3.18*
Investment																
Sample	70/05	*70/97*	70/05	*70/97*	70/05	*70/97*	95/05	87/05	*87/97*	95/05	95/05	74/05	*74/97*	99/05	**70/05**	*70/97*
No of obs.	36	*28*	36	*28*	36	*28*	11	19	*11*	11	11	32	*24*	7	**36**	*28*
MV(F)	3.17	*2.95*	1.53	*1.09*	1.50	*1.31*	3.52	5.47	*6.77*	7.02	5.78	2.40	*1.88*	3.43	**3.02**	*2.96*
MV(R)	1.60	*1.48*	2.78	*2.52*	2.00	*2.08*	2.58	4.48	*7.41*	4.85	3.98	1.73	*1.01*	1.63	**2.23**	*2.19*
ME	1.57	*1.48*	-1.25	*-1.44*	-0.50	*-0.77*	0.94	0.99	*-0.64*	2.17	1.80	0.67	*0.87*	1.80	**0.79**	*0.78*
STD(R)	4.31	*4.70*	7.23	*6.43*	4.68	*4.92*	3.32	7.00	*6.15*	4.74	5.23	4.76	*5.13*	2.90	**3.06**	*3.18*
Unemployment rate																
Sample	71/05	*71/97*	76/05	*76/97*	71/05	*71/97*	95/05	87/05	*87/97*	95/05	95/05	74/05	*74/97*	99/05	**71/05**	*71/97*
No of obs.	35	*27*	30	*22*	35	*27*	11	19	*11*	11	11	32	*24*	7	**35**	*27*
MV(F)	9.10	*8.82*	2.00	*1.63*	6.65	*7.48*	4.27	5.98	*6.42*	11.40	7.04	7.69	*8.46*	9.03	**8.05**	*7.86*
MV(R)	9.04	*8.89*	2.08	*1.69*	6.42	*7.26*	4.27	5.66	*5.83*	11.05	7.27	7.57	*8.32*	8.80	**7.95**	*7.84*
ME	0.06	*-0.07*	-0.08	*-0.06*	0.24	*0.21*	0.00	0.32	*0.59*	0.35	-0.24	0.12	*0.14*	0.23	**0.10**	*0.02*
STD(R)	3.04	*3.37*	1.12	*0.87*	3.76	*3.88*	0.51	1.28	*1.30*	2.95	1.90	2.75	*2.77*	0.59	**2.90**	*3.28*
Government bal.																
Sample	70/05	*70/97*	75/05	*75/97*	70/05	*70/97*	95/05	87/05	*87/97*	95/05	95/05	74/05	*74/97*	99/05	**70/05**	*70/97*
No of obs.	36	*28*	31	*23*	36	*28*	11	19	*11*	11	11	32	*24*	7	**36**	*28*
MV(F)	-7.14	*-8.54*	0.43	*0.29*	-2.66	*-3.12*	-2.33	-4.44	*-5.98*	1.02	-0.55	-2.35	*-2.99*	-1.76	**-3.18**	*-3.67*
MV(R)	-7.60	*-9.09*	1.69	*1.41*	-2.48	*-3.01*	-1.89	-4.39	*-5.45*	1.55	0.61	-2.72	*-3.42*	-1.79	**-3.30**	*-3.83*
ME	0.46	*0.55*	-1.27	*-1.12*	-0.19	*-0.11*	-0.44	-0.04	*-0.54*	-0.53	-1.16	0.37	*0.43*	0.03	**0.12**	*0.16*
STD(R)	3.83	*2.88*	2.37	*2.16*	2.55	*2.50*	1.72	2.05	*1.75*	3.51	3.71	2.58	*2.15*	1.07	**1.80**	*1.57*
Current account																
Sample	71/05	*71/97*	73/05	*73/97*	71/05	*71/97*	95/05	87/05	*87/97*	95/05	95/05	74/05	*74/97*	99/05	**71/05**	*71/97*
No of obs.	35	*27*	26	*25*	35	*27*	11	19	*11*	11	11	32	*24*	7	**35**	*27*
MV(F)	0.26	*0.06*	19.65	*20.22*	3.09	*2.53*	-1.32	-3.28	*-1.10*	5.29	2.87	-1.02	*-0.85*	0.83	**0.22**	*0.12*
MV(R)	-0.17	*-0.23*	20.51	*20.94*	3.15	*2.68*	-0.94	-4.38	*-1.53*	5.49	3.51	-1.01	*-0.80*	0.46	**0.18**	*0.12*
ME	0.43	*0.30*	-0.86	*-0.72*	-0.07	*-0.15*	-0.38	1.10	*0.43*	-0.20	-0.64	-0.01	*-0.05*	0.37	**0.04**	*-0.01*
STD(R)	1.81	*2.00*	13.73	*13.83*	2.07	*1.92*	1.91	3.75	*1.61*	1.26	2.20	1.64	*1.81*	0.46	**0.74**	*0.80*

F=forecast data; R=realisation data; MV=average mean value; ME= mean error (MV(F) – MV(R)): thus the mean error is equal to the mean forecast minus the mean realised average;
STD(R): standard deviation of realisation data

Table A3: Basic characteristics of the forecast errors - current year

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
MAV	2.51	*2.65*	2.10	*2.18*	2.55	*2.88*	4.77	*4.09*	2.33	*1.58*	3.09	*3.07*	2.73	*2.91*	**2.53**	*2.68*
MAE	0.70	*0.72*	0.68	*0.70*	0.84	*0.96*	1.65	*1.60*	0.68	*0.85*	0.55	*0.70*	0.57	*0.56*	**0.50**	*0.53*
RMSE	0.87	*0.87*	0.88	*0.91*	1.13	*1.23*	1.98	*1.93*	0.87	*1.03*	0.77	*0.94*	0.74	*0.77*	**0.72**	*0.77*
THEIL1	0.45	*0.42*	0.39	*0.37*	0.46	*0.45*	0.65	*0.64*	0.63	*0.61*	0.62	*0.61*	0.37	*0.35*	**0.38**	*0.37*
THEIL2	0.47	*0.44*	0.55	*0.51*	0.55	*0.56*	0.60	*0.65*	0.54	*0.77*	0.55	*0.55*	0.38	*0.37*	**0.43**	*0.42*
THEIL2*	0.44		0.48		0.50		0.55		0.51		0.49		0.36		**0.39**	
% of positive errors	43		64		51		39		36		40		54		**57**	
Inflation																
MAV	4.26	*4.89*	5.23	*6.25*	3.11	*3.61*	7.37	*8.57*	11.84	*15.80*	4.55	*5.51*	5.15	*6.25*	**5.32**	*6.29*
MAE	0.57	*0.59*	0.58	*0.66*	0.32	*0.33*	0.95	*1.05*	0.95	*1.15*	0.44	*0.40*	0.47	*0.49*	**0.31**	*0.37*
RMSE	0.71	*0.74*	0.73	*0.80*	0.42	*0.44*	1.32	*1.44*	1.36	*1.53*	0.57	*0.52*	0.72	*0.73*	**0.44**	*0.49*
THEIL1	0.43	*0.40*	0.41	*0.40*	0.41	*0.38*	0.46	*0.45*	0.51	*0.48*	0.51	*0.37*	0.48	*0.44*	**0.32**	*0.31*
THEIL2	0.24	*0.24*	0.19	*0.21*	0.22	*0.24*	0.21	*0.21*	0.19	*0.30*	0.33	*0.33*	0.18	*0.19*	**0.14**	*0.16*
THEIL2*	0.23		0.18		0.21		0.20		0.18		0.29		0.17		**0.13**	
% of positive errors	49		48		62		61		52		40		57		**59**	
Investment																
MAV	4.37	*4.56*	7.04	*7.79*	4.02	*4.39*	6.79	*6.57*	5.88	*5.11*	6.59	*7.48*	3.52	*3.51*	**3.40**	*3.53*
MAE	2.28	*2.31*	3.84	*3.94*	2.40	*2.26*	3.49	*3.48*	3.22	*3.59*	2.43	*3.24*	1.51	*1.60*	**1.24**	*1.14*
RMSE	2.95	*3.05*	4.79	*4.86*	3.03	*2.87*	4.42	*4.36*	4.26	*4.77*	2.87	*3.58*	1.95	*2.01*	**1.72**	*1.63*
THEIL1	0.63	*0.61*	0.47	*0.44*	0.71	*0.63*	0.55	*0.50*	0.79	*0.80*	0.58	*0.58*	0.54	*0.53*	**0.50**	*0.45*
THEIL2	0.60	*0.57*	0.56	*0.52*	0.64	*0.60*	0.61	*0.59*	0.70	*0.75*	0.49	*0.50*	0.53	*0.52*	**0.50**	*0.45*
THEIL2*	0.56		0.50		0.59		0.56		0.64		0.44		0.50		**0.46**	
% of positive errors	54		52		59		45		64		50		57		**73**	
Unemployment rate																
MAV	8.27	*8.38*	6.66	*7.24*	6.08	*5.31*	11.07	*13.00*	8.52	*7.79*	17.24	*20.00*	8.24	*7.80*	**7.72**	*7.56*
MAE	0.49	*0.46*	0.54	*0.62*	0.30	*0.30*	0.65	*0.68*	0.66	*0.65*	0.68	*0.63*	0.32	*0.35*	**0.23**	*0.28*
RMSE	0.63	*0.61*	0.85	*0.95*	0.45	*0.48*	0.88	*0.93*	0.94	*0.96*	0.85	*0.80*	0.43	*0.47*	**0.32**	*0.41*
THEIL1	0.64	*0.61*	0.66	*0.66*	0.38	*0.37*	0.55	*0.54*	0.99	*0.90*	0.48	*0.44*	0.54	*0.59*	**0.38**	*0.46*
THEIL2	0.19	*0.16*	0.36	*0.39*	0.15	*0.16*	0.17	*0.21*	0.58	*0.66*	0.19	*0.31*	0.13	*0.13*	**0.10**	*0.11*
THEIL2*	0.18		0.33		0.14		0.16		0.52		0.18		0.12		**0.10**	
% of positive errors	51		58		51		70		68		75		61		**57**	
Government bal.																
MAV	5.13	*6.55*	2.88	*3.00*	2.50	*2.43*	6.26	*7.80*	8.77	*11.90*	2.98	*4.55*	2.28	*2.18*	**3.32**	*3.78*
MAE	0.43	*0.45*	0.84	*0.89*	0.79	*0.80*	1.45	*1.44*	1.66	*2.03*	0.80	*0.99*	0.62	*0.68*	**0.50**	*0.46*
RMSE	0.61	*0.66*	1.22	*1.23*	0.97	*0.94*	1.84	*1.89*	2.14	*2.43*	1.07	*1.29*	0.86	*0.92*	**0.63**	*0.56*
THEIL1	0.53	*0.51*	0.62	*0.56*	0.61	*0.62*	0.95	*0.93*	0.83	*0.82*	0.86	*0.85*	0.80	*0.83*	**0.59**	*0.54*
THEIL2	0.16	*0.22*	0.35	*0.40*	0.55	*0.52*	0.31	*0.38*	0.37	*0.59*	0.43	*0.82*	0.50	*0.50*	**0.34**	*0.34*
THEIL2*	0.16		0.32		0.51		0.29		0.35		0.40		0.48		**0.32**	
% of positive errors	51		55		46		34		63		40		51		**43**	
Current account																
MAV	2.85	*2.47*	2.50	*2.61*	1.73	*1.67*	3.86	*4.73*	4.38	*4.05*	2.44	*1.84*	1.13	*1.05*	**0.56**	*0.59*
MAE	0.90	*0.90*	0.75	*0.75*	0.59	*0.57*	1.35	*1.55*	1.22	*1.21*	0.84	*0.79*	0.53	*0.48*	**0.33**	*0.31*
RMSE	1.16	*1.15*	0.97	*0.96*	0.78	*0.74*	1.92	*2.14*	1.70	*1.68*	1.06	*1.06*	0.64	*0.60*	**0.42**	*0.41*
THEIL1	0.84	*0.80*	0.72	*0.67*	0.75	*0.72*	0.68	*0.68*	0.91	*0.85*	0.81	*0.84*	0.63	*0.55*	**0.66**	*0.62*
THEIL2	0.39	*0.39*	0.36	*0.40*	0.42	*0.41*	0.40	*0.40*	0.85	*1.00*	0.49	*0.57*	0.46	*0.46*	**0.63**	*0.57*
THEIL2*	0.37		0.35		0.41		0.38		0.79		0.44		0.44		**0.58**	
% of positive errors	51		58		51		45		71		75		51		**60**	

MAV: mean absolute value of the realisation data; MAE: mean absolute forecast error; RMSE: root mean squared forecast error;
THEIL1 is defined as the ratio between the root mean squared errors of the Commission forecast and "no change forecast"
THEIL2 is defined as the ratio between the root mean squared errors of the Commission forecast and "average forecast"
THEIL2* is defined as the ratio between the root mean sqaured errors of the Commission forecast and "recursive mean forecast"

Table A3: Basic characteristics of the forecast errors - current year (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
MAV	2.36	*2.69*	3.51	*3.27*	2.47	*2.61*	1.88	2.59	*3.06*	3.45	2.46	2.25	*2.24*	1.86	**2.53**	*2.68*
MAE	0.88	*0.94*	1.44	*1.43*	0.72	*0.69*	0.50	0.70	*0.73*	0.96	0.58	0.69	*0.77*	0.38	**0.50**	*0.53*
RMSE	1.22	*1.32*	1.95	*2.01*	0.92	*0.86*	0.71	0.87	*0.89*	1.31	0.82	0.89	*0.98*	0.53	**0.72**	*0.77*
THEIL1	0.47	*0.45*	0.56	*0.54*	0.63	*0.57*	0.65	0.62	*0.62*	0.60	0.63	0.46	*0.45*	0.47	**0.38**	*0.37*
THEIL2	0.62	*0.63*	0.72	*0.74*	0.56	*0.52*	0.83	0.47	*0.50*	0.79	0.87	0.50	*0.49*	0.55	**0.43**	*0.42*
THEIL2*	0.58		0.66		0.52		0.71	0.43		0.69	0.72	0.44		0.46	**0.39**	
% of positive errors	70		38		38		64	65		55	45	61		75	**57**	
Inflation																
MAV	8.22	*9.79*	4.16	*4.73*	4.01	*4.44*	1.75	6.26	*8.40*	1.67	1.55	6.31	*7.85*	1.91	**5.32**	*6.29*
MAE	0.65	*0.75*	0.52	*0.54*	0.40	*0.43*	0.44	0.56	*0.63*	0.47	0.35	0.77	*0.84*	0.15	**0.31**	*0.37*
RMSE	0.93	*1.03*	0.67	*0.71*	0.54	*0.58*	0.48	0.74	*0.86*	0.52	0.40	1.22	*1.35*	0.21	**0.44**	*0.49*
THEIL1	0.37	*0.37*	0.42	*0.39*	0.36	*0.37*	0.89	0.50	*0.48*	0.81	0.47	0.43	*0.42*	0.72	**0.32**	*0.31*
THEIL2	0.16	*0.18*	0.24	*0.24*	0.19	*0.19*	0.97	0.19	*0.22*	0.79	0.61	0.24	*0.27*	0.69	**0.14**	*0.16*
THEIL2*	0.15		0.23		0.18		0.82	0.17		0.69	0.49	0.22		0.55	**0.13**	
% of positive errors	32		54		54		73	30		45	45	61		50	**59**	
Investment																
MAV	3.87	*4.19*	5.10	*5.16*	4.00	*4.19*	3.17	6.92	*8.22*	5.09	5.61	3.68	*3.60*	2.70	**3.40**	*3.53*
MAE	2.60	*2.85*	3.34	*3.07*	2.55	*2.58*	2.23	3.55	*3.67*	2.90	3.45	2.15	*2.05*	1.44	**1.24**	*1.14*
RMSE	3.54	*3.85*	4.26	*3.90*	3.20	*3.27*	2.63	4.25	*4.40*	3.97	3.82	2.65	*2.58*	1.94	**1.72**	*1.63*
THEIL1	0.56	*0.55*	0.82	*0.80*	0.59	*0.56*	0.71	0.77	*0.78*	1.05	0.58	0.52	*0.47*	0.80	**0.50**	*0.45*
THEIL2	0.74	*0.73*	0.79	*0.70*	0.70	*0.68*	0.92	0.62	*0.74*	0.99	0.76	0.60	*0.56*	0.75	**0.50**	*0.45*
THEIL2*	0.68		0.73		0.65		0.81	0.56		0.86	0.63	0.56		0.63	**0.46**	
% of positive errors	68		41		46		64	55		73	64	64		88	**73**	
Unemployment rate																
MAV	8.93	*8.74*	2.08	*1.68*	6.13	*6.85*	4.27	5.86	*6.14*	11.15	7.29	7.48	*8.16*	9.08	**7.72**	*7.56*
MAE	0.72	*0.79*	0.31	*0.26*	0.67	*0.74*	0.28	0.59	*0.68*	0.37	0.78	0.28	*0.31*	0.20	**0.23**	*0.28*
RMSE	1.13	*1.25*	0.40	*0.33*	1.13	*1.26*	0.40	0.74	*0.83*	0.52	1.01	0.33	*0.35*	0.24	**0.32**	*0.41*
THEIL1	0.88	*0.88*	0.79	*0.83*	0.74	*0.75*	1.01	0.81	*0.89*	0.44	0.95	0.25	*0.24*	0.39	**0.38**	*0.46*
THEIL2	0.33	*0.33*	0.35	*0.37*	0.30	*0.32*	0.98	0.56	*0.62*	0.18	0.55	0.11	*0.12*	0.28	**0.10**	*0.11*
THEIL2*	0.31		0.34		0.29		0.87	0.49		0.15	0.48	0.11		0.22	**0.10**	
% of positive errors	51		58		65		36	75		73	45	70		100	**57**	
Government bal.																
MAV	7.41	*8.83*	2.18	*2.05*	2.96	*3.41*	2.04	4.68	*5.89*	3.25	2.86	3.21	*3.51*	1.88	**3.32**	*3.78*
MAE	0.95	*1.09*	1.49	*1.67*	0.94	*0.86*	0.51	0.77	*0.96*	0.87	1.25	0.82	*0.72*	0.51	**0.50**	*0.46*
RMSE	1.39	*1.54*	1.86	*2.03*	1.18	*1.13*	0.67	1.02	*1.20*	1.09	1.38	1.08	*0.93*	0.65	**0.63**	*0.56*
THEIL1	0.76	*0.76*	0.98	*1.04*	0.89	*0.91*	0.65	0.84	*1.00*	0.51	0.58	0.63	*0.60*	0.63	**0.59**	*0.54*
THEIL2	0.36	*0.51*	0.85	*0.98*	0.50	*0.50*	0.40	0.49	*0.76*	0.32	0.40	0.42	*0.43*	0.66	**0.34**	*0.34*
THEIL2*	0.35		0.80		0.47		0.33	0.45		0.28	0.33	0.40		0.53	**0.32**	
% of positive errors	59		22		41		45	40		36	18	58		50	**43**	
Current account																
MAV	1.40	*1.56*	19.48	*21.40*	3.32	*2.91*	1.90	3.96	*1.53*	5.17	3.49	1.39	*1.34*	0.65	**0.56**	*0.59*
MAE	0.76	*0.75*	3.10	*2.33*	0.98	*0.81*	0.81	1.45	*1.14*	1.19	0.91	0.78	*0.85*	0.46	**0.33**	*0.31*
RMSE	0.94	*0.95*	5.51	*3.59*	1.27	*1.04*	1.07	2.03	*1.41*	1.32	1.07	0.98	*1.04*	0.56	**0.42**	*0.41*
THEIL1	0.61	*0.56*	0.65	*0.47*	0.85	*0.80*	0.94	0.93	*0.94*	0.94	0.84	0.60	*0.56*	0.93	**0.66**	*0.62*
THEIL2	0.56	*0.52*	0.38	*0.25*	0.61	*0.55*	0.58	0.50	*0.80*	0.85	0.52	0.62	*0.61*	1.16	**0.63**	*0.57*
THEIL2*	0.52		0.36		0.58		0.52	0.47		0.74	0.47	0.54		0.86	**0.58**	
% of positive errors	69		58		46		55	50		55	36	45		88	**60**	

MAV: mean absolute value of the realisation data; MAE: mean absolute forecast error; RMSE: root mean squared forecast error;
THEIL1 is defined as the ratio between the root mean squared errors of the Commission forecast and "no change forecast"
THEIL2 is defined as the ratio between the root mean squared errors of the Commission forecast and "average forecast"
THEIL2* is defined as the ratio between the root mean sqaured errors of the Commission forecast and "recursive mean forecast"

Table A4: Basic characteristics of the forecast errors - year ahead

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
MAV	2.42	*2.54*	2.16	*2.20*	2.42	*2.75*	4.75	*3.97*	2.45	*1.66*	3.14	*3.06*	2.55	*2.70*	**2.43**	*2.56*
MAE	1.14	*1.19*	0.94	*1.03*	1.21	*1.31*	2.24	*2.36*	0.87	*1.14*	0.79	*1.06*	0.88	*0.94*	**0.86**	*0.94*
RMSE	1.53	*1.62*	1.23	*1.33*	1.63	*1.75*	2.63	*2.71*	1.23	*1.47*	1.06	*1.32*	1.20	*1.28*	**1.23**	*1.33*
THEIL1	0.77	*0.77*	0.60	*0.58*	0.69	*0.68*	0.90	*0.83*	0.81	*0.83*	0.65	*0.66*	0.62	*0.61*	**0.67**	*0.67*
THEIL2	0.85	*0.83*	0.81	*0.80*	0.86	*0.87*	0.80	*0.87*	0.76	*1.11*	0.72	*0.72*	0.71	*0.70*	**0.79**	*0.78*
THEIL2*	0.75		0.77		0.77		0.71		0.66		0.55		0.62		**0.70**	
% of positive errors	56		50		64		34		29		47		61		**58**	
Inflation																
MAV	4.21	*4.88*	5.10	*6.07*	3.08	*3.62*	7.05	*8.20*	11.29	*15.25*	4.31	*5.22*	5.19	*6.24*	**5.36**	*6.37*
MAE	1.02	*1.13*	1.14	*1.38*	0.69	*0.76*	1.83	*2.08*	1.22	*1.57*	0.56	*0.57*	0.94	*1.15*	**0.81**	*0.99*
RMSE	1.56	*1.72*	1.90	*2.17*	0.88	*0.95*	2.73	*3.04*	1.96	*2.36*	0.76	*0.84*	1.47	*1.78*	**1.33**	*1.51*
THEIL1	0.81	*0.81*	0.99	*0.99*	0.75	*0.74*	0.74	*0.73*	0.70	*0.71*	0.71	*0.66*	0.87	*0.88*	**0.75**	*0.76*
THEIL2	0.53	*0.57*	0.51	*0.57*	0.45	*0.50*	0.44	*0.45*	0.29	*0.51*	0.52	*0.68*	0.37	*0.45*	**0.40**	*0.48*
THEIL2*	0.45		0.45		0.40		0.38		0.25		0.43		0.33		**0.35**	
% of positive errors	64		44		64		66		38		26		42		**50**	
Investment																
MAV	4.06	*4.39*	6.90	*7.95*	3.86	*4.17*	7.31	*7.18*	5.28	*4.45*	5.94	*6.33*	3.19	*3.06*	**3.16**	*3.24*
MAE	3.33	*3.71*	5.15	*5.65*	3.19	*3.18*	5.69	*6.28*	3.42	*3.39*	3.03	*3.71*	1.93	*1.97*	**1.77**	*1.74*
RMSE	4.75	*5.22*	6.59	*7.17*	3.89	*3.78*	6.82	*7.35*	3.87	*3.88*	3.66	*4.35*	2.52	*2.63*	**2.45**	*2.51*
THEIL1	0.94	*0.96*	0.69	*0.67*	0.79	*0.76*	0.81	*0.83*	0.82	*0.77*	0.69	*0.70*	0.69	*0.74*	**0.68**	*0.66*
THEIL2	0.92	*0.92*	0.77	*0.75*	0.88	*0.86*	0.89	*0.92*	0.76	*0.77*	0.74	*0.75*	0.80	*0.83*	**0.81**	*0.80*
THEIL2*	0.85		0.66		0.73		0.77		0.67		0.57		0.71		**0.71**	
% of positive errors	58		63		61		53		71		37		56		**61**	
Unemployment rate																
MAV	8.41	*8.57*	6.80	*7.42*	6.30	*5.53*	11.15	*13.23*	8.91	*8.19*	16.85	*19.82*	8.35	*7.91*	**7.95**	*7.84*
MAE	0.84	*0.86*	1.02	*1.18*	0.75	*0.83*	1.05	*1.15*	1.17	*1.27*	1.34	*1.53*	0.59	*0.64*	**0.51**	*0.52*
RMSE	1.13	*1.18*	1.29	*1.43*	1.04	*1.14*	1.46	*1.58*	1.48	*1.56*	1.61	*1.80*	0.76	*0.82*	**0.75**	*0.80*
THEIL1	0.81	*0.79*	0.86	*0.84*	0.87	*0.88*	0.67	*0.71*	1.02	*1.03*	0.64	*0.70*	0.87	*0.98*	**0.74**	*0.73*
THEIL2	0.36	*0.33*	0.64	*0.74*	0.38	*0.43*	0.29	*0.38*	1.10	*1.64*	0.36	*0.65*	0.25	*0.25*	**0.26**	*0.25*
THEIL2*	0.31		0.55		0.34		0.25		0.96		0.30		0.22		**0.23**	
% of positive errors	54		47		54		69		42		53		49		**57**	
Government bal.																
MAV	5.01	*6.31*	2.88	*3.06*	2.45	*2.39*	6.25	*7.80*	8.79	*11.67*	2.97	*4.64*	2.32	*2.23*	**3.36**	*3.83*
MAE	1.09	*1.19*	1.59	*1.79*	1.03	*1.07*	2.15	*2.28*	2.25	*2.56*	0.89	*1.21*	0.71	*0.75*	**0.71**	*0.69*
RMSE	1.50	*1.63*	1.97	*2.12*	1.29	*1.34*	2.54	*2.72*	2.77	*3.05*	1.28	*1.61*	1.01	*1.07*	**0.89**	*0.87*
THEIL1	0.95	*0.96*	0.71	*0.68*	0.68	*0.68*	0.93	*0.94*	0.75	*0.75*	0.81	*0.82*	0.77	*0.82*	**0.73**	*0.76*
THEIL2	0.40	*0.52*	0.56	*0.68*	0.81	*0.83*	0.42	*0.53*	0.51	*0.74*	0.50	*1.02*	0.60	*0.59*	**0.50**	*0.56*
THEIL2*	0.36		0.48		0.69		0.38		0.44		0.43		0.54		**0.44**	
% of positive errors	54		52		47		44		58		42		42		**58**	
Current account																
MAV	2.76	*2.42*	2.72	*2.86*	1.78	*1.72*	3.89	*4.83*	4.64	*4.09*	2.54	*1.83*	1.19	*1.11*	**0.61**	*0.65*
MAE	1.35	*1.41*	1.60	*1.79*	0.91	*0.90*	2.12	*2.46*	1.53	*1.30*	1.32	*1.25*	0.75	*0.77*	**0.51**	*0.49*
RMSE	1.68	*1.78*	2.20	*2.45*	1.23	*1.18*	2.82	*3.16*	1.88	*1.63*	1.61	*1.57*	0.93	*0.96*	**0.68**	*0.68*
THEIL1	0.83	*0.81*	0.99	*1.03*	0.79	*0.82*	0.95	*0.98*	0.83	*0.82*	0.75	*0.81*	0.80	*0.93*	**0.90**	*0.88*
THEIL2	0.60	*0.63*	0.75	*0.86*	0.65	*0.64*	0.60	*0.59*	0.90	*1.00*	0.77	*0.95*	0.66	*0.70*	**0.94**	*0.86*
THEIL2*	0.53		0.67		0.59		0.52		0.79		0.63		0.59		**0.83**	
% of positive errors	57		50		43		53		71		58		57		**46**	

MAV: mean absolute value of the realisation data; MAE: mean absolute forecast error; RMSE: root mean squared forecast error;
THEIL1 is defined as the ratio between the root mean squared errors of the Commission forecast and "no change forecast"
THEIL2 is defined as the ratio between the root mean squared errors of the Commission forecast and "average forecast"
THEIL2* is defined as the ratio between the root mean sqaured errors of the Commission forecast and "recursive mean forecast"

Table A4: Basic characteristics of the forecast errors - year ahead (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
MAV	2.30	*2.63*	3.38	*3.07*	2.42	*2.52*	1.99	2.49	*2.95*	3.65	2.45	2.25	*2.25*	1.77	**2.43**	*2.56*
MAE	1.29	*1.36*	2.03	*1.89*	1.08	*1.08*	0.71	0.95	*0.99*	1.27	0.80	1.07	*1.25*	0.69	**0.86**	*0.94*
RMSE	1.75	*1.89*	2.71	*2.61*	1.36	*1.36*	0.95	1.19	*1.18*	1.59	1.06	1.38	*1.56*	0.86	**1.23**	*1.33*
THEIL1	0.66	*0.65*	0.79	*0.77*	0.82	*0.85*	0.74	0.77	*0.75*	0.78	0.75	0.72	*0.73*	0.69	**0.67**	*0.67*
THEIL2	0.89	*0.89*	0.90	*0.91*	0.79	*0.79*	1.23	0.65	*0.65*	0.99	1.13	0.81	*0.81*	0.96	**0.79**	*0.78*
THEIL2*	0.83		0.82		0.70		0.95	0.53		0.80	0.93	0.73		0.65	**0.70**	
% of positive errors	72		44		50		55	63		45	55	59		71	**58**	
Inflation																
MAV	8.38	*10.05*	4.30	*4.87*	3.95	*4.40*	1.64	6.09	*8.29*	1.54	1.54	6.34	*7.95*	2.03	**5.36**	*6.37*
MAE	1.42	*1.69*	1.27	*1.49*	0.68	*0.75*	0.37	1.04	*1.43*	0.92	0.64	1.47	*1.75*	0.29	**0.81**	*0.99*
RMSE	2.49	*2.80*	1.63	*1.80*	0.90	*1.00*	0.54	1.71	*2.18*	1.11	0.77	2.27	*2.58*	0.35	**1.33**	*1.51*
THEIL1	0.88	*0.88*	0.82	*0.83*	0.56	*0.57*	0.73	1.11	*1.14*	0.95	0.93	0.64	*0.63*	0.72	**0.75**	*0.76*
THEIL2	0.42	*0.49*	0.58	*0.61*	0.31	*0.32*	0.94	0.45	*0.59*	0.98	1.15	0.42	*0.49*	1.03	**0.40**	*0.48*
THEIL2*	0.36		0.51		0.27		0.65	0.36		0.75	0.97	0.37		0.62	**0.35**	
% of positive errors	31		56		61		55	26		64	82	56		43	**50**	
Investment																
MAV	3.44	*3.65*	5.64	*5.44*	4.18	*4.29*	3.49	6.44	*7.54*	5.99	5.67	4.03	*4.07*	2.60	**3.16**	*3.24*
MAE	2.92	*3.14*	5.58	*5.60*	3.16	*3.28*	2.34	3.93	*3.73*	3.86	4.00	2.82	*3.15*	1.97	**1.77**	*1.74*
RMSE	3.75	*3.97*	7.22	*6.82*	3.86	*4.04*	2.83	4.90	*4.67*	5.30	4.49	3.62	*3.97*	2.72	**2.45**	*2.51*
THEIL1	0.60	*0.57*	0.99	*1.13*	0.72	*0.73*	0.69	0.91	*0.93*	0.98	0.62	0.66	*0.65*	0.77	**0.68**	*0.66*
THEIL2	0.88	*0.86*	1.01	*1.08*	0.84	*0.84*	0.89	0.72	*0.80*	1.17	0.90	0.77	*0.79*	1.01	**0.81**	*0.80*
THEIL2*	0.80		0.91		0.74		0.74	0.57		0.90	0.66	0.70		0.59	**0.71**	
% of positive errors	64		50		36		64	68		64	55	66		86	**61**	
Unemployment rate																
MAV	9.04	*8.89*	2.08	*1.69*	6.42	*7.26*	4.27	5.66	*5.83*	11.05	7.27	7.57	*8.32*	8.80	**7.95**	*7.84*
MAE	1.03	*1.18*	0.38	*0.36*	1.09	*1.27*	0.49	1.03	*1.15*	0.52	1.00	0.58	*0.71*	0.40	**0.51**	*0.52*
RMSE	1.56	*1.75*	0.47	*0.44*	1.53	*1.70*	0.75	1.34	*1.52*	0.71	1.17	0.83	*0.94*	0.43	**0.75**	*0.80*
THEIL1	0.96	*1.00*	0.74	*0.93*	0.77	*0.77*	1.45	0.93	*0.95*	0.47	0.74	0.61	*0.61*	0.48	**0.74**	*0.73*
THEIL2	0.52	*0.53*	0.43	*0.51*	0.41	*0.45*	1.56	1.08	*1.23*	0.25	0.64	0.31	*0.35*	0.78	**0.26**	*0.25*
THEIL2*	0.46		0.39		0.36		1.22	0.85		0.17	0.47	0.26		0.44	**0.23**	
% of positive errors	54		50		57		55	63		82	45	63		86	**57**	
Government bal.																
MAV	7.60	*9.09*	2.35	*2.10*	2.97	*3.41*	1.93	4.39	*5.45*	3.25	2.90	3.23	*3.56*	1.87	**3.36**	*3.83*
MAE	1.36	*1.51*	2.18	*2.32*	1.24	*1.14*	0.69	1.21	*1.39*	1.00	1.38	1.38	*1.36*	0.66	**0.71**	*0.69*
RMSE	1.73	*1.90*	2.52	*2.65*	1.50	*1.40*	0.83	1.60	*1.76*	1.25	1.56	1.64	*1.64*	0.81	**0.89**	*0.87*
THEIL1	0.90	*0.90*	0.91	*0.93*	0.80	*0.85*	0.70	0.87	*0.86*	0.58	0.47	0.79	*0.86*	0.66	**0.73**	*0.76*
THEIL2	0.46	*0.67*	1.08	*1.25*	0.60	*0.57*	0.51	0.80	*1.05*	0.37	0.44	0.65	*0.78*	0.82	**0.50**	*0.56*
THEIL2*	0.41		0.97		0.52		0.34	0.65		0.26	0.29	0.58		0.59	**0.44**	
% of positive errors	69		29		33		27	47		27	18	59		57	**58**	
Current account																
MAV	1.45	*1.65*	21.45	*21.91*	3.35	*2.94*	1.88	4.57	*1.85*	5.49	3.51	1.58	*1.56*	0.49	**0.61**	*0.65*
MAE	1.25	*1.27*	6.88	*6.97*	1.35	*1.26*	0.95	1.92	*1.34*	1.29	1.42	0.97	*1.10*	0.80	**0.51**	*0.49*
RMSE	1.69	*1.75*	9.27	*9.42*	1.70	*1.57*	1.29	2.52	*1.57*	1.43	1.73	1.50	*1.69*	0.86	**0.68**	*0.68*
THEIL1	0.92	*0.91*	1.06	*1.05*	0.90	*0.91*	0.69	0.76	*0.74*	0.81	1.09	1.03	*1.03*	0.82	**0.90**	*0.88*
THEIL2	0.95	*0.89*	0.69	*0.69*	0.83	*0.83*	0.71	0.69	*1.02*	1.19	0.82	0.93	*0.95*	2.02	**0.94**	*0.86*
THEIL2*	0.80		0.58		0.74		0.57	0.59		0.91	0.63	0.77		1.46	**0.83**	
% of positive errors	69		42		49		64	74		45	36	47		71	**46**	

MAV: mean absolute value of the realisation data; MAE: mean absolute forecast error; RMSE: root mean squared forecast error;
THEIL1 is defined as the ratio between the root mean squared errors of the Commission forecast and "no change forecast"
THEIL2 is defined as the ratio between the root mean squared errors of the Commission forecast and "average forecast"
THEIL2* is defined as the ratio between the root mean sqaured errors of the Commission forecast and "recursive mean forecast"

Table A5: MAE by periods - current year

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom	euro area	European Union
real GDP growth																	
1969-1979	0.8	1.0	1.2	1.5			0.7	1.6	1.6	0.7					1.0		0.7
1980-1989	0.7	0.5	0.7	1.7	0.9	1.0	0.5	0.5	1.9	0.7		0.8			0.7		0.4
1990-1997	0.6	0.7	0.8	1.5	0.8	0.6	0.5	0.6	0.6	0.7	0.7	0.7	1.0	0.2	0.7		0.4
1998-2005	0.6	0.6	0.4	1.8	0.3	0.3	0.6	0.6	1.5	0.8	0.4	0.7	1.0	0.7	0.4	0.4	0.4
Inflation																	
1969-1979	0.9	1.0	0.5	1.9			0.6	1.0	0.5	0.7					1.0		0.5
1980-1989	0.5	0.7	0.3	0.8	1.3	0.8	0.5	0.7	0.8	0.3		0.8			1.0		0.3
1990-1997	0.2	0.3	0.3	0.6	1.0	0.2	0.2	0.5	0.3	0.3	0.4	0.5	0.5	0.4	0.5		0.2
1998-2005	0.5	0.3	0.3	0.7	0.5	0.5	0.4	0.3	0.5	0.3	0.4	0.5	0.3	0.5	0.5	0.2	0.1
Investment																	
1969-1979	2.1	3.3	2.7	3.5			1.7	4.0	3.6	3.1					2.0		1.4
1980-1989	3.0	4.7	2.0	3.4	4.4	3.0	1.2	2.2	1.9	2.5		4.6			1.9		0.8
1990-1997	1.7	3.5	2.0	3.6	2.7	3.4	1.9	2.2	3.7	1.9	1.8	3.2	5.5	4.7	2.3		1.4
1998-2005	2.2	3.5	2.9	3.5	2.4	1.2	1.2	1.7	4.4	2.4	2.4	3.4	1.9	3.0	2.5	1.4	1.5
Unemployment																	
1969-1979	0.4	0.7	0.2	0.4			0.3	0.6	0.4	0.1					0.3		0.2
1980-1989	0.6	0.5	0.3	0.7	0.8	0.8	0.4	1.3	0.2	1.4		1.1			0.3		0.4
1990-1997	0.4	0.7	0.4	0.9	0.5	0.5	0.4	0.4	0.3	0.8	0.3	0.5	0.5	1.2	0.4		0.1
1998-2005	0.6	0.3	0.3	0.6	0.7	0.8	0.2	0.4	0.5	0.4	0.3	0.5	0.3	0.6	0.2	0.2	0.2
Government balance																	
1969-1979	0.4	0.3	0.9	2.7			1.0	1.5	1.5	1.1					0.9		0.7
1980-1989	0.6	1.3	0.5	1.2	2.2	1.0	0.6	1.1	1.7	0.7		1.6			0.6		0.4
1990-1997	0.3	0.6	1.0	0.9	1.9	1.0	0.4	0.5	1.8	0.7	0.9	0.7	0.8	1.5	0.7		0.4
1998-2005	0.4	0.7	0.8	1.5	0.9	0.5	0.4	0.5	1.0	1.2	0.4	0.5	0.9	1.2	1.1	0.5	0.6
Current account																	
1969-1979	1.3	0.5	0.6	2.6			0.5	1.0	1.4	1.0					0.9		0.3
1980-1989	0.9	0.9	0.6	1.2	1.8	0.9	0.4	0.6	3.3	0.9		1.9			0.9		0.3
1990-1997	0.5	0.8	0.5	1.0	0.6	0.8	0.6	0.7	2.2	0.5	0.5	0.8	1.4	0.5	0.8		0.4
1998-2005	0.9	0.8	0.7	0.8	1.2	0.9	0.7	0.8	6.6	1.6	0.9	1.9	1.1	1.1	0.6	0.5	0.4

Table A6: MAE by periods - year ahead

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom	euro area	European Union
real GDP growth																	
1969-1979	0.8	1.0	1.2	1.5			0.7	1.6	1.6	0.7					1.0		0.7
1980-1989	0.7	0.5	0.7	1.7	0.9	1.0	0.5	0.5	1.9	0.7		0.8			0.7		0.4
1990-1997	0.6	0.7	0.8	1.5	0.8	0.6	0.5	0.6	0.6	0.7	0.7	0.7	1.0	0.2	0.7		0.4
1998-2005	0.6	0.6	0.4	1.8	0.3	0.3	0.6	0.6	1.5	0.8	0.4	0.7	1.0	0.7	0.4	0.4	0.4
Inflation																	
1969-1979	0.9	1.0	0.5	1.9			0.6	1.0	0.5	0.7					1.0		0.5
1980-1989	0.5	0.7	0.3	0.8	1.3	0.8	0.5	0.7	0.8	0.3		0.8			1.0		0.3
1990-1997	0.2	0.3	0.3	0.6	1.0	0.2	0.2	0.5	0.3	0.3	0.4	0.5	0.5	0.4	0.5		0.2
1998-2005	0.5	0.3	0.3	0.7	0.5	0.5	0.4	0.3	0.5	0.3	0.4	0.5	0.3	0.5	0.5	0.2	0.1
Investment																	
1969-1979	2.1	3.3	2.7	3.5			1.7	4.0	3.6	3.1					2.0		1.4
1980-1989	3.0	4.7	2.0	3.4	4.4	3.0	1.2	2.2	1.9	2.5		4.6			1.9		0.8
1990-1997	1.7	3.5	2.0	3.6	2.7	3.4	1.9	2.2	3.7	1.9	1.8	3.2	5.5	4.7	2.3		1.4
1998-2005	2.2	3.5	2.9	3.5	2.4	1.2	1.2	1.7	4.4	2.4	2.4	3.4	1.9	3.0	2.5	1.4	1.5
Unemployment																	
1969-1979	0.4	0.7	0.2	0.4			0.3	0.6	0.4	0.1					0.3		0.2
1980-1989	0.6	0.5	0.3	0.7	0.8	0.8	0.4	1.3	0.2	1.4		1.1			0.3		0.4
1990-1997	0.4	0.7	0.4	0.9	0.5	0.5	0.4	0.4	0.3	0.8	0.3	0.5	0.5	1.2	0.4		0.1
1998-2005	0.6	0.3	0.3	0.6	0.7	0.8	0.2	0.4	0.5	0.4	0.3	0.5	0.3	0.6	0.2	0.2	0.2
Government balance																	
1969-1979	0.4	0.3	0.9	2.7			1.0	1.5	1.5	1.1					0.9		0.7
1980-1989	0.6	1.3	0.5	1.2	2.2	1.0	0.6	1.1	1.7	0.7		1.6			0.6		0.4
1990-1997	0.3	0.6	1.0	0.9	1.9	1.0	0.4	0.5	1.8	0.7	0.9	0.7	0.8	1.5	0.7		0.4
1998-2005	0.4	0.7	0.8	1.5	0.9	0.5	0.4	0.5	1.0	1.2	0.4	0.5	0.9	1.2	1.1	0.5	0.6
Current account																	
1969-1979	1.3	0.5	0.6	2.6			0.5	1.0	1.4	1.0					0.9		0.3
1980-1989	0.9	0.9	0.6	1.2	1.8	0.9	0.4	0.6	3.3	0.9		1.9			0.9		0.3
1990-1997	0.5	0.8	0.5	1.0	0.6	0.8	0.6	0.7	2.2	0.5	0.5	0.8	1.4	0.5	0.8		0.4
1998-2005	0.9	0.8	0.7	0.8	1.2	0.9	0.7	0.8	6.6	1.6	0.9	1.9	1.1	1.1	0.6	0.5	0.4

Table A7: Persistence in current-year forecast error

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
ρ1	0.20		0.05		0.01		0.02		0.06		0.31		0.20		**-0.06**	
Signif ρ_1=0	0.20	*0.12*	0.74	*0.47*	0.94	*1.00*	0.91	*0.25*	0.76	*0.78*	0.14	*0.17*	0.20	*0.15*	**0.72**	*0.67*
ρ2	0.07		0.13		0.16		0.11		0.07		0.02		0.03		**0.05**	
Signif ρ_2=0	0.40	*0.24*	0.69	*0.60*	0.57	*0.66*	0.80	*0.40*	0.89	*0.90*	0.33	*0.39*	0.43	*0.36*	**0.90**	*0.89*
ρ3	-0.18		0.02		0.03		0.02		0.01		-0.08		-0.10		**-0.09**	
Signif ρ_3=0	0.37	*0.26*	0.86	*0.71*	0.77	*0.82*	0.93	*0.47*	0.97	*0.98*	0.49	*0.57*	0.55	*0.51*	**0.90**	*0.94*
Inflation																
ρ1	0.10		-0.01		0.06		-0.28		0.09		-0.28		-0.11		**0.11**	
Signif ρ_1=0	0.54	*0.95*	0.97	*0.56*	0.71	*0.46*	0.09	*0.07*	0.63	*0.54*	0.17	*0.07*	0.49	*0.37*	**0.48**	*0.47*
ρ2	0.08		-0.07		-0.14		0.01		-0.16		0.02		0.09		**0.13**	
Signif ρ_2=0	0.73	*0.92*	0.92	*0.70*	0.63	*0.61*	0.23	*0.19*	0.62	*0.57*	0.39	*0.19*	0.67	*0.52*	**0.54**	*0.47*
ρ3	-0.29		-0.12		-0.29		-0.02		0.10		0.23		-0.06		**-0.24**	
Signif ρ_3=0	0.25	*0.16*	0.86	*0.65*	0.22	*0.14*	0.40	*0.34*	0.74	*0.68*	0.36	*0.13*	0.82	*0.69*	**0.30**	*0.31*
Investment																
ρ1	0.23		0.16		0.26		0.15		-0.08		0.39		0.04		**0.21**	
Signif ρ_1=0	0.15	*0.14*	0.35	*0.35*	0.10	*0.37*	0.36	*0.50*	0.69	*0.80*	0.06	*0.18*	0.81	*0.95*	**0.18**	*0.59*
ρ2	-0.03		0.04		0.08		-0.12		0.01		0.01		-0.18		**-0.17**	
Signif ρ_2=0	0.35	*0.33*	0.62	*0.58*	0.22	*0.66*	0.50	*0.66*	0.92	*0.92*	0.17	*0.38*	0.51	*0.95*	**0.22**	*0.59*
ρ3	-0.32		-0.24		-0.12		-0.26		0.20		-0.01		0.00		**-0.19**	
Signif ρ_3=0	0.09	*0.17*	0.37	*0.35*	0.31	*0.37*	0.26	*0.35*	0.72	*0.82*	0.32	*0.59*	0.72	*0.88*	**0.20**	*0.73*
Unemployment rate																
ρ1	0.20		-0.26		0.27		-0.16		0.10		0.04		-0.19		**0.20**	
Signif ρ_1=0	0.20	*0.03*	0.11	*0.19*	0.08	*0.07*	0.35	*0.53*	0.60	*0.57*	0.83	*0.57*	0.23	*0.19*	**0.20**	*0.90*
ρ2	0.17		0.03		0.12		0.11		0.12		0.06		-0.08		**0.09**	
Signif ρ_2=0	0.24	*0.01*	0.28	*0.42*	0.17	*0.16*	0.51	*0.56*	0.70	*0.83*	0.94	*0.29*	0.43	*0.38*	**0.38**	*0.92*
ρ3	0.28		-0.09		-0.17		0.04		-0.09		-0.03		-0.05		**-0.08**	
Signif ρ_3=0	0.10	*0.00*	0.42	*0.47*	0.19	*0.25*	0.70	*0.76*	0.81	*0.79*	0.99	*0.11*	0.62	*0.58*	**0.52**	*0.08*
Government bal.																
ρ1	0.21		0.23		-0.01		-0.06		0.04		-0.06		0.05		**0.09**	
Signif ρ_1=0	0.20	*0.55*	0.20	*0.40*	0.95	*0.63*	0.70	*0.78*	0.84	*0.97*	0.78	*0.77*	0.74	*0.96*	**0.56**	*0.65*
ρ2	-0.03		0.13		-0.21		-0.08		0.23		0.29		-0.13		**-0.12**	
Signif ρ_2=0	0.43	*0.51*	0.33	*0.44*	0.40	*0.37*	0.83	*0.88*	0.46	*0.57*	0.35	*0.67*	0.66	*0.74*	**0.63**	*0.69*
ρ3	0.08		-0.17		-0.21		-0.14		0.02		-0.03		0.11		**-0.16**	
Signif ρ_3=0	0.58	*0.72*	0.35	*0.41*	0.29	*0.35*	0.77	*0.83*	0.66	*0.77*	0.55	*0.74*	0.71	*0.71*	**0.58**	*0.68*
Current account																
ρ1	0.08		0.05		0.01		0.11		-0.09		0.34		0.04		**-0.12**	
Signif ρ_1=0	0.62	*0.36*	0.75	*0.52*	0.97	*0.87*	0.51	*0.56*	0.66	*0.74*	0.11	*0.51*	0.81	*0.98*	**0.48**	*0.41*
ρ2	-0.10		-0.02		-0.14		-0.02		-0.24		0.19		-0.03		**-0.12**	
Signif ρ_2=0	0.74	*0.41*	0.95	*0.77*	0.68	*0.81*	0.79	*0.80*	0.39	*0.08*	0.17	*0.59*	0.95	*1.00*	**0.58**	*0.68*
ρ3	0.08		0.14		-0.13		-0.23		0.11		-0.05		0.11		**-0.10**	
Signif ρ_3=0	0.82	*0.50*	0.84	*0.90*	0.69	*0.67*	0.47	*0.39*	0.51	*0.13*	0.31	*0.76*	0.91	*0.94*	**0.68**	*0.82*

Note: The test for serial correlation is based on the Ljung-Box Q statistic, which is asymptotically distributed as $\chi 2$. Autocorrelation coefficients up to three lags as well as their significance are reported.
Numbers above 0.05 indicate no serial correlation at the 5 % significance level.

Table A7: Persistence in current-year forecast error (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria		Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																	
ρ1	-0.13		0.27		0.18		0.12		0.42		-0.18	-0.01	-0.21		0.02	**-0.06**	
Signif ρ_1=0	0.40	*0.48*	0.09	*0.11*	0.26	*0.80*	0.64		0.04	*0.05*	0.49	0.96	0.20	*0.18*	0.95	**0.72**	*0.67*
ρ2	-0.08		-0.16		0.10		0.02		0.30		0.04	-0.50	-0.08		-0.09	**0.05**	
Signif ρ_2=0	0.62	*0.70*	0.14	*0.25*	0.43	*0.73*	0.90		0.04	*0.08*	0.78	0.14	0.39	*0.36*	0.94	**0.90**	*0.89*
ρ3	0.21		-0.25		-0.03		-0.37		-0.15		-0.34	-0.33	0.01		-0.58	**-0.09**	
Signif ρ_3=0	0.41	*0.53*	0.09	*0.18*	0.63	*0.89*	0.44		0.07	*0.12*	0.46	0.12	0.60	*0.54*	0.13	**0.90**	*0.94*
Inflation																	
ρ1	0.17		0.13		-0.12		0.13		0.24		-0.03	-0.12	-0.01		-0.14	**0.11**	
Signif ρ_1=0	0.28	*0.35*	0.41	*0.78*	0.45	*0.41*	0.61		0.25	*0.27*	0.91	0.66	0.96	*0.85*	0.64	**0.48**	*0.47*
ρ2	-0.13		0.06		-0.05		-0.22		0.33		-0.23	0.21	0.24		-0.38	**0.13**	
Signif ρ_2=0	0.40	*0.46*	0.66	*0.86*	0.72	*0.70*	0.59		0.14	*0.19*	0.66	0.64	0.35	*0.52*	0.35	**0.54**	*0.47*
ρ3	-0.22		0.04		-0.07		0.11		0.04		0.09	-0.21	0.08		0.02	**-0.24**	
Signif ρ_3=0	0.27	*0.35*	0.82	*0.96*	0.83	*0.80*	0.74		0.26	*0.33*	0.80	0.64	0.51	*0.63*	0.55	**0.30**	*0.31*
Investment																	
ρ1	0.00		0.27		0.08		0.13		0.16		0.18	0.29	0.21		0.33	**0.21**	
Signif ρ_1=0	0.99	*0.97*	0.09	*0.36*	0.60	*0.86*	0.62		0.44	*0.92*	0.50	0.27	0.20	*0.28*	0.26	**0.18**	*0.59*
ρ2	-0.27		-0.11		0.12		-0.18		0.15		-0.07	-0.49	-0.18		-0.43	**-0.17**	
Signif ρ_2=0	0.23	*0.26*	0.19	*0.61*	0.65	*0.64*	0.68		0.56	*0.96*	0.77	0.08	0.25	*0.50*	0.15	**0.22**	*0.59*
ρ3	0.09		-0.17		-0.28		-0.31		-0.12		0.05	-0.50	-0.32		-0.47	**-0.19**	
Signif ρ_3=0	0.35	*0.36*	0.21	*0.72*	0.25	*0.28*	0.48		0.66	*0.91*	0.90	0.02	0.08	*0.51*	0.07	**0.20**	*0.73*
Unemployment rate																	
ρ1	-0.19		-0.42		-0.19		-0.11		0.34		-0.15	0.39	-0.25		0.57	**0.20**	
Signif ρ_1=0	0.24	*0.21*	0.02	*0.13*	0.23	*0.27*	0.68		0.11	*0.10*	0.57	0.14	0.13	*0.12*	0.05	**0.20**	*0.90*
ρ2	-0.06		0.28		-0.05		-0.26		0.23		-0.15	0.08	0.02		0.07	**0.09**	
Signif ρ_2=0	0.47	*0.40*	0.01	*0.20*	0.46	*0.51*	0.55		0.14	*0.10*	0.71	0.31	0.32	*0.30*	0.15	**0.38**	*0.92*
ρ3	0.06		-0.02		0.06		0.15		0.10		-0.42	-0.29	-0.30		-0.14	**-0.08**	
Signif ρ_3=0	0.65	*0.60*	0.03	*0.32*	0.64	*0.69*	0.66		0.24	*0.18*	0.28	0.28	0.13	*0.14*	0.25	**0.52**	*0.08*
Government bal.																	
ρ1	-0.21		-0.25		0.01		-0.19		0.21		-0.49	0.49	0.26		0.28	**0.09**	
Signif ρ_1=0	0.19	*0.20*	0.14	*0.16*	0.96	*0.44*	0.48		0.30	*0.35*	0.06	0.06	0.12	*0.65*	0.34	**0.56**	*0.65*
ρ2	0.02		-0.09		0.03		-0.19		0.22		0.23	-0.20	0.00		-0.30	**-0.12**	
Signif ρ_2=0	0.41	*0.43*	0.30	*0.31*	0.97	*0.57*	0.59		0.33	*0.23*	0.11	0.13	0.30	*0.74*	0.34	**0.63**	*0.69*
ρ3	-0.09		0.02		-0.14		-0.08		0.01		-0.24	-0.39	-0.05		-0.32	**-0.16**	
Signif ρ_3=0	0.54	*0.55*	0.49	*0.49*	0.83	*0.75*	0.76		0.53	*0.40*	0.15	0.08	0.47	*0.89*	0.29	**0.58**	*0.68*
Current account																	
ρ1	-0.03		-0.36		0.17		0.11		0.00		0.02	-0.19	-0.02		-0.04	**-0.12**	
Signif ρ_1=0	0.86	*0.61*	0.03	*0.07*	0.29	*0.23*	0.67		0.99	*0.71*	0.94	0.47	0.92	*0.89*	0.88	**0.48**	*0.41*
ρ2	-0.18		-0.01		-0.12		0.42		-0.06		0.32	-0.07	-0.13		-0.54	**-0.12**	
Signif ρ_2=0	0.54	*0.46*	0.10	*0.14*	0.42	*0.48*	0.23		0.95	*0.61*	0.44	0.74	0.71	*0.78*	0.14	**0.58**	*0.68*
ρ3	-0.01		0.04		-0.12		-0.05		0.10		0.08	-0.23	-0.10		0.09	**-0.10**	
Signif ρ_3=0	0.74	*0.64*	0.19	*0.09*	0.51	*0.69*	0.39		0.95	*0.65*	0.62	0.68	0.78	*0.92*	0.26	**0.68**	*0.82*

Note: The test for serial correlation is based on the Ljung-Box Q statistic, which is asymptotically distributed as $\chi 2$. Autocorrelation coefficients up to three lags as well as their significance are reported.
Numbers above 0.05 indicate no serial correlation at the 5 % significance level.

Table A8: Persistence in year-ahead forecast error

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
ρ1	0.17		0.08		-0.07		0.30		-0.01		0.34		0.01		**-0.02**	
Signif ρ_1=0	0.30	*0.18*	0.62	*0.42*	0.68	*0.79*	0.07	*0.01*	0.95	*0.95*	0.11	*0.18*	0.94	*0.79*	**0.91**	*0.96*
ρ2	0.00		-0.13		-0.14		0.18		-0.36		0.01		-0.06		**-0.21**	
Signif ρ_2=0	0.58	*0.41*	0.66	*0.50*	0.64	*0.59*	0.11	*0.03*	0.16	*0.25*	0.27	*0.41*	0.93	*0.82*	**0.41**	*0.38*
ρ3	0.05		-0.07		-0.04		0.15		0.22		-0.03		-0.11		**-0.04**	
Signif ρ_3=0	0.75	*0.57*	0.79	*0.66*	0.81	*0.77*	0.16	*0.06*	0.16	*0.27*	0.45	*0.62*	0.89	*0.91*	**0.61**	*0.58*
Inflation																
ρ1	0.30		-0.31		0.48		0.37		0.35		0.12		0.14		**0.37**	
Signif ρ_1=0	0.06	*0.10*	0.06	*0.09*	0.00	*0.01*	0.03	*0.04*	0.07	*0.15*	0.57	*0.65*	0.38	*0.75*	**0.02**	*0.04*
ρ2	-0.02		0.01		0.25		-0.10		0.19		-0.18		0.03		**-0.08**	
Signif ρ_2=0	0.17	*0.27*	0.18	*0.24*	0.00	*0.01*	0.08	*0.10*	0.11	*0.29*	0.57	*0.40*	0.66	*0.95*	**0.06**	*0.10*
ρ3	-0.20		0.21		-0.12		-0.27		-0.01		0.01		0.10		**-0.19**	
Signif ρ_3=0	0.16	*0.24*	0.17	*0.26*	0.01	*0.01*	0.05	*0.09*	0.22	*0.47*	0.77	*0.60*	0.74	*0.96*	**0.06**	*0.09*
Investment																
ρ1	0.13		0.14		0.31		0.07		0.12		0.29		0.23		**0.26**	
Signif ρ_1=0	0.43	*0.53*	0.39	*0.39*	0.05	*0.22*	0.68	*0.99*	0.52	*0.30*	0.17	*0.30*	0.15	*0.28*	**0.10**	*0.28*
ρ2	0.12		0.02		-0.03		-0.06		-0.26		-0.10		-0.19		**-0.33**	
Signif ρ_2=0	0.54	*0.59*	0.69	*0.68*	0.15	*0.40*	0.86	*0.90*	0.31	*0.55*	0.35	*0.58*	0.17	*0.47*	**0.03**	*0.06*
ρ3	-0.20		-0.12		-0.10		-0.11		0.00		-0.44		-0.34		**-0.33**	
Signif ρ_3=0	0.40	*0.53*	0.73	*0.63*	0.23	*0.52*	0.85	*0.95*	0.50	*0.75*	0.07	*0.16*	0.04	*0.43*	**0.01**	*0.06*
Unemployment rate																
ρ1	0.42		0.35		0.54		0.70		0.33		0.53		0.15		**0.59**	
Signif ρ_1=0	0.01	*0.00*	0.04	*0.05*	0.00	*0.00*	0.00	*0.00*	0.08	*0.21*	0.01	*0.02*	0.35	*0.38*	**0.00**	*0.00*
ρ2	0.14		0.00		0.26		0.41		-0.21		0.13		0.00		**0.22**	
Signif ρ_2=0	0.02	*0.00*	0.12	*0.14*	0.00	*0.00*	0.00	*0.00*	0.12	*0.18*	0.04	*0.07*	0.65	*0.68*	**0.00**	*0.00*
ρ3	0.21		-0.15		0.02		0.23		-0.20		-0.05		-0.11		**0.09**	
Signif ρ_3=0	0.03	*0.00*	0.16	*0.17*	0.00	*0.00*	0.00	*0.00*	0.14	*0.18*	0.09	*0.09*	0.72	*0.77*	**0.00**	*0.01*
Government bal.																
ρ1	0.15		0.48		-0.04		0.29		0.44		0.31		0.28		**0.10**	
Signif ρ_1=0	0.35	*0.63*	0.01	*0.01*	0.79	*0.69*	0.08	*0.10*	0.02	*0.10*	0.14	*0.35*	0.08	*0.14*	**0.55**	*0.98*
ρ2	0.03		0.08		-0.32		-0.22		0.13		0.32		0.00		**-0.22**	
Signif ρ_2=0	0.63	*0.87*	0.02	*0.02*	0.13	*0.11*	0.09	*0.12*	0.05	*0.25*	0.11	*0.50*	0.22	*0.33*	**0.31**	*0.21*
ρ3	0.12		-0.21		-0.01		-0.23		0.25		-0.09		0.05		**0.05**	
Signif ρ_3=0	0.69	*0.94*	0.03	*0.02*	0.25	*0.19*	0.08	*0.12*	0.05	*0.28*	0.20	*0.38*	0.38	*0.46*	**0.48**	*0.25*
Current account																
ρ1	0.51		0.04		0.17		-0.14		0.20		0.43		0.16		**0.27**	
Signif ρ_1=0	0.00	*0.00*	0.83	*0.99*	0.30	*0.64*	0.40	*0.36*	0.30	*0.65*	0.04	*0.35*	0.34	*0.62*	**0.09**	*0.19*
ρ2	0.04		-0.38		-0.17		0.01		-0.02		0.12		-0.07		**-0.11**	
Signif ρ_2=0	0.01	*0.01*	0.08	*0.08*	0.32	*0.67*	0.70	*0.65*	0.59	*0.61*	0.11	*0.50*	0.58	*0.81*	**0.19**	*0.42*
ρ3	-0.14		0.01		-0.11		0.00		0.09		-0.16		0.11		**-0.45**	
Signif ρ_3=0	0.01	*0.02*	0.16	*0.18*	0.43	*0.85*	0.87	*0.84*	0.73	*0.80*	0.17	*0.71*	0.66	*0.84*	**0.01**	*0.12*

Note: The test for serial correlation is based on the Ljung-Box Q statistic, which is asymptotically distributed as $\chi 2$. Autocorrelation coefficients up to three lags as well as their significance are reported.
Numbers above 0.05 indicate no serial correlation at the 5 % significance level.

Table A8: Persistence in year-ahead forecast error (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
ρ1	0.10		0.07		0.04		-0.28	0.22		-0.14	-0.27	0.25		-0.44	**-0.02**	
Signif ρ_1=0	0.53	*0.50*	0.65	*0.81*	0.82	*0.92*	0.29	0.30	*0.19*	0.60	0.30	0.13	*0.16*	0.16	**0.91**	*0.96*
ρ2	-0.33		-0.16		0.20		0.10	0.28		0.07	-0.09	-0.04		0.18	**-0.21**	
Signif ρ_2=0	0.09	*0.10*	0.54	*0.84*	0.45	*0.42*	0.53	0.23	*0.28*	0.84	0.55	0.32	*0.36*	0.30	**0.41**	*0.38*
ρ3	0.12		-0.15		-0.15		-0.31	-0.11		-0.33	-0.41	-0.28		-0.44	**-0.04**	
Signif ρ_3=0	0.14	*0.16*	0.53	*0.81*	0.47	*0.54*	0.40	0.35	*0.42*	0.51	0.24	0.16	*0.24*	0.14	**0.61**	*0.58*
Inflation																
ρ1	0.18		0.52		0.28		0.02	0.53		0.26	0.27	0.39		-0.19	**0.37**	
Signif ρ_1=0	0.26	*0.41*	0.00	*0.00*	0.08	*0.12*	0.94	0.01	*0.05*	0.32	0.30	0.02	*0.05*	0.53	**0.02**	*0.04*
ρ2	0.11		0.13		0.15		-0.63	0.00		0.16	0.07	-0.06		-0.06	**-0.08**	
Signif ρ_2=0	0.42	*0.66*	0.00	*0.01*	0.13	*0.20*	0.04	0.04	*0.14*	0.49	0.56	0.06	*0.13*	0.81	**0.06**	*0.10*
ρ3	-0.25		-0.20		0.01		-0.02	-0.03		-0.24	0.03	-0.11		-0.40	**-0.19**	
Signif ρ_3=0	0.22	*0.31*	0.01	*0.01*	0.25	*0.36*	0.10	0.10	*0.26*	0.49	0.76	0.11	*0.21*	0.40	**0.06**	*0.09*
Investment																
ρ1	0.12		0.13		0.30		-0.01	0.33		0.05	0.11	0.19		0.28	**0.26**	
Signif ρ_1=0	0.45	*0.38*	0.41	*0.04*	0.07	*0.17*	0.97	0.12	*0.40*	0.86	0.67	0.25	*0.35*	0.36	**0.10**	*0.28*
ρ2	-0.35		0.36		0.07		-0.30	0.09		-0.29	-0.44	-0.30		-0.45	**-0.33**	
Signif ρ_2=0	0.06	*0.04*	0.05	*0.02*	0.17	*0.38*	0.48	0.26	*0.66*	0.51	0.20	0.10	*0.21*	0.19	**0.03**	*0.06*
ρ3	-0.01		-0.29		-0.29		0.11	-0.08		-0.08	-0.29	-0.53		-0.49	**-0.33**	
Signif ρ_3=0	0.14	*0.09*	0.03	*0.03*	0.07	*0.21*	0.65	0.42	*0.75*	0.69	0.20	0.00	*0.02*	0.07	**0.01**	*0.06*
Unemployment rate																
ρ1	0.50		0.37		0.26		0.04	0.31		0.29	0.44	0.22		0.20	**0.59**	
Signif ρ_1=0	0.00	*0.01*	0.03	*0.16*	0.11	*0.16*	0.89	0.14	*0.12*	0.27	0.10	0.20	*0.21*	0.51	**0.00**	*0.00*
ρ2	0.13		0.07		-0.20		-0.11	0.33		-0.51	0.04	-0.34		-0.24	**0.22**	
Signif ρ_2=0	0.01	*0.02*	0.09	*0.33*	0.12	*0.21*	0.90	0.10	*0.08*	0.07	0.25	0.05	*0.08*	0.57	**0.00**	*0.00*
ρ3	-0.16		-0.16		-0.10		-0.08	0.06		-0.44	-0.25	-0.36		-0.27	**0.09**	
Signif ρ_3=0	0.01	*0.03*	0.13	*0.21*	0.20	*0.32*	0.96	0.19	*0.15*	0.03	0.27	0.01	*0.02*	0.52	**0.00**	*0.01*
Government bal.																
ρ1	0.11		0.16		0.38		-0.14	0.16		-0.10	0.21	0.26		0.14	**0.10**	
Signif ρ_1=0	0.49	*0.66*	0.34	*0.40*	0.02	*0.08*	0.60	0.46	*0.93*	0.70	0.43	0.12	*0.34*	0.65	**0.55**	*0.98*
ρ2	-0.12		-0.16		-0.09		-0.35	-0.07		0.08	-0.29	-0.15		-0.29	**-0.22**	
Signif ρ_2=0	0.59	*0.66*	0.40	*0.46*	0.05	*0.22*	0.33	0.72	*0.71*	0.89	0.37	0.20	*0.30*	0.53	**0.31**	*0.21*
ρ3	-0.09		0.11		-0.23		0.05	-0.20		-0.13	-0.08	-0.16		-0.32	**0.05**	
Signif ρ_3=0	0.71	*0.67*	0.52	*0.64*	0.04	*0.31*	0.52	0.65	*0.48*	0.91	0.56	0.24	*0.40*	0.41	**0.48**	*0.25*
Current account																
ρ1	0.15		0.06		0.35		0.49	0.30		0.21	0.19	-0.02		0.32	**0.27**	
Signif ρ_1=0	0.34	*0.54*	0.73	*0.74*	0.03	*0.10*	0.06	0.15	*0.46*	0.42	0.48	0.89	*0.84*	0.30	**0.09**	*0.19*
ρ2	-0.24		-0.45		-0.09		0.13	-0.19		0.19	0.14	0.04		-0.46	**-0.11**	
Signif ρ_2=0	0.22	*0.41*	0.04	*0.05*	0.08	*0.26*	0.16	0.24	*0.75*	0.54	0.67	0.97	*0.93*	0.15	**0.19**	*0.42*
ρ3	-0.18		0.02		-0.25		-0.04	-0.46		-0.02	-0.01	-0.12		-0.51	**-0.45**	
Signif ρ_3=0	0.22	*0.42*	0.10	*0.10*	0.06	*0.29*	0.29	0.04	*0.08*	0.74	0.85	0.90	*0.97*	0.05	**0.01**	*0.12*

Note: The test for serial correlation is based on the Ljung-Box Q statistic, which is asymptotically distributed as $\chi 2$. Autocorrelation coefficients up to three lags as well as their significance are reported.
Numbers above 0.05 indicate no serial correlation at the 5 % significance level.

Table A9: Bias – current year

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
α	-0.05	*-0.13*	0.14	*0.13*	0.09	*0.04*	-0.57	*-0.48*	-0.12	*-0.08*	-0.20	*-0.22*	0.03	*-0.03*	**0.11**	*0.08*
Signif α=0	0.72	*0.42*	0.36	*0.49*	0.62	*0.87*	0.10	*0.22*	0.50	*0.77*	0.26	*0.45*	0.83	*0.85*	**0.37**	*0.61*
α_1	0.01	*0.01*	0.52	*0.52*	0.44	*0.44*	0.31	*0.31*					0.19	*0.19*	**0.32**	*0.32*
α_2	-0.09	*-0.26*	-0.02	*-0.13*	-0.11	*-0.33*	-0.95	*-1.01*	-0.25	*-0.27*	-0.20	*-0.22*	-0.07	*-0.23*	**-0.02**	*-0.15*
Signif α_1=α_2	0.60	*0.42*	0.00	*0.08*	0.00	*0.10*	0.00	*0.09*					0.08	*0.16*	**0.01**	*0.10*
Inflation																
α	-0.02	*0.10*	-0.18	*-0.29*	0.10	*0.08*	0.01	*0.11*	-0.11	*0.03*	-0.28	*-0.18*	0.04	*-0.02*	**0.02**	*0.02*
Signif α=0	0.89	*0.49*	0.16	*0.07*	0.14	*0.32*	0.96	*0.70*	0.70	*0.94*	0.02	*0.24*	0.74	*0.86*	**0.74**	*0.80*
α_1	0.14	*0.14*	-0.29	*-0.29*	0.04	*0.04*	-0.23	*-0.23*					-0.11	*-0.11*	**0.06**	*0.06*
α_2	-0.11	*0.06*	-0.13	*-0.29*	0.14	*0.12*	0.12	*0.34*	-0.23	*-0.13*	-0.28	*-0.18*	0.13	*0.06*	**0.00**	*-0.01*
Signif α_1=α_2	0.02	*0.79*	0.17	*0.99*	0.12	*0.64*	0.03	*0.35*					0.02	*0.54*	**0.12**	*0.68*
Investment																
α	0.05	*0.09*	0.33	*0.83*	1.08	*0.60*	0.53	*0.67*	1.42	*1.62*	-0.10	*0.04*	0.32	*0.47*	**0.65**	*0.58*
Signif α=0	0.91	*0.88*	0.70	*0.40*	0.03	*0.27*	0.50	*0.45*	0.10	*0.17*	0.88	*0.97*	0.32	*0.22*	**0.02**	*0.05*
α_1	0.31	*0.31*	3.22	*3.22*	0.64	*0.64*	1.92	*1.92*					-0.05	*-0.05*	**0.52**	*0.59*
α_2	-0.10	*-0.12*	-0.93	*-0.76*	1.34	*0.56*	-0.07	*-0.16*	1.03	*1.05*	-0.10	*0.04*	0.55	*0.95*	**0.73**	*0.57*
Signif α_1=α_2	0.53	*0.72*	0.00	*0.04*	0.21	*0.94*	0.03	*0.26*					0.12	*0.18*	**0.52**	*0.98*
Unemployment rate																
α	0.02	*0.04*	-0.02	*-0.02*	0.03	*0.03*	0.34	*0.30*	0.00	*0.18*	0.36	*0.22*	0.02	*0.00*	**0.03**	*-0.05*
Signif α=0	0.89	*0.73*	0.90	*0.90*	0.69	*0.73*	0.03	*0.10*	0.98	*0.47*	0.06	*0.37*	0.76	*0.96*	**0.62**	*0.54*
α_1	-0.30	*-0.30*	-0.22	*-0.22*	-0.18	*-0.18*	0.13	*0.13*					-0.04	*-0.04*	**-0.19**	*-0.19*
α_2	0.21	*0.36*	0.07	*0.11*	0.16	*0.23*	0.43	*0.42*	0.10	*0.36*	0.36	*0.22*	0.06	*0.04*	**0.16**	*0.08*
Signif α_1=α_2	0.00	*0.00*	0.11	*0.42*	0.00	*0.02*	0.11	*0.44*					0.38	*0.68*	**0.00**	*0.09*
Government bal.																
α	0.12	*0.23*	-0.10	*0.05*	-0.16	*-0.15*	-0.33	*-0.23*	0.54	*0.46*	0.05	*0.28*	-0.06	*-0.13*	**-0.08**	*-0.02*
Signif α=0	0.27	*0.07*	0.67	*0.85*	0.32	*0.39*	0.32	*0.56*	0.23	*0.46*	0.85	*0.48*	0.68	*0.46*	**0.44**	*0.82*
α_1	0.50	*0.51*	0.48	*0.48*	-0.05	*-0.06*	0.71	*0.71*					-0.31	*-0.31*	**-0.06**	*-0.01*
α_2	-0.08	*0.01*	-0.25	*-0.12*	-0.23	*-0.25*	-0.74	*-0.79*	0.68	*0.68*	0.05	*0.28*	0.09	*0.04*	**-0.09**	*-0.03*
Signif α_1=α_2	0.00	*0.04*	0.00	*0.34*	0.38	*0.60*	0.00	*0.06*					0.01	*0.32*	**0.81**	*0.93*
Current account																
α	0.03	*-0.09*	0.01	*0.10*	-0.20	*-0.17*	-0.30	*-0.46*	0.68	*0.54*	0.37	*0.04*	0.05	*-0.07*	**-0.03**	*-0.80*
Signif α=0	0.88	*0.68*	0.97	*0.62*	0.13	*0.25*	0.37	*0.29*	0.05	*0.21*	0.13	*0.90*	0.68	*0.54*	**0.64**	*0.32*
α_1	-0.08	*-0.09*	0.14	*0.13*	0.03	*0.02*	-0.93	*-0.92*					0.05	*0.06*	**-0.02**	*-0.02*
α_2	0.09	*-0.10*	-0.05	*0.07*	-0.32	*-0.31*	-0.03	*-0.15*	0.62	*0.43*	0.37	*0.04*	0.04	*-0.17*	**-0.04**	*-0.13*
Signif α_1=α_2	0.43	*0.98*	0.41	*0.88*	0.04	*0.25*	0.01	*0.39*					0.96	*0.34*	**0.76**	*0.51*

α: coefficient in regression (1); without subscript: whole period; subscripts 1 and 2 refer to the first (until 1982) and second subperiod (from 1983). Signif. α=0 and Signif. α1=α2 denote the p-values for the α=0 and α1=α2 t-tests respectively. Numbers above 0.05 indicate absence of bias, respectively absence of change in bias between the two subperiods at the 5 % significance level.

Table A9: Bias – current year (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
α	0.43	*0.39*	-0.63	*-0.60*	-0.02	*-0.14*	0.15	0.24	*0.00*	0.16	-0.09	0.01	*-0.01*	0.28	**0.11**	*0.08*
Signif α=0	0.03	*0.11*	0.05	*0.11*	0.92	*0.40*	0.50	0.23	*1.00*	0.70	0.73	0.95	*0.95*	0.15	**0.37**	*0.61*
α_1	0.61	*0.61*	-0.10	*-0.10*	0.24	*0.24*						0.03	*0.03*		**0.32**	*0.32*
α_2	0.32	*0.19*	-0.95	*-1.07*	-0.17	*-0.49*	0.15	0.24	*0.00*	0.16	-0.09	0.00	*-0.04*	0.28	**-0.02**	*-0.15*
Signif $\alpha_1=\alpha_2$	0.02	*0.38*	0.03	*0.19*	0.04	*0.02*						0.84	*0.87*		**0.01**	*0.10*
Inflation																
α	-0.14	*-0.09*	0.02	*0.12*	-0.04	*-0.01*	0.13	-0.41	*-0.38*	-0.11	-0.01	0.17	*0.12*	-0.08	**0.02**	*0.02*
Signif α=0	0.38	*0.64*	0.83	*0.38*	0.70	*0.93*	0.41	0.01	*0.14*	0.52	0.94	0.44	*0.68*	0.35	**0.74**	*0.80*
α_1	0.07	*0.07*	-0.02	*-0.02*	-0.04	*-0.04*						0.16	*0.16*		**0.06**	*0.06*
α_2	-0.26	*-0.25*	0.05	*0.25*	-0.03	*0.02*	0.13	-0.41	*-0.37*	-0.11	-0.01	0.17	*0.09*	-0.08	**0.00**	*-0.01*
Signif $\alpha_1=\alpha_2$	0.00	*0.42*	0.51	*0.32*	0.87	*0.78*						0.94	*0.90*		**0.12**	*0.68*
Investment																
α	1.16	*1.13*	-0.84	*-0.76*	0.04	*-0.10*	0.99	0.55	*-0.73*	2.14	1.22	0.66	*0.53*	1.11	**0.65**	*0.58*
Signif α=0	0.05	*0.12*	0.24	*0.30*	0.94	*0.87*	0.23	0.58	*0.59*	0.07	0.31	0.16	*0.31*	0.11	**0.02**	*0.05*
α_1	0.98	*0.98*	-1.11	*-1.11*	1.06	*1.06*						0.57	*0.57*		**0.52**	*0.59*
α_2	1.27	*1.27*	-0.67	*-0.43*	-0.57	*-1.19*	0.99	0.55	*-0.73*	2.14	1.22	0.70	*0.51*	1.11	**0.73**	*0.57*
Signif $\alpha_1=\alpha_2$	0.53	*0.84*	0.63	*0.65*	0.01	*0.07*						0.83	*0.95*		**0.52**	*0.98*
Unemployment rate																
α	0.01	*-0.10*	0.01	*-0.02*	0.24	*0.23*	-0.12	0.31	*0.40*	0.03	-0.29	0.08	*0.04*	0.20	**0.03**	*-0.05*
Signif α=0	0.97	*0.68*	0.93	*0.76*	0.19	*0.34*	0.36	0.06	*0.10*	0.87	0.36	0.17	*0.58*	0.01	**0.62**	*0.54*
α_1	-0.44	*-0.44*	0.08	*0.08*	-0.31	*-0.31*						0.03	*0.03*		**-0.19**	*-0.19*
α_2	0.28	*0.23*	-0.02	*-0.07*	0.58	*0.73*	-0.12	0.31	*0.40*	0.03	-0.29	0.10	*0.05*	0.20	**0.16**	*0.08*
Signif $\alpha_1=\alpha_2$	0.00	*0.16*	0.30	*0.32*	0.00	*0.02*						0.31	*0.91*		**0.00**	*0.09*
Government bal.																
α	0.15	*0.19*	-0.65	*-0.58*	-0.30	*-0.27*	-0.09	-0.29	*-0.58*	-0.47	-1.16	0.03	*0.16*	-0.11	**-0.08**	*-0.02*
Signif α=0	0.51	*0.51*	0.05	*0.16*	0.12	*0.20*	0.67	0.22	*0.10*	0.16	0.00	0.86	*0.42*	0.66	**0.44**	*0.82*
α_1	0.44	*0.44*	-0.49	*-0.49*	-0.17	*-0.17*						0.17	*0.17*		**-0.06**	*-0.01*
α_2	-0.02	*-0.04*	-0.72	*-0.64*	-0.38	*-0.37*	-0.09	-0.29	*-0.58*	-0.47	-1.16	-0.03	*0.15*	-0.11	**-0.09**	*-0.03*
Signif $\alpha_1=\alpha_2$	0.00	*0.42*	0.55	*0.86*	0.29	*0.64*						0.41	*0.96*		**0.81**	*0.93*
Current account																
α	0.15	*0.06*	0.43	*0.06*	-0.05	*-0.10*	-0.23	0.26	*-0.37*	-0.05	-0.36	-0.18	*-0.16*	0.24	**-0.03**	*-0.80*
Signif α=0	0.34	*0.75*	0.66	*0.93*	0.83	*0.61*	0.51	0.59	*0.38*	0.92	0.28	0.29	*0.44*	0.25	**0.64**	*0.32*
α_1	0.11	*0.10*	-0.53	*-0.54*	0.09	*0.10*						-0.50	*-0.48*		**-0.02**	*-0.02*
α_2	0.18	*0.03*	0.97	*0.55*	-0.12	*-0.27*	-0.23	0.26	*-0.37*	-0.05	-0.36	-0.05	*0.05*	0.24	**-0.04**	*-0.13*
Signif $\alpha_1=\alpha_2$	0.70	*0.84*	0.33	*0.46*	0.43	*0.38*						0.02	*0.23*		**0.76**	*0.51*

α: coefficient in regression (1); without subscript: whole period; subscripts 1 and 2 refer to the first (until 1982) and second subperiod (from 1983). Signif. α=0 and Signif. α1=α2 denote the p-values for the α=0 and α1=α2 t-tests respectively. Numbers above 0.05 indicate absence of bias, respectively absence of change in bias between the two subperiods at the 5 % significance level.

Table A10: Bias – year ahead

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
α	0.25	*0.21*	0.20	*0.18*	0.41	*0.31*	-0.76	*-0.64*	-0.11	*-0.04*	-0.13	*-0.07*	0.30	*0.29*	**0.34**	*0.32*
Signif α=0	0.34	*0.49*	0.36	*0.53*	0.13	*0.36*	0.10	*0.29*	0.66	*0.91*	0.62	*0.86*	0.13	*0.25*	**0.09**	*0.21*
α_1	0.75	*0.75*	0.48	*0.48*	0.77	*0.77*	1.16	*1.16*					0.47	*0.47*	**0.67**	*0.66*
α_2	-0.03	*-0.25*	0.09	*-0.01*	0.20	*-0.09*	-1.51	*-1.71*	-0.21	*-0.19*	-0.13	*-0.07*	0.21	*0.13*	**0.16**	*0.02*
Signif $\alpha_1=\alpha_2$	0.01	*0.10*	0.13	*0.41*	0.02	*0.20*	0.00	*0.01*					0.21	*0.49*	**0.01**	*0.20*
Inflation																
α	0.01	*0.10*	-0.39	*-0.52*	0.01	*-0.08*	-0.33	*-0.32*	-0.69	*-0.91*	-0.41	*-0.35*	-0.37	*-0.48*	**-0.23**	*-0.31*
Signif α=0	0.96	*0.76*	0.25	*0.25*	0.93	*0.67*	0.50	*0.62*	0.09	*0.13*	0.01	*0.17*	0.13	*0.16*	**0.31**	*0.28*
α_1	-0.49	*-0.49*	-1.01	*-1.01*	-0.61	*-0.61*	-2.47	*-2.47*					-1.15	*-1.18*	**-0.86**	*-0.87*
α_2	0.30	*0.62*	-0.15	*-0.22*	0.37	*0.38*	0.50	*0.97*	-0.76	*-1.03*	-0.41	*-0.35*	0.07	*0.13*	**0.13**	*0.17*
Signif $\alpha_1=\alpha_2$	0.00	*0.09*	0.00	*0.40*	0.00	*0.00*	0.00	*0.01*					0.00	*0.05*	**0.00**	*0.07*
Investment																
α	0.90	*0.80*	0.85	*1.41*	1.15	*0.61*	0.57	*0.85*	1.67	*1.44*	-0.21	*-0.04*	0.73	*0.94*	**0.79**	*0.78*
Signif α=0	0.26	*0.43*	0.48	*0.35*	0.08	*0.40*	0.65	*0.58*	0.03	*0.14*	0.81	*0.98*	0.08	*0.06*	**0.051**	*0.10*
α_1	2.45	*2.45*	4.84	*4.84*	1.07	*1.07*	1.24	*1.24*					1.11	*1.11*	**1.04**	*1.22*
α_2	0.02	*-0.62*	-0.72	*-0.65*	1.19	*0.22*	0.30	*0.61*	1.64	*1.37*	-0.21	*-0.04*	0.52	*0.79*	**0.65**	*0.39*
Signif $\alpha_1=\alpha_2$	0.01	*0.13*	0.00	*0.07*	0.87	*0.56*	0.45	*0.84*					0.24	*0.75*	**0.42**	*0.37*
Unemployment rate																
α	0.23	*0.31*	-0.01	*0.06*	0.05	*0.05*	0.58	*0.54*	-0.38	*-0.14*	0.30	*-0.15*	0.02	*-0.04*	**0.10**	*0.02*
Signif α=0	0.23	*0.18*	0.98	*0.85*	0.78	*0.83*	0.02	*0.09*	0.21	*0.74*	0.43	*0.80*	0.86	*0.82*	**0.43**	*0.90*
α_1	-0.52	*-0.52*	-0.86	*-0.86*	-0.47	*-0.47*	-0.10	*-0.10*					-0.25	*-0.25*	**-0.40**	*-0.40*
α_2	0.63	*0.97*	0.33	*0.61*	0.32	*0.46*	0.85	*0.93*	-0.29	*0.03*	0.30	*-0.15*	0.17	*0.13*	**0.36**	*0.35*
Signif $\alpha_1=\alpha_2$	0.00	*0.00*	0.00	*0.01*	0.00	*0.04*	0.01	*0.11*					0.03	*0.25*	**0.00**	*0.01*
Government bal.																
α	0.35	*0.51*	0.01	*0.14*	-0.09	*-0.06*	-0.08	*-0.05*	0.97	*0.80*	0.16	*0.54*	0.07	*0.01*	**0.12**	*0.16*
Signif α=0	0.17	*0.10*	0.98	*0.78*	0.67	*0.82*	0.87	*0.93*	0.09	*0.31*	0.60	*0.29*	0.69	*0.95*	**0.44**	*0.32*
α_1	1.23	*1.23*	1.30	*1.31*	0.02	*0.03*	1.66	*1.66*					-0.24	*-0.24*	**0.22**	*0.23*
α_2	-0.10	*-0.07*	-0.33	*-0.33*	-0.16	*-0.13*	-0.76	*-1.07*	0.90	*0.68*	0.16	*0.54*	0.24	*0.23*	**0.06**	*0.11*
Signif $\alpha_1=\alpha_2$	0.00	*0.03*	0.00	*0.12*	0.41	*0.76*	0.00	*0.02*					0.02	*0.26*	**0.30**	*0.71*
Current account																
α	-0.05	*-0.25*	0.19	*0.37*	-0.19	*-0.13*	0.08	*-0.04*	0.86	*0.44*	0.42	*-0.08*	-0.04	*-0.21*	**0.04**	*-0.01*
Signif α=0	0.88	*0.47*	0.63	*0.46*	0.38	*0.59*	0.88	*0.95*	0.02	*0.30*	0.27	*0.87*	0.82	*0.26*	**0.72**	*0.96*
α_1	0.21	*0.19*	0.72	*0.72*	0.08	*0.07*	0.54	*0.53*					-0.08	*-0.06*	**0.23**	*0.23*
α_2	-0.18	*-0.61*	-0.02	*0.17*	-0.32	*-0.28*	-0.10	*-0.38*	0.84	*0.38*	0.42	*-0.08*	-0.02	*-0.33*	**-0.05**	*-0.19*
Signif $\alpha_1=\alpha_2$	0.21	*0.25*	0.02	*0.60*	0.12	*0.47*	0.16	*0.51*					0.72	*0.48*	**0.02**	*0.12*

α: coefficient in regression (2); without subscript: whole period; subscripts 1 and 2 refer to the first (until 1982) and second subperiod (from 1983). Signif. α=0 and Signif. α1=α2 denote the p-values for the α=0 and α1=α2 t-tests respectively. Numbers above 0.05 indicate absence of bias, respectively absence of change in bias between the two subperiods at the 5 % significance level.

Table A10: Bias – year ahead (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
α	0.70	*0.66*	-0.08	*0.11*	0.02	*-0.10*	0.36	0.41	*0.10*	-0.07	0.22	0.25	*0.28*	0.46	**0.34**	*0.32*
Signif α=0	0.01	*0.06*	0.86	*0.84*	0.94	*0.71*	0.22	0.14	*0.79*	0.89	0.52	0.31	*0.39*	0.18	**0.09**	*0.21*
α_1	0.92	*0.92*	0.94	*0.93*	0.49	*0.49*						0.80	*0.80*		**0.67**	*0.66*
α_2	0.58	*0.44*	-0.66	*-0.61*	-0.25	*-0.61*	0.36	0.41	*0.10*	-0.07	0.22	0.04	*-0.03*	0.46	**0.16**	*0.02*
Signif $\alpha_1=\alpha_2$	0.10	*0.49*	0.01	*0.13*	0.01	*0.03*						0.01	*0.21*		**0.01**	*0.20*
Inflation																
α	-1.11	*-1.32*	-0.18	*-0.11*	0.15	*0.21*	0.21	-0.83	*-1.06*	0.32	0.45	-0.23	*-0.42*	-0.17	**-0.23**	*-0.31*
Signif α=0	0.01	*0.01*	0.51	*0.75*	0.33	*0.27*	0.21	0.03	*0.11*	0.37	0.05	0.58	*0.44*	0.21	**0.31**	*0.28*
α_1	-2.32	*-2.32*	-1.08	*-1.08*	0.10	*0.10*						-1.17	*-1.17*		**-0.86**	*-0.87*
α_2	-0.43	*-0.46*	0.32	*0.73*	0.18	*0.31*	0.21	-0.83	*-1.06*	0.32	0.45	0.14	*0.03*	-0.17	**0.13**	*0.17*
Signif $\alpha_1=\alpha_2$	0.00	*0.05*	0.00	*0.01*	0.58	*0.59*						0.00	*0.28*		**0.00**	*0.07*
Investment																
α	1.57	*1.48*	-1.25	*-1.44*	-0.50	*-0.77*	0.94	0.99	*-0.64*	2.17	1.80	0.67	*0.87*	1.80	**0.79**	*0.78*
Signif α=0	0.01	*0.05*	0.31	*0.27*	0.45	*0.32*	0.29	0.39	*0.67*	0.19	0.20	0.31	*0.29*	0.07	**0.05**	*0.10*
α_1	1.72	*1.72*	-1.22	*-1.22*	1.15	*1.15*						1.73	*1.73*		**1.04**	*1.22*
α_2	1.48	*1.27*	-1.26	*-1.62*	-1.43	*-2.43*	0.94	0.99	*-0.64*	2.17	1.80	0.25	*0.35*	1.80	**0.65**	*0.39*
Signif $\alpha_1=\alpha_2$	0.61	*0.75*	0.98	*0.88*	0.00	*0.02*						0.08	*0.42*		**0.42**	*0.37*
Unemployment rate																
α	0.06	*-0.07*	-0.08	*-0.06*	0.24	*0.21*	0.00	0.32	*0.59*	0.35	-0.24	0.12	*0.14*	0.23	**0.10**	*0.02*
Signif α=0	0.82	*0.83*	0.34	*0.54*	0.37	*0.52*	1.00	0.31	*0.21*	0.10	0.53	0.41	*0.47*	0.17	**0.43**	*0.90*
α_1	-0.53	*-0.53*	0.06	*0.06*	-0.54	*-0.54*						-0.26	*-0.26*		**-0.40**	*-0.40*
α_2	0.37	*0.29*	-0.13	*-0.11*	0.64	*0.82*	0.00	0.32	*0.59*	0.35	-0.24	0.27	*0.38*	0.23	**0.36**	*0.35*
Signif $\alpha_1=\alpha_2$	0.02	*0.25*	0.09	*0.41*	0.00	*0.04*						0.00	*0.12*		**0.00**	*0.01*
Government bal.																
α	0.46	*0.55*	-1.27	*-1.12*	-0.19	*-0.11*	-0.44	-0.04	*-0.54*	-0.53	-1.16	0.37	*0.43*	0.03	**0.12**	*0.16*
Signif α=0	0.11	*0.12*	0.00	*0.04*	0.46	*0.70*	0.08	0.91	*0.33*	0.17	0.01	0.21	*0.20*	0.93	**0.44**	*0.32*
α_1	0.85	*0.85*	-1.36	*-1.36*	0.39	*0.39*						0.40	*0.40*		**0.22**	*0.23*
α_2	0.24	*0.29*	-1.23	*-0.99*	-0.52	*-0.53*	-0.44	-0.04	*-0.54*	-0.53	-1.16	0.35	*0.45*	0.03	**0.06**	*0.11*
Signif $\alpha_1=\alpha_2$	0.02	*0.43*	0.78	*0.74*	0.00	*0.09*						0.89	*0.94*		**0.30**	*0.71*
Current account																
α	0.43	*0.30*	-0.86	*-0.72*	-0.07	*-0.15*	-0.38	1.10	*0.43*	-0.20	-0.64	-0.01	*-0.05*	0.37	**0.04**	*-0.01*
Signif α=0	0.14	*0.39*	0.65	*0.71*	0.82	*0.63*	0.35	0.06	*0.39*	0.67	0.24	0.96	*0.88*	0.29	**0.72**	*0.96*
α_1	0.72	*0.70*	-2.55	*-2.54*	-0.25	*-0.25*						0.01	*0.01*		**0.23**	*0.23*
α_2	0.28	*-0.03*	0.19	*0.50*	0.03	*-0.07*	-0.38	1.10	*0.43*	-0.20	-0.64	-0.02	*-0.09*	0.37	**-0.05**	*-0.19*
Signif $\alpha_1=\alpha_2$	0.12	*0.30*	0.28	*0.45*	0.42	*0.77*						0.86	*0.89*		**0.02**	*0.12*

α: coefficient in regression (2); without subscript: whole period; subscripts 1 and 2 refer to the first (until 1982) and second subperiod (from 1983). Signif. α=0 and Signif. α1=α2 denote the p-values for the α=0 and α1=α2 t-tests respectively. Numbers above 0.05 indicate absence of bias, respectively absence of change in bias between the two subperiods at the 5 % significance level.

Table A11: Efficiency - current year

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
α	-0.13	*-0.08*	-0.04	*0.00*	-0.08	*0.03*	-0.23	*-0.46*	0.16	*0.23*	-0.08	*-0.11*	-0.05	*0.02*	**-0.19**	*-0.15*
Signif α=0	0.63	*0.78*	0.87	*1.00*	0.81	*0.93*	0.74	*0.56*	0.63	*0.62*	0.86	*0.87*	0.83	*0.95*	**0.42**	*0.60*
β	1.08	*1.09*	0.95	*0.94*	0.99	*0.97*	1.20	*1.28*	0.98	*0.89*	1.10	*1.12*	1.01	*1.00*	**1.03**	*1.03*
Signif β=1	0.41	*0.35*	0.65	*0.57*	0.94	*0.83*	0.18	*0.18*	0.89	*0.68*	0.53	*0.60*	0.90	*0.96*	**0.69**	*0.76*
Signif α=0, β=1	0.67	*0.47*	0.60	*0.68*	0.88	*0.96*	0.11	*0.19*	0.80	*0.88*	0.44	*0.66*	0.97	*0.98*	**0.62**	*0.84*
$\bar{R}^2$	0.77	*0.81*	0.70	*0.74*	0.69	*0.67*	0.68	*0.62*	0.70	*0.38*	0.71	*0.69*	0.85	*0.86*	**0.82**	*0.82*
DW	1.52	*1.39*	1.81	*1.68*	1.83	*1.84*	2.17	*1.66*	1.66	*1.67*	1.49	*1.44*	1.50	*1.40*	**2.05**	*2.08*
Inflation																
α	0.12	*-0.15*	0.07	*0.31*	-0.10	*-0.04*	0.23	*0.12*	0.67	*1.04*	0.43	*-0.19*	0.02	*0.21*	**0.21**	*0.37*
Signif α=0	0.57	*0.59*	0.75	*0.31*	0.48	*0.82*	0.52	*0.81*	0.20	*0.41*	0.17	*0.75*	0.93	*0.44*	**0.13**	*0.07*
β	0.98	*1.01*	1.02	*1.00*	1.00	*0.99*	0.97	*0.97*	0.95	*0.93*	0.96	*1.07*	0.99	*0.97*	**0.96**	*0.94*
Signif β=1	0.54	*0.83*	0.54	*0.94*	0.96	*0.81*	0.37	*0.56*	0.21	*0.37*	0.60	*0.52*	0.72	*0.42*	**0.05**	*0.03*
Signif α=0, β=1	0.82	*0.77*	0.32	*0.21*	0.34	*0.59*	0.67	*0.78*	0.41	*0.66*	0.07	*0.41*	0.88	*0.71*	**0.13**	*0.09*
$\bar{R}^2$	0.94	*0.94*	0.96	*0.96*	0.95	*0.94*	0.96	*0.95*	0.97	*0.91*	0.92	*0.90*	0.97	*0.96*	**0.98**	*0.98*
DW	1.74	*2.05*	2.00	*2.13*	1.84	*1.69*	2.33	*2.43*	1.75	*1.72*	2.42	*2.83*	1.93	*2.11*	**1.77**	*1.78*
Investment																
α	-0.64	*-0.68*	-1.10	*-1.48*	-1.24	*-0.59*	-1.49	*-1.78*	-1.88	*-1.83*	-0.98	*-1.31*	-0.44	*-0.64*	**-0.82**	*-0.74*
Signif α=0	0.31	*0.34*	0.18	*0.10*	0.05	*0.41*	0.17	*0.12*	0.15	*0.24*	0.34	*0.40*	0.31	*0.19*	**0.03**	*0.07*
β	1.22	*1.23*	1.43	*1.43*	1.06	*1.00*	1.21	*1.28*	1.09	*1.06*	1.21	*1.24*	1.04	*1.07*	**1.06**	*1.05*
Signif β=1	0.14	*0.15*	0.01	*0.01*	0.66	*0.98*	0.19	*0.12*	0.64	*0.83*	0.17	*0.26*	0.68	*0.57*	**0.52**	*0.57*
Signif α=0, β=1	0.33	*0.35*	0.02	*0.01*	0.09	*0.55*	0.33	*0.23*	0.23	*0.39*	0.38	*0.51*	0.56	*0.40*	**0.05**	*0.14*
$\bar{R}^2$	0.66	*0.68*	0.75	*0.81*	0.63	*0.64*	0.64	*0.68*	0.55	*0.43*	0.78	*0.78*	0.72	*0.73*	**0.78**	*0.82*
DW	1.65	*1.65*	2.14	*2.27*	1.58	*1.67*	1.49	*1.60*	1.87	*1.77*	1.16	*1.20*	1.89	*1.92*	**1.63**	*1.88*
Unemployment rate																
α	0.52	*0.48*	0.76	*0.98*	0.21	*0.24*	-0.36	*-0.21*	1.83	*2.35*	-0.33	*1.18*	0.14	*0.12*	**0.25**	*0.23*
Signif α=0	0.05	*0.07*	0.07	*0.08*	0.20	*0.18*	0.33	*0.72*	0.05	*0.01*	0.67	*0.52*	0.48	*0.59*	**0.06**	*0.19*
β	0.94	*0.94*	0.89	*0.87*	0.96	*0.95*	1.00	*0.99*	0.79	*0.68*	1.00	*0.93*	0.98	*0.98*	**0.96**	*0.98*
Signif β=1	0.03	*0.03*	0.06	*0.07*	0.10	*0.08*	0.94	*0.88*	0.05	*0.01*	0.96	*0.45*	0.38	*0.54*	**0.02**	*0.25*
Signif α=0, β=1	0.08	*0.08*	0.17	*0.19*	0.23	*0.20*	0.09	*0.27*	0.13	*0.02*	0.17	*0.51*	0.64	*0.83*	**0.06**	*0.42*
$\bar{R}^2$	0.97	*0.98*	0.88	*0.86*	0.98	*0.98*	0.97	*0.96*	0.71	*0.73*	0.97	*0.91*	0.98	*0.98*	**0.99**	*0.99*
DW	1.69	*1.37*	2.56	*2.51*	1.51	*1.45*	2.32	*2.15*	1.62	*1.92*	1.84	*1.62*	2.39	*2.46*	**1.80**	*2.01*
Government bal.																
α	0.12	*-0.14*	0.03	*-0.40*	-0.18	*-0.28*	0.49	*0.52*	-0.81	*-1.13*	0.00	*-1.51*	0.02	*0.11*	**0.22**	*0.00*
Signif α=0	0.51	*0.65*	0.91	*0.22*	0.48	*0.27*	0.31	*0.53*	0.32	*0.60*	0.99	*0.23*	0.93	*0.72*	**0.36**	*0.99*
β	1.05	*1.02*	0.94	*0.85*	0.85	*0.81*	1.03	*1.04*	0.97	*0.94*	1.02	*0.71*	0.98	*0.99*	**1.04**	*0.99*
Signif β=1	0.11	*0.73*	0.33	*0.07*	0.10	*0.03*	0.64	*0.68*	0.69	*0.75*	0.88	*0.29*	0.85	*0.92*	**0.52**	*0.99*
Signif α=0, β=1	0.15	*0.18*	0.56	*0.17*	0.15	*0.06*	0.55	*0.78*	0.45	*0.73*	0.97	*0.44*	0.90	*0.76*	**0.61**	*0.97*
$\bar{R}^2$	0.98	*0.96*	0.88	*0.86*	0.73	*0.77*	0.91	*0.86*	0.86	*0.64*	0.80	*0.37*	0.75	*0.75*	**0.88**	*0.88*
DW	1.80	*1.75*	1.31	*1.64*	1.88	*1.96*	2.13	*2.10*	1.76	*1.78*	2.06	*1.84*	1.74	*1.86*	**1.79**	*2.06*
Current account																
α	0.16	*0.17*	0.03	*-0.04*	0.26	*0.22*	0.20	*0.33*	-0.82	*-1.90*	-0.50	*-0.34*	-0.04	*0.11*	**0.06**	*0.09*
Signif α=0	0.47	*0.45*	0.89	*0.88*	0.08	*0.17*	0.57	*0.46*	0.42	*0.20*	0.11	*0.32*	0.71	*0.34*	**0.40**	*0.29*
β	0.88	*0.90*	1.04	*1.04*	0.93	*0.94*	0.91	*0.92*	0.96	*0.61*	0.92	*0.75*	0.97	*1.17*	**0.84**	*0.92*
Signif β=1	0.07	*0.18*	0.60	*0.68*	0.36	*0.42*	0.18	*0.29*	0.88	*0.33*	0.49	*0.08*	0.76	*0.16*	**0.16**	*0.51*
Signif α=0, β=1	0.18	*0.36*	0.87	*0.82*	0.21	*0.38*	0.27	*0.33*	0.14	*0.29*	0.25	*0.21*	0.88	*0.30*	**0.34**	*0.49*
$\bar{R}^2$	0.86	*0.85*	0.87	*0.84*	0.83	*0.84*	0.85	*0.85*	0.37	*0.10*	0.79	*0.74*	0.78	*0.80*	**0.61**	*0.68*
DW	1.63	*1.45*	1.96	*1.81*	1.83	*1.91*	1.76	*1.76*	2.01	*1.78*	1.02	*1.34*	1.87	*2.25*	**2.04**	*2.13*

α and β: coefficients in regression (3). Signif. (.): significance level of the t-statistic (single test) or F-statistic (joint test) of the null hypothesis;
numbers above 0.05 indicate that the null hypothesis can be accepted at the 5% significance level.

Table A11: Efficiency - current year (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
α	-0.16	*-0.03*	0.45	*0.48*	0.15	*0.30*	0.43	-1.33	*-1.47*	0.13	0.82	0.24	*0.21*	-0.40	**-0.19**	*-0.15*
Signif α=0	0.63	*0.94*	0.39	*0.40*	0.59	*0.32*	0.51	0.00	*0.04*	0.93	0.37	0.28	*0.41*	0.48	**0.42**	*0.60*
β	0.89	*0.87*	1.08	*1.06*	0.94	*0.93*	0.71	1.42	*1.51*	0.92	0.69	0.86	*0.88*	1.06	**1.03**	*1.03*
Signif β=1	0.31	*0.28*	0.66	*0.78*	0.57	*0.51*	0.34	0.00	*0.03*	0.84	0.40	0.12	*0.23*	0.81	**0.69**	*0.76*
Signif α=0, β=1	0.06	*0.16*	0.13	*0.27*	0.84	*0.57*	0.50	0.01	*0.08*	0.91	0.65	0.30	*0.48*	0.38	**0.62**	*0.84*
$\bar{R}^2$	0.66	*0.64*	0.52	*0.48*	0.69	*0.73*	0.34	0.87	*0.84*	0.32	0.23	0.76	*0.76*	0.74	**0.82**	*0.82*
DW	2.35	*2.39*	1.40	*1.37*	1.59	*1.85*	1.58	1.79	*1.87*	2.23	1.94	2.21	*2.31*	1.93	**2.05**	*2.08*
Inflation																
α	0.59	*0.74*	0.13	*-0.04*	0.12	*0.10*	0.69	0.12	*-0.51*	0.45	0.31	0.06	*0.34*	0.44	**0.21**	*0.37*
Signif α=0	0.02	*0.04*	0.50	*0.87*	0.42	*0.62*	0.21	0.64	*0.38*	0.38	0.35	0.86	*0.51*	0.40	**0.13**	*0.07*
β	0.94	*0.93*	0.96	*0.99*	0.98	*0.98*	0.56	1.05	*1.11*	0.78	0.81	0.96	*0.94*	0.80	**0.96**	*0.94*
Signif β=1	0.02	*0.03*	0.34	*0.75*	0.48	*0.59*	0.13	0.21	*0.11*	0.48	0.33	0.40	*0.29*	0.47	**0.05**	*0.03*
Signif α=0, β=1	0.04	*0.09*	0.62	*0.65*	0.72	*0.86*	0.22	0.02	*0.09*	0.63	0.60	0.52	*0.52*	0.51	**0.13**	*0.09*
$\bar{R}^2$	0.98	*0.97*	0.94	*0.94*	0.96	*0.96*	0.26	0.98	*0.97*	0.37	0.63	0.94	*0.93*	0.55	**0.98**	*0.98*
DW	1.80	*1.80*	1.66	*1.85*	2.19	*2.24*	1.47	1.74	*2.18*	1.39	2.25	1.76	*1.63*	1.48	**1.77**	*1.78*
Investment																
α	-0.78	*-0.75*	1.35	*1.12*	-0.14	*-0.07*	-0.61	-2.86	*-1.05*	0.69	-0.82	-0.38	*-0.35*	-1.50	**-0.82**	*-0.74*
Signif α=0	0.24	*0.35*	0.10	*0.18*	0.82	*0.92*	0.72	0.07	*0.74*	0.56	0.70	0.44	*0.51*	0.27	**0.03**	*0.07*
β	0.86	*0.84*	0.80	*0.86*	1.06	*1.11*	0.88	1.44	*1.26*	0.57	0.92	0.85	*0.84*	1.13	**1.06**	*1.05*
Signif β=1	0.30	*0.32*	0.19	*0.35*	0.73	*0.58*	0.80	0.07	*0.53*	0.01	0.82	0.15	*0.14*	0.72	**0.52**	*0.57*
Signif α=0, β=1	0.08	*0.18*	0.21	*0.38*	0.94	*0.84*	0.49	0.16	*0.71*	0.01	0.60	0.13	*0.20*	0.28	**0.05**	*0.14*
$\bar{R}^2$	0.52	*0.51*	0.42	*0.53*	0.49	*0.52*	0.19	0.67	*0.44*	0.65	0.42	0.68	*0.72*	0.56	**0.78**	*0.82*
DW	2.02	*2.03*	1.34	*1.43*	1.81	*1.92*	1.64	2.22	*2.14*	1.84	1.43	1.62	*1.64*	1.41	**1.63**	*1.88*
Unemployment rate																
α	0.73	*0.78*	0.11	*0.08*	0.30	*0.46*	1.79	0.96	*1.35*	0.01	0.45	0.01	*0.16*	0.61	**0.25**	*0.23*
Signif α=0	0.15	*0.18*	0.49	*0.62*	0.38	*0.31*	0.28	0.13	*0.10*	0.99	0.77	0.94	*0.45*	0.21	**0.06**	*0.19*
β	0.92	*0.92*	0.95	*0.97*	0.91	*0.90*	0.60	0.79	*0.73*	1.00	0.98	0.99	*0.98*	0.91	**0.96**	*0.98*
Signif β=1	0.12	*0.19*	0.40	*0.69*	0.07	*0.08*	0.31	0.04	*0.04*	0.96	0.91	0.54	*0.31*	0.11	**0.02**	*0.25*
Signif α=0, β=1	0.29	*0.39*	0.70	*0.88*	0.08	*0.14*	0.39	0.02	*0.03*	0.99	0.67	0.33	*0.51*	0.01	**0.06**	*0.42*
$\bar{R}^2$	0.90	*0.90*	0.88	*0.86*	0.92	*0.91*	0.13	0.79	*0.79*	0.96	0.69	0.99	*0.99*	0.98	**0.99**	*0.99*
DW	2.35	*2.41*	2.62	*2.43*	2.36	*2.37*	1.23	1.01	*0.98*	2.01	0.66	2.48	*2.59*	1.39	**1.80**	*2.01*
Government bal.																
α	-0.49	*-1.24*	0.90	*0.90*	0.28	*0.33*	0.29	-0.89	*-1.62*	0.43	1.14	0.19	*-0.24*	0.11	**0.22**	*0.00*
Signif α=0	0.33	*0.16*	0.01	*0.02*	0.41	*0.45*	0.48	0.04	*0.07*	0.25	0.00	0.53	*0.51*	0.88	**0.36**	*0.99*
β	0.95	*0.88*	0.68	*0.55*	0.99	*1.02*	1.09	0.76	*0.66*	1.04	0.96	1.09	*0.97*	1.00	**1.04**	*0.99*
Signif β=1	0.45	*0.21*	0.02	*0.01*	0.94	*0.88*	0.57	0.00	*0.02*	0.71	0.61	0.34	*0.78*	1.00	**0.52**	*0.99*
Signif α=0, β=1	0.60	*0.36*	0.01	*0.01*	0.31	*0.44*	0.77	0.01	*0.01*	0.36	0.00	0.63	*0.70*	0.91	**0.61**	*0.97*
$\bar{R}^2$	0.87	*0.75*	0.46	*0.35*	0.76	*0.75*	0.83	0.86	*0.73*	0.91	0.95	0.82	*0.77*	0.51	**0.88**	*0.88*
DW	2.38	*2.39*	2.07	*2.10*	1.76	*2.06*	1.90	1.63	*1.61*	2.94	0.94	1.61	*1.69*	1.42	**1.79**	*2.06*
Current account																
α	-0.15	*-0.06*	0.76	*0.50*	0.42	*0.34*	0.37	-0.20	*0.13*	2.04	0.68	0.18	*0.18*	0.24	**0.06**	*0.09*
Signif α=0	0.36	*0.75*	0.64	*0.69*	0.31	*0.34*	0.44	0.76	*0.78*	0.12	0.29	0.42	*0.47*	0.44	**0.40**	*0.29*
β	0.89	*0.97*	0.94	*0.97*	0.88	*0.90*	1.12	1.02	*0.75*	0.61	0.90	1.00	*1.03*	0.46	**0.84**	*0.92*
Signif β=1	0.29	*0.82*	0.36	*0.58*	0.29	*0.41*	0.64	0.90	*0.35*	0.11	0.55	0.98	*0.88*	0.10	**0.16**	*0.51*
Signif α=0, β=1	0.36	*0.93*	0.60	*0.85*	0.55	*0.63*	0.73	0.86	*0.44*	0.25	0.47	0.57	*0.74*	0.12	**0.34**	*0.49*
$\bar{R}^2$	0.70	*0.72*	0.85	*0.94*	0.63	*0.70*	0.65	0.74	*0.41*	0.41	0.74	0.62	*0.62*	0.21	**0.61**	*0.68*
DW	1.90	*2.01*	2.61	*2.57*	1.33	*1.40*	1.99	1.95	*1.60*	1.65	1.89	1.95	*1.94*	2.02	**2.04**	*2.13*

α and β: coefficients in regression (3). Signif. (.): significance level of the t-statistic (single test) or F-statistic (joint test) of the null hypothesis;
numbers above 0.05 indicate that the null hypothesis can be accepted at the 5% significance level.

Table A12: Efficiency - year ahead

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
α	0.25	*0.25*	-0.36	*-0.39*	-0.24	*-0.04*	0.44	*0.01*	0.41	*1.39*	-0.78	*-1.01*	-0.27	*-0.24*	**-0.32**	*-0.32*
Signif α=0	0.64	*0.68*	0.57	*0.59*	0.72	*0.97*	0.68	*1.00*	0.44	*0.11*	0.41	*0.46*	0.58	*0.68*	**0.56**	*0.63*
β	0.79	*0.81*	1.07	*1.10*	0.93	*0.90*	1.08	*1.19*	0.87	*0.08*	1.31	*1.39*	0.99	*0.98*	**0.99**	*1.00*
Signif β=1	0.29	*0.38*	0.79	*0.75*	0.78	*0.72*	0.73	*0.63*	0.52	*0.09*	0.32	*0.41*	0.93	*0.92*	**0.96**	*1.00*
Signif α=0, β=1	0.36	*0.53*	0.64	*0.78*	0.32	*0.62*	0.25	*0.48*	0.74	*0.22*	0.53	*0.69*	0.33	*0.51*	**0.25**	*0.46*
$\bar{R}^2$	0.30	*0.32*	0.34	*0.34*	0.29	*0.25*	0.39	*0.26*	0.42	*-0.07*	0.50	*0.46*	0.52	*0.52*	**0.41**	*0.41*
DW	1.63	*1.52*	1.75	*1.59*	2.08	*2.05*	1.28	*0.74*	1.83	*1.81*	1.40	*1.40*	1.81	*1.73*	**2.01**	*1.94*
Inflation																
α	0.02	*-0.30*	0.50	*0.87*	-0.60	*-0.61*	-0.60	*-0.99*	0.40	*1.48*	0.65	*0.66*	0.12	*0.29*	**0.13**	*0.37*
Signif α=0	0.96	*0.70*	0.40	*0.32*	0.08	*0.21*	0.46	*0.38*	0.60	*0.48*	0.17	*0.60*	0.77	*0.67*	**0.78**	*0.59*
β	0.99	*1.04*	0.98	*0.94*	1.19	*1.20*	1.14	*1.17*	1.03	*0.96*	0.94	*0.94*	1.05	*1.03*	**1.02**	*0.99*
Signif β=1	0.93	*0.78*	0.82	*0.63*	0.05	*0.13*	0.16	*0.17*	0.66	*0.77*	0.58	*0.80*	0.46	*0.74*	**0.79**	*0.92*
Signif α=0, β=1	0.99	*0.92*	0.50	*0.47*	0.15	*0.29*	0.29	*0.34*	0.21	*0.31*	0.05	*0.40*	0.25	*0.36*	**0.57**	*0.57*
$\bar{R}^2$	0.72	*0.67*	0.74	*0.69*	0.81	*0.76*	0.82	*0.81*	0.92	*0.77*	0.80	*0.58*	0.87	*0.81*	**0.84**	*0.77*
DW	1.34	*1.44*	2.11	*2.04*	1.19	*1.13*	1.09	*1.05*	1.29	*1.22*	1.63	*1.54*	1.85	*1.94*	**1.28**	*1.25*
Investment																
α	-0.99	*-0.91*	-2.77	*-3.30*	-1.03	*-0.22*	-0.15	*-0.57*	-2.32	*-3.80*	-0.11	*-0.82*	-0.47	*-0.56*	**-0.55**	*-0.61*
Signif α=0	0.47	*0.58*	0.04	*0.04*	0.31	*0.85*	0.94	*0.81*	0.12	*0.04*	0.95	*0.76*	0.50	*0.47*	**0.43**	*0.45*
β	1.03	*1.04*	1.81	*1.86*	0.96	*0.87*	0.91	*0.93*	1.12	*1.63*	1.06	*1.16*	0.91	*0.87*	**0.92**	*0.94*
Signif β=1	0.93	*0.93*	0.02	*0.02*	0.88	*0.65*	0.78	*0.87*	0.60	*0.12*	0.83	*0.70*	0.63	*0.52*	**0.68**	*0.80*
Signif α=0, β=1	0.54	*0.73*	0.04	*0.04*	0.21	*0.63*	0.87	*0.85*	0.09	*0.10*	0.95	*0.92*	0.20	*0.14*	**0.14**	*0.26*
$\bar{R}^2$	0.16	*0.15*	0.51	*0.56*	0.27	*0.26*	0.19	*0.12*	0.51	*0.54*	0.42	*0.43*	0.40	*0.39*	**0.39**	*0.40*
DW	1.76	*1.78*	1.98	*2.00*	1.30	*1.39*	1.71	*1.88*	1.75	*1.86*	1.25	*1.35*	1.46	*1.50*	**1.44**	*1.57*
Unemployment rate																
α	0.99	*0.88*	2.15	*2.70*	0.67	*0.75*	0.08	*0.94*	5.04	*6.03*	-1.12	*2.90*	0.56	*0.53*	**0.79**	*0.73*
Signif α=0	0.04	*0.09*	0.00	*0.00*	0.12	*0.12*	0.89	*0.36*	0.00	*0.00*	0.51	*0.55*	0.12	*0.19*	**0.02**	*0.05*
β	0.86	*0.87*	0.68	*0.63*	0.89	*0.86*	0.94	*0.89*	0.45	*0.27*	1.05	*0.86*	0.93	*0.94*	**0.89**	*0.90*
Signif β=1	0.01	*0.02*	0.00	*0.00*	0.07	*0.07*	0.22	*0.14*	0.00	*0.00*	0.62	*0.57*	0.09	*0.18*	**0.00**	*0.03*
Signif α=0, β=1	0.01	*0.02*	0.00	*0.00*	0.17	*0.18*	0.03	*0.08*	0.00	*0.00*	0.65	*0.82*	0.22	*0.39*	**0.01**	*0.09*
$\bar{R}^2$	0.90	*0.92*	0.74	*0.68*	0.86	*0.83*	0.93	*0.88*	0.28	*0.21*	0.87	*0.55*	0.94	*0.94*	**0.95**	*0.95*
DW	1.28	*1.09*	1.45	*1.45*	0.87	*0.79*	0.58	*0.59*	0.89	*1.23*	0.95	*0.71*	1.70	*1.67*	**0.94**	*0.87*
Government bal.																
α	-0.37	*-1.01*	-0.20	*-0.80*	-0.71	*-0.82*	-0.02	*0.06*	-2.04	*-3.70*	-0.07	*-2.42*	-0.22	*-0.10*	**-0.37**	*-0.72*
Signif α=0	0.38	*0.14*	0.60	*0.14*	0.04	*0.02*	0.98	*0.96*	0.04	*0.09*	0.88	*0.09*	0.48	*0.77*	**0.25**	*0.09*
β	1.00	*0.91*	0.83	*0.72*	0.65	*0.61*	0.98	*1.00*	0.86	*0.73*	1.03	*0.54*	0.93	*0.96*	**0.92**	*0.85*
Signif β=1	0.95	*0.41*	0.10	*0.04*	0.00	*0.00*	0.83	*0.99*	0.17	*0.14*	0.83	*0.16*	0.57	*0.76*	**0.36**	*0.16*
Signif α=0, β=1	0.39	*0.19*	0.26	*0.10*	0.02	*0.01*	0.96	*1.00*	0.09	*0.20*	0.86	*0.20*	0.78	*0.95*	**0.49**	*0.22*
$\bar{R}^2$	0.84	*0.76*	0.70	*0.61*	0.47	*0.50*	0.82	*0.71*	0.78	*0.53*	0.74	*0.19*	0.63	*0.64*	**0.76**	*0.71*
DW	1.60	*1.63*	0.84	*0.78*	1.87	*1.89*	1.34	*1.31*	0.98	*0.92*	1.33	*1.13*	1.31	*1.36*	**1.67**	*1.77*
Current account																
α	0.36	*0.37*	-0.27	*-0.71*	0.33	*0.25*	-0.23	*-0.12*	-0.51	*-1.88*	-0.94	*-0.67*	0.04	*0.27*	**0.05**	*0.04*
Signif α=0	0.24	*0.30*	0.51	*0.21*	0.18	*0.34*	0.67	*0.86*	0.68	*0.28*	0.07	*0.19*	0.80	*0.18*	**0.66**	*0.76*
β	0.79	*0.82*	0.83	*0.70*	0.85	*0.86*	0.87	*0.89*	1.09	*0.60*	0.73	*0.53*	0.95	*1.20*	**0.57**	*0.71*
Signif β=1	0.03	*0.16*	0.31	*0.17*	0.23	*0.32*	0.25	*0.40*	0.76	*0.39*	0.14	*0.02*	0.73	*0.37*	**0.02**	*0.17*
Signif α=0, β=1	0.10	*0.29*	0.53	*0.29*	0.33	*0.52*	0.50	*0.70*	0.07	*0.41*	0.18	*0.06*	0.92	*0.35*	**0.05**	*0.38*
$\bar{R}^2$	0.68	*0.62*	0.45	*0.30*	0.59	*0.60*	0.65	*0.65*	0.33	*0.05*	0.49	*0.46*	0.56	*0.53*	**0.24**	*0.29*
DW	0.73	*0.67*	1.74	*1.74*	1.46	*1.59*	1.94	*2.02*	1.68	*1.79*	0.66	*0.91*	1.55	*1.93*	**1.33**	*1.34*

α and β: coefficients in regression (4). Signif. (.): significance level of the t-statistic (single test) or F-statistic (joint test) of the null hypothesis;
numbers above 0.05 indicate that the null hypothesis can be accepted at the 5% significance level.

Table A12: Efficiency - year ahead (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
α	-0.04	*0.14*	0.22	*-0.24*	0.27	*0.34*	1.39	-1.81	*-1.67*	1.73	1.96	-0.20	*-0.35*	-0.09	**-0.32**	*-0.32*
Signif α=0	0.94	*0.83*	0.83	*0.83*	0.58	*0.54*	0.22	0.02	*0.16*	0.46	0.23	0.71	*0.60*	0.94	**0.56**	*0.63*
β	0.75	*0.72*	0.95	*1.06*	0.87	*0.89*	0.25	1.53	*1.55*	0.54	0.18	0.98	*1.04*	0.84	**0.99**	*1.00*
Signif β=1	0.14	*0.15*	0.87	*0.90*	0.50	*0.61*	0.12	0.04	*0.17*	0.47	0.18	0.92	*0.90*	0.76	**0.96**	*1.00*
Signif α=0, β=1	0.02	*0.06*	0.97	*0.97*	0.79	*0.82*	0.13	0.04	*0.35*	0.75	0.31	0.60	*0.69*	0.42	**0.25**	*0.46*
$\bar{R}^2$	0.36	*0.33*	0.16	*0.15*	0.36	*0.37*	-0.07	0.69	*0.63*	-0.02	-0.10	0.34	*0.33*	0.22	**0.41**	*0.41*
DW	1.95	*1.99*	1.84	*1.89*	1.77	*1.89*	1.82	2.23	*1.80*	2.00	1.95	1.37	*1.35*	2.61	**2.01**	*1.94*
Inflation																
α	0.31	*0.47*	-0.08	*-0.59*	-0.07	*-0.17*	0.09	0.26	*0.41*	-0.61	0.38	-0.30	*-0.11*	0.47	**0.13**	*0.37*
Signif α=0	0.64	*0.64*	0.89	*0.50*	0.79	*0.64*	0.92	0.71	*0.81*	0.76	0.58	0.66	*0.92*	0.74	**0.78**	*0.59*
β	1.11	*1.10*	1.06	*1.15*	0.98	*0.99*	0.84	1.11	*1.09*	1.16	0.58	1.09	*1.07*	0.84	**1.02**	*0.99*
Signif β=1	0.15	*0.34*	0.61	*0.39*	0.73	*0.88*	0.73	0.34	*0.68*	0.88	0.22	0.34	*0.58*	0.83	**0.79**	*0.92*
Signif α=0, β=1	0.01	*0.02*	0.71	*0.65*	0.59	*0.54*	0.45	0.07	*0.27*	0.67	0.07	0.54	*0.64*	0.48	**0.57**	*0.57*
$\bar{R}^2$	0.86	*0.81*	0.67	*0.63*	0.90	*0.90*	0.18	0.85	*0.71*	0.02	0.19	0.82	*0.76*	0.05	**0.84**	*0.77*
DW	1.95	*1.93*	0.96	*0.98*	1.39	*1.42*	1.84	1.12	*1.04*	1.20	1.73	0.90	*0.89*	1.89	**1.28**	*1.25*
Investment																
α	-1.08	*-1.02*	1.99	*2.24*	0.33	*0.53*	-1.78	-4.47	*-0.91*	1.61	-2.76	-0.91	*-1.07*	-2.44	**-0.55**	*-0.61*
Signif α=0	0.20	*0.30*	0.15	*0.10*	0.68	*0.55*	0.47	0.05	*0.81*	0.39	0.45	0.30	*0.29*	0.33	**0.43**	*0.45*
β	0.85	*0.84*	0.52	*0.26*	1.11	*1.18*	1.24	1.64	*1.23*	0.46	1.17	1.10	*1.11*	1.19	**0.92**	*0.94*
Signif β=1	0.42	*0.47*	0.24	*0.07*	0.69	*0.59*	0.71	0.07	*0.67*	0.02	0.77	0.66	*0.71*	0.77	**0.68**	*0.80*
Signif α=0, β=1	0.03	*0.11*	0.29	*0.11*	0.70	*0.53*	0.55	0.13	*0.83*	0.02	0.43	0.54	*0.54*	0.23	**0.14**	*0.26*
$\bar{R}^2$	0.35	*0.35*	0.02	*-0.02*	0.29	*0.31*	0.23	0.57	*0.32*	0.33	0.25	0.41	*0.38*	0.32	**0.39**	*0.40*
DW	1.76	*1.72*	1.78	*1.21*	1.45	*1.58*	1.92	1.42	*1.12*	1.74	1.62	1.58	*1.59*	1.29	**1.44**	*1.57*
Unemployment rate																
α	1.90	*2.01*	0.24	*0.29*	0.69	*1.00*	4.05	2.86	*3.10*	0.08	0.84	0.59	*0.83*	2.55	**0.79**	*0.73*
Signif α=0	0.01	*0.02*	0.19	*0.15*	0.15	*0.13*	0.01	0.01	*0.04*	0.92	0.65	0.15	*0.16*	0.22	**0.02**	*0.05*
β	0.78	*0.78*	0.92	*0.86*	0.86	*0.84*	0.05	0.47	*0.43*	0.96	0.91	0.91	*0.89*	0.69	**0.89**	*0.90*
Signif β=1	0.00	*0.01*	0.32	*0.20*	0.03	*0.04*	0.01	0.00	*0.02*	0.60	0.73	0.07	*0.09*	0.19	**0.00**	*0.03*
Signif α=0, β=1	0.02	*0.04*	0.39	*0.35*	0.06	*0.09*	0.02	0.01	*0.02*	0.24	0.78	0.13	*0.18*	0.17	**0.01**	*0.09*
$\bar{R}^2$	0.78	*0.77*	0.82	*0.75*	0.85	*0.83*	-0.11	0.30	*0.26*	0.95	0.56	0.92	*0.89*	0.64	**0.95**	*0.95*
DW	0.99	*1.00*	1.13	*1.26*	1.42	*1.43*	0.85	0.62	*0.49*	1.23	0.67	1.48	*1.42*	1.78	**0.94**	*0.87*
Government bal.																
α	-0.97	*-2.36*	1.45	*1.30*	-0.10	*-0.27*	0.43	-1.57	*-2.47*	0.39	1.13	-0.69	*-1.31*	-0.35	**-0.37**	*-0.72*
Signif α=0	0.13	*0.03*	0.00	*0.01*	0.80	*0.55*	0.36	0.05	*0.22*	0.34	0.01	0.10	*0.02*	0.73	**0.25**	*0.09*
β	0.93	*0.79*	0.56	*0.39*	0.89	*0.88*	1.00	0.64	*0.50*	1.14	0.94	0.86	*0.71*	0.82	**0.92**	*0.85*
Signif β=1	0.36	*0.08*	0.01	*0.00*	0.33	*0.31*	0.98	0.03	*0.13*	0.31	0.57	0.28	*0.05*	0.73	**0.36**	*0.16*
Signif α=0, β=1	0.19	*0.07*	0.00	*0.00*	0.47	*0.54*	0.24	0.08	*0.19*	0.24	0.02	0.26	*0.07*	0.93	**0.49**	*0.22*
$\bar{R}^2$	0.80	*0.62*	0.30	*0.15*	0.65	*0.68*	0.79	0.49	*0.14*	0.89	0.91	0.61	*0.50*	0.22	**0.76**	*0.71*
DW	1.72	*1.75*	1.28	*1.28*	1.12	*1.24*	1.90	1.62	*1.53*	2.63	1.50	1.25	*1.13*	1.55	**1.67**	*1.77*
Current account																
α	-0.32	*-0.27*	5.09	*5.04*	1.11	*1.02*	0.36	-1.72	*-0.97*	3.41	1.05	-0.38	*-0.30*	0.52	**0.05**	*0.04*
Signif α=0	0.23	*0.41*	0.13	*0.16*	0.03	*0.04*	0.54	0.03	*0.05*	0.02	0.36	0.26	*0.46*	0.17	**0.66**	*0.76*
β	0.59	*0.67*	0.78	*0.79*	0.66	*0.66*	0.99	0.81	*0.51*	0.39	0.86	0.61	*0.58*	-0.08	**0.57**	*0.71*
Signif β=1	0.01	*0.13*	0.13	*0.15*	0.02	*0.03*	0.97	0.21	*0.03*	0.02	0.68	0.07	*0.11*	0.02	**0.02**	*0.17*
Signif α=0, β=1	0.02	*0.21*	0.28	*0.33*	0.06	*0.08*	0.66	0.07	*0.06*	0.05	0.47	0.19	*0.28*	0.03	**0.05**	*0.38*
$\bar{R}^2$	0.28	*0.27*	0.55	*0.54*	0.39	*0.41*	0.49	0.63	*0.38*	0.20	0.36	0.20	*0.15*	-0.19	**0.24**	*0.29*
DW	1.40	*1.43*	1.64	*1.64*	0.99	*1.08*	0.92	1.11	*2.31*	1.66	1.18	1.07	*1.01*	1.79	**1.33**	*1.34*

α and β: coefficients in regression (4). Signif. (.): significance level of the t-statistic (single test) or F-statistic (joint test) of the null hypothesis;
numbers above 0.05 indicate that the null hypothesis can be accepted at the 5% significance level.

Table A13: Unbiasedness and no serial correlation-current year

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom	euro area	European Union
GDP																	
α	-0.01	0.09	0.17	-0.54	-0.19	-0.14	0.06	0.46	-0.41	0.00	0.06	0.18	0.08	-0.08	0.00	0.31	0.14
Signif. α=0	0.94	0.59	0.37	0.16	0.26	0.45	0.61	0.03	0.21	1.00	0.81	0.35	0.86	0.80	0.99	0.26	0.25
Signif. α=0 (Bootstrap)	0.94	0.57	0.33	0.17	0.26	0.47	0.61	0.04	0.26	0.99	0.78	0.45	0.80	0.82	1.00	0.24	0.19
β	0.21	0.06	0.01	0.02	0.06	0.32	0.21	-0.14	0.27	0.18	0.12	0.44	-0.20	-0.01	-0.22	0.02	-0.06
Signif. β=0	0.22	0.74	0.94	0.91	0.76	0.19	0.21	0.43	0.11	0.30	0.72	0.06	0.58	0.97	0.23	0.97	0.74
Signif. β=0 (Bootstrap)	0.13	0.58	0.80	0.75	0.59	0.05	0.12	0.47	0.05	0.18	0.40	0.02	0.66	0.73	0.27	0.59	0.84
Signif. α=0, β=0	0.46	0.78	0.66	0.31	0.48	0.24	0.39	0.10	0.05	0.58	0.88	0.07	0.84	0.96	0.48	0.40	0.51
Inflation																	
α	-0.01	-0.14	0.09	0.09	-0.09	-0.31	0.08	-0.10	0.01	-0.03	0.07	-0.34	-0.19	-0.06	0.25	-0.14	0.04
Signif. α=0	0.93	0.28	0.24	0.67	0.75	0.02	0.50	0.53	0.92	0.78	0.70	0.06	0.32	0.68	0.23	0.10	0.63
Signif. α=0 (Bootstrap)	0.93	0.27	0.23	0.69	0.74	0.01	0.46	0.56	0.91	0.78	0.75	0.06	0.32	0.70	0.18	0.05	0.62
β	0.10	-0.01	0.06	-0.28	0.10	-0.28	-0.13	0.17	0.13	-0.12	0.13	0.24	-0.04	-0.11	-0.01	-0.15	0.11
Signif. β=0	0.57	0.97	0.73	0.09	0.66	0.20	0.48	0.32	0.45	0.48	0.70	0.31	0.90	0.74	0.96	0.64	0.51
Signif. β=0 (Bootstrap)	0.42	0.88	0.57	0.09	0.44	0.21	0.49	0.19	0.29	0.55	0.39	0.14	0.91	0.91	0.92	0.62	0.36
Signif. α=0, β=0	0.85	0.53	0.40	0.22	0.86	0.06	0.61	0.45	0.74	0.75	0.82	0.02	0.59	0.86	0.48	0.22	0.70
Investment																	
α	0.09	0.28	0.84	0.52	1.04	0.18	0.39	1.09	-0.54	-0.10	0.66	0.56	0.96	0.68	0.48	0.83	0.53
Signif. α=0	0.86	0.75	0.10	0.52	0.17	0.76	0.24	0.08	0.45	0.86	0.49	0.59	0.31	0.64	0.32	0.38	0.08
β	0.24	0.16	0.26	0.18	-0.08	0.40	0.04	0.00	0.28	0.08	0.13	0.17	0.17	0.31	0.21	0.34	0.21
Signif. β=0	0.17	0.39	0.12	0.36	0.64	0.06	0.82	0.99	0.10	0.62	0.71	0.50	0.45	0.40	0.24	0.46	0.22
Signif. α=0, β=0	0.37	0.63	0.03	0.46	0.38	0.17	0.46	0.18	0.14	0.87	0.63	0.66	0.22	0.48	0.22	0.25	0.03
Unemployment																	
α	0.01	-0.02	0.02	0.39	0.00	0.33	0.02	0.02	0.03	0.30	-0.13	0.10	0.12	-0.05	0.11	0.07	0.03
Signif. α=0	0.95	0.87	0.76	0.02	0.98	0.13	0.74	0.93	0.66	0.13	0.40	0.52	0.45	0.84	0.07	0.44	0.64
β	0.21	-0.26	0.27	-0.16	0.10	0.05	-0.19	-0.19	-0.47	-0.19	-0.30	0.38	-0.15	0.51	-0.25	0.57	0.20
Signif. β=0	0.23	0.15	0.11	0.39	0.64	0.86	0.27	0.28	0.01	0.27	0.62	0.08	0.61	0.12	0.16	0.16	0.24
Signif. α=0, β=0	0.48	0.34	0.25	0.07	0.89	0.22	0.52	0.55	0.04	0.22	0.63	0.06	0.67	0.26	0.12	0.02	0.42
Government balance																	
α	0.08	-0.08	-0.13	-0.43	0.66	0.01	-0.01	0.19	-0.90	-0.38	-0.27	-0.07	-0.79	-0.55	0.00	-0.06	-0.04
Signif. α=0	0.47	0.73	0.42	0.21	0.16	0.98	0.97	0.43	0.01	0.05	0.09	0.74	0.04	0.22	0.98	0.85	0.68
Signif. α=0 (Bootstrap)	0.43	0.79	0.40	0.22	0.19	0.95	0.99	0.43	0.01	0.05	0.10	0.80	0.02	0.45	0.98	0.92	0.69
β	0.21	0.27	-0.01	-0.06	0.04	-0.06	0.05	-0.21	-0.25	0.01	-0.18	0.25	-0.50	0.59	0.26	0.28	0.09
Signif. β=0	0.23	0.20	0.95	0.72	0.85	0.81	0.74	0.22	0.17	0.95	0.40	0.24	0.12	0.11	0.15	0.54	0.58
Signif. β=0 (Bootstrap)	0.14	0.08	0.92	0.83	0.65	0.98	0.61	0.24	0.16	0.81	0.46	0.12	0.08	0.01	0.07	0.12	0.44
Signif. α=0, β=0	0.30	0.41	0.72	0.44	0.30	0.97	0.95	0.38	0.04	0.12	0.17	0.36	0.08	0.00	0.35	0.78	0.76
Current acount																	
α	0.09	0.00	-0.21	-0.30	0.68	0.17	0.05	0.21	0.56	-0.03	-0.29	0.37	0.08	-0.43	-0.14	0.25	-0.02
Signif. α=0	0.66	0.99	0.14	0.40	0.08	0.46	0.65	0.19	0.58	0.89	0.47	0.46	0.87	0.33	0.43	0.37	0.76
β	0.09	0.05	0.01	0.11	-0.10	0.36	0.04	-0.03	-0.36	0.23	0.12	0.00	0.04	-0.28	-0.02	-0.05	-0.12
Signif. β=0	0.62	0.77	0.97	0.54	0.67	0.11	0.82	0.87	0.05	0.26	0.74	0.99	0.92	0.52	0.92	0.92	0.50
Signif. α=0, β=0	0.80	0.96	0.30	0.52	0.19	0.13	0.88	0.42	0.13	0.52	0.68	0.75	0.98	0.60	0.72	0.63	0.77

α and β: coefficients in regression (5). Signif. α=0, Signif. β=0 denote the p-values for the α=0, β=0 t-tests respectively.
Signif. α=0, β=0 denotes the p-value for the α=0, β=0 F-test.

Table A14: Unbiasedness and no serial correlation-year ahead

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom	euro area	European Union
GDP																	
α	0.25	0.13	0.47	-0.72	-0.21	0.02	0.38	0.58	-0.06	0.06	0.37	0.41	-0.17	0.32	0.11	0.71	0.38
Signif. α=0	0.35	0.58	0.10	0.10	0.42	0.94	0.06	0.06	0.90	0.80	0.27	0.16	0.77	0.41	0.64	0.15	0.08
Signif. α=0 (Bootstrap)	0.33	0.60	0.07	0.11	0.45	0.90	0.04	0.05	0.92	0.78	0.19	0.18	0.79	0.36	0.66	0.14	0.05
β	0.17	0.09	-0.06	0.30	-0.01	0.35	0.01	0.10	0.07	0.04	-0.28	0.25	-0.14	-0.27	0.25	-0.44	-0.02
Signif. β=0	0.33	0.64	0.71	0.07	0.95	0.11	0.93	0.56	0.67	0.83	0.40	0.32	0.69	0.44	0.15	0.38	0.92
Signif. β=0 (Bootstrap)	0.21	0.48	0.81	0.03	0.86	0.03	0.79	0.40	0.52	0.70	0.42	0.15	0.85	0.48	0.07	0.35	0.95
Signif. α=0, β=0	0.34	0.72	0.26	0.02	0.71	0.27	0.15	0.07	0.90	0.95	0.47	0.14	0.89	0.57	0.26	0.31	0.20
Inflation																	
α	-0.05	-0.29	0.04	0.09	-0.52	-0.38	-0.34	-0.96	-0.15	0.08	0.21	-0.34	0.09	0.30	0.11	-0.28	-0.16
Signif. α=0	0.86	0.23	0.77	0.81	0.21	0.06	0.19	0.03	0.53	0.61	0.34	0.38	0.78	0.28	0.69	0.11	0.48
Signif. α=0 (Bootstrap)	0.81	0.23	0.79	0.85	0.19	0.04	0.16	0.01	0.55	0.63	0.28	0.47	0.83	0.37	0.68	0.13	0.47
β	0.31	-0.31	0.48	0.37	0.35	0.12	0.14	0.18	0.53	0.29	0.02	0.54	0.28	0.28	0.39	-0.19	0.37
Signif. β=0	0.07	0.02	0.00	0.01	0.09	0.62	0.41	0.30	0.00	0.09	0.95	0.02	0.39	0.43	0.00	0.64	0.03
Signif. β=0 (Bootstrap)	0.03	0.02	0.00	0.01	0.02	0.39	0.25	0.17	0.00	0.04	0.61	0.00	0.16	0.15	0.00	0.76	0.01
Signif. α=0, β=0	0.19	0.04	0.01	0.03	0.05	0.05	0.21	0.01	0.00	0.17	0.55	0.01	0.62	0.18	0.01	0.22	0.05
Investment																	
α	0.73	0.21	0.93	0.22	1.44	0.16	0.66	1.23	-0.88	-0.27	1.00	1.41	1.59	1.88	0.39	1.64	0.62
Signif. α=0	0.39	0.86	0.15	0.86	0.10	0.84	0.12	0.06	0.49	0.67	0.36	0.14	0.43	0.29	0.55	0.26	0.15
β	0.13	0.15	0.31	0.08	0.13	0.30	0.23	0.12	0.13	0.30	-0.01	0.37	0.05	0.12	0.19	0.28	0.26
Signif. β=0	0.47	0.38	0.06	0.69	0.57	0.19	0.17	0.47	0.45	0.08	0.98	0.07	0.88	0.75	0.28	0.55	0.13
Signif. α=0, β=0	0.46	0.64	0.03	0.90	0.11	0.41	0.06	0.05	0.52	0.18	0.62	0.05	0.61	0.37	0.41	0.15	0.05
Unemployment																	
α	0.13	0.05	0.04	0.19	-0.16	0.14	0.02	0.04	-0.06	0.19	-0.20	-0.06	0.33	-0.04	0.13	0.14	0.05
Signif. α=0	0.48	0.81	0.83	0.33	0.58	0.70	0.86	0.86	0.52	0.47	0.27	0.81	0.18	0.91	0.41	0.54	0.65
β	0.42	0.35	0.54	0.70	0.33	0.55	0.15	0.51	0.38	0.26	0.11	0.40	0.29	0.55	0.22	0.20	0.59
Signif. β=0	0.01	0.05	0.00	0.00	0.10	0.02	0.39	0.00	0.04	0.13	0.69	0.05	0.36	0.11	0.23	0.69	0.00
Signif. α=0, β=0	0.02	0.13	0.00	0.00	0.16	0.05	0.67	0.01	0.08	0.21	0.51	0.11	0.11	0.24	0.30	0.59	0.00
Government balance																	
α	0.37	-0.03	-0.08	-0.16	0.48	0.13	0.09	0.42	-1.15	-0.11	-0.64	-0.06	-0.65	-0.88	0.21	0.13	0.13
Signif. α=0	0.16	0.93	0.72	0.72	0.39	0.67	0.57	0.18	0.02	0.66	0.02	0.88	0.18	0.14	0.47	0.77	0.39
Signif. α=0 (Bootstrap)	0.13	0.95	0.72	0.75	0.46	0.66	0.57	0.20	0.02	0.69	0.02	0.89	0.18	0.21	0.54	0.85	0.39
β	0.16	0.54	-0.04	0.30	0.45	0.33	0.28	0.11	0.16	0.40	-0.14	0.18	-0.10	0.24	0.26	0.14	0.10
Signif. β=0	0.36	0.01	0.81	0.10	0.03	0.19	0.10	0.52	0.38	0.02	0.63	0.51	0.78	0.54	0.15	0.78	0.58
Signif. β=0 (Bootstrap)	0.23	0.00	0.93	0.04	0.01	0.06	0.05	0.38	0.24	0.01	0.72	0.28	0.98	0.22	0.07	0.38	0.43
Signif. α=0, β=0	0.18	0.02	0.92	0.23	0.03	0.33	0.19	0.24	0.01	0.05	0.05	0.78	0.38	0.04	0.20	0.91	0.55
Current account																	
α	0.09	0.11	-0.13	-0.08	0.68	0.10	0.01	0.44	-0.49	-0.07	-0.33	0.72	0.07	-0.68	-0.22	0.09	0.08
Signif. α=0	0.71	0.78	0.57	0.88	0.11	0.75	0.97	0.14	0.81	0.81	0.42	0.25	0.89	0.29	0.23	0.81	0.48
β	0.53	0.04	0.17	-0.14	0.20	0.48	0.17	0.15	0.06	0.38	0.51	0.31	0.22	0.20	-0.03	0.32	0.28
Signif. β=0	0.00	0.85	0.33	0.42	0.36	0.03	0.35	0.37	0.77	0.04	0.12	0.21	0.49	0.57	0.84	0.45	0.09
Signif. α=0, β=0	0.00	0.94	0.48	0.71	0.07	0.07	0.64	0.14	0.92	0.10	0.16	0.10	0.77	0.30	0.48	0.63	0.17

α and β: coefficients in regression (6). Signif. α=0, Signif. β=0 denote the p-values for the α=0, β=0 t-tests respectively.
Signif. α=0, β=0 denotes the p-value for the α=0, β=0 F-test.

Table A15: Predictability of forecast errors in relation to current information variables-current year

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom	euro area	European Union
GDP																	
β	-0.15	0.02	-0.06	-0.30	-0.35	-0.19	-0.10	-0.02	-0.18	-0.04	0.19	-0.53	0.21	0.35	0.16		
Signif. β=0	0.12	0.87	0.66	0.28	0.05	0.35	0.26	0.86	0.40	0.72	0.60	0.01	0.75	0.40	0.21		
β^1	0.22	-0.05		0.08	-0.28	-0.05	0.16	-0.34	-0.03	-0.13	-0.88	-0.53	-1.96	-0.87	0.32	-1.05	0.00
Signif. β^1=0	0.20	0.79		0.84	0.24	0.87	0.16	0.10	0.93	0.51	0.24	0.11	0.18	0.32	0.08	0.07	0.99
β^2	0.03	0.36	0.30	-0.03	0.25	0.38		0.05	0.54	0.43	0.56	0.69	1.46	0.80	-0.05	-0.50	0.17
Signif. β^2=0	0.89	0.07	0.10	0.95	0.33	0.33		0.83	0.21	0.05	0.49	0.09	0.36	0.41	0.81	0.39	0.30
β^3	-0.35	-0.29	-0.24	-0.12	-0.09	-0.38	-0.16		-0.60	-0.19	0.72	-0.40	1.20	0.32	-0.25	1.99	-0.19
Signif. β^3=0	0.02	0.05	0.18	0.71	0.79	0.20	0.18		0.06	0.23	0.20	0.18	0.25	0.60	0.09	0.04	0.14
β^4	-0.15	-0.08	-0.07	-0.26	-0.19	-0.31	-0.12	-0.04	-0.33	-0.12	0.12	-0.34	-0.02	0.61		0.09	-0.07
Signif. β^4=0	0.08	0.35	0.52	0.20	0.17	0.07	0.12	0.67	0.09	0.24	0.77	0.05	0.98	0.23		0.63	0.39
Signif. $\beta^1=\beta^2=\beta^3=\beta^4=0$	0.07	0.17	0.39	0.72	0.15	0.10	0.24	0.048	0.13	0.21	0.51	0.01	0.52	0.52	0.15	0.13	0.50
Inflation																	
β	0.10	-0.14	0.00	-0.37	-0.25	-0.08	-0.10	-0.10	0.03	-0.07	-0.09	-0.22	-0.15	0.26	-0.25	-0.05	-0.08
Signif. β=0	0.21	0.16	0.99	0.05	0.39	0.53	0.21	0.36	0.74	0.22	0.70	0.19	0.57	0.17	0.15	0.71	0.11
β^1	0.23	-0.07	-0.06	0.34	0.23	-0.09	-0.27	0.33	0.21	-0.17	0.40	0.38	-0.05	-0.08	-0.05	0.04	-0.09
Signif. β^1=0	0.13	0.63	0.44	0.19	0.57	0.74	0.06	0.04	0.14	0.11	0.44	0.21	0.94	0.80	0.85	0.92	0.33
β^2	-0.09	0.16	0.09	-0.58	-0.14	-0.15	0.32	0.08	-0.37	0.14	-0.38	-0.37	-0.33	-0.12	-0.20	-0.36	0.19
Signif. β^2=0	0.59	0.33	0.30	0.05	0.75	0.63	0.05	0.62	0.02	0.22	0.51	0.30	0.63	0.73	0.46	0.53	0.06
β^3	-0.06	-0.23	0.03	-0.19	-0.58	0.24	-0.02	-0.63	0.20	0.06	0.03	-0.49	0.39	0.61	0.26	0.37	-0.11
Signif. β^3=0	0.65	0.06	0.69	0.37	0.31	0.32	0.90	0.00	0.08	0.46	0.94	0.07	0.40	0.03	0.19	0.56	0.14
β^4	-0.06	-0.05	-0.01	0.00	0.21	-0.02	0.00	-0.12	0.03	-0.08	-0.41	0.20	0.00	-0.08	-0.25	-0.01	-0.07
Signif. β^4=0	0.45	0.52	0.76	1.00	0.37	0.85	0.98	0.12	0.67	0.13	0.18	0.18	1.00	0.65	0.04	0.95	0.11
Signif. $\beta^1=\beta^2=\beta^3=\beta^4=0$	0.51	0.22	0.72	0.07	0.67	0.78	0.34	0.000	0.12	0.19	0.62	0.23	0.88	0.14	0.15	0.94	0.11

β: coefficient in regression (7). Signif. β: p-value of the β=0 t-test. β^1, β^2, β^3, β^4: coefficients in regression (9). Signif. $\beta^1=\beta^2=\beta^3=\beta^4=0$: p-value of the F-test that all the coefficients are jointly insignificant.

Table A16: Predictability of forecast errors in relation to current information variables-year ahead

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom	euro area	European Union
GDP																	
β	-0.07	0.42	-0.02	0.49	-0.28	-0.47	-0.21	0.29	-0.34	-0.07	0.70	-0.79	0.56	0.73	0.39		
Signif. β=0	0.77	0.12	0.93	0.40	0.49	0.24	0.28	0.27	0.45	0.74	0.20	0.05	0.59	0.27	0.21		
β^1	-0.53	-0.12		-0.20	0.02	-0.68	0.03	-0.72	-0.26	-0.05	-1.61	-1.12	-3.08	-0.69	-0.03	-1.76	-0.25
Signif. β^1=0	0.20	0.71		0.76	0.97	0.35	0.90	0.07	0.72	0.89	0.06	0.10	0.08	0.61	0.94	0.03	0.46
β^2	1.06	0.40	0.61	-0.05	0.68	1.26		0.54	1.50	0.67	1.29	1.64	1.65	0.17	0.44	-1.58	0.63
Signif. β^2=0	0.03	0.28	0.14	0.94	0.15	0.18		0.15	0.07	0.10	0.22	0.06	0.45	0.93	0.28	0.09	0.09
β^3	-0.33	0.04	-0.47	1.12	-0.71	-0.53	0.00		-1.14	-0.54	1.51	-0.58	2.99	1.28	-0.09	4.91	-0.28
Signif. β^3=0	0.37	0.90	0.23	0.07	0.25	0.35	0.99		0.09	0.11	0.03	0.25	0.04	0.25	0.77	0.01	0.35
β^4	-0.04	0.03	0.24	-0.89	-0.59	-0.55	-0.11	0.40	-0.36	-0.02	0.28	-0.65	0.42	0.56		0.08	0.12
Signif. β^4=0	0.89	0.91	0.43	0.07	0.15	0.17	0.63	0.11	0.50	0.93	0.41	0.07	0.57	0.39		0.53	0.62
Signif. β^1=β^2=β^3=β^4=0	0.23	0.59	0.49	0.16	0.18	0.22	0.96	0.113	0.17	0.34	0.05	0.03	0.12	0.54	0.51	0.03	0.55
Inflation																	
β	-0.24	-0.79	-0.25	-0.33	-1.26	0.06	-0.42	-0.49	-0.27	-0.19	-0.04	-0.49	0.04	0.43	-1.43	-0.09	-0.54
Signif. β=0	0.35	0.06	0.08	0.60	0.03	0.82	0.08	0.19	0.33	0.20	0.90	0.40	0.95	0.28	0.00	0.73	0.01
β^1	1.22	0.11	0.35	1.41	-0.43	0.99	0.29	1.06	1.30	0.24	0.12	1.66	0.24	0.79	0.23	0.75	0.40
Signif. β^1=0	0.00	0.79	0.10	0.04	0.49	0.04	0.40	0.01	0.00	0.25	0.79	0.12	0.88	0.33	0.67	0.41	0.17
β^2	-0.82	0.50	-0.22	-1.18	0.88	-0.81	0.06	-0.74	-1.66	-0.03	0.45	-1.01	-0.95	-0.88	-0.46	-1.15	-0.08
Signif. β^2=0	0.05	0.28	0.34	0.11	0.16	0.17	0.87	0.09	0.00	0.91	0.48	0.44	0.68	0.43	0.44	0.44	0.81
β^3	-0.56	-1.44	-0.11	-0.85	-1.81	-0.50	-0.98	-1.65	0.07	-0.17	-0.36	-1.92	0.82	0.49	-0.88	0.42	-0.97
Signif. β^3=0	0.10	0.00	0.54	0.15	0.03	0.15	0.00	0.00	0.82	0.37	0.32	0.02	0.53	0.43	0.08	0.75	0.00
β^4	0.09	0.52	0.21	1.15	0.29	-0.05	0.57	1.14	0.12	-0.06	-0.69	0.16	0.05	-0.42	-0.01	-0.29	0.43
Signif. β^4=0	0.74	0.09	0.16	0.02	0.57	0.82	0.03	0.00	0.62	0.68	0.01	0.76	0.95	0.27	0.99	0.35	0.04
Signif. β^1=β^2=β^3=β^4=0	0.01	0.00	0.38	0.04	0.01	0.18	0.01	0.000	0.00	0.59	0.45	0.11	0.92	0.36	0.02	0.76	0.00

β: coefficient in regression (8). Signif. β=0: p-value of the β=0 t-test. β^1, β^2, β^3, β^4: coefficients in regression (10). Signif. β^1=β^2=β^3=β^4=0: p-value of the F-test that all the coefficients are jointly insignificant.

Table A17: Lagged realisation-current year

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom	euro area	European Union
GDP																	
β	0.04	-0.03	0.08	-0.04	0.06	0.01	0.03	0.32	0.03	0.01	0.31	-0.17	0.27	0.33	-0.04	0.19	0.10
Signif. β=0	0.64	0.78	0.38	0.72	0.53	0.94	0.64	0.00	0.77	0.94	0.24	0.13	0.34	0.28	0.64	0.37	0.16
Inflation																	
β	0.03	-0.02	0.01	0.01	0.04	0.14	-0.01	0.06	0.04	0.03	0.28	-0.06	-0.09	0.12	0.01	0.38	0.05
Signif. β=0	0.52	0.58	0.82	0.81	0.28	0.02	0.78	0.02	0.32	0.35	0.38	0.07	0.72	0.56	0.75	0.02	0.02

β: coefficient in regression (11). Signif. β=0: p-value of the β=0 t-test.

Table A18: Lagged realisation-year ahead

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom	euro area	European Union
GDP																	
β	0.18	0.10	0.09	-0.12	0.19	0.04	0.14	0.22	0.21	0.04	0.01	-0.13	-0.20	0.42	0.09	0.20	0.19
Signif. β=0	0.22	0.46	0.52	0.33	0.23	0.81	0.22	0.08	0.18	0.77	0.97	0.38	0.59	0.32	0.46	0.62	0.13
Inflation																	
β	0.10	-0.11	-0.02	0.03	-0.09	0.05	-0.04	-0.06	0.07	0.10	0.52	-0.07	-0.11	0.22	0.05	0.23	0.08
Signif. β=0	0.25	0.02	0.76	0.68	0.15	0.66	0.55	0.35	0.47	0.04	0.08	0.47	0.77	0.50	0.33	0.48	0.27

β: coefficient in regression (12). Signif. β=0: p-value of the β=0 t-test.

Table A19: Directional accuracy – current year

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
Success rate	0.83	*0.83*	0.88	*0.83*	0.86	*0.89*	0.84	*0.88*	0.88	*0.94*	0.89	*0.82*	0.89	*0.86*	0.83	*0.82*
Signif indep	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.04*	0.00	*0.00*	0.00	*0.00*
Inflation																
Success rate	0.89	*0.93*	0.91	*0.96*	0.94	*0.96*	0.81	*0.83*	0.79	*0.88*	0.74	*0.82*	0.83	*0.82*	0.81	*0.82*
Signif indep	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.01	*0.01*	0.15	*0.20*	0.00	*0.00*	0.00	*0.00*
Investment																
Success rate	0.78	*0.82*	0.75	*0.79*	0.81	*0.82*	0.75	*0.79*	0.75	*0.81*	0.84	*0.73*	0.86	*0.82*	0.81	*0.89*
Signif indep	0.00	*0.00*	0.01	*0.00*	0.00	*0.00*	0.00	*0.01*	0.00	*0.01*	0.00	*0.14*	0.00	*0.00*	0.00	*0.00*
Unemployment rate																
Success rate	0.69	*0.71*	0.88	*0.92*	0.75	*0.75*	0.88	*0.92*	0.46	*0.50*	0.95	*1.00*	0.91	*0.89*	0.92	*0.89*
Signif indep	0.02	*0.03*	0.00	*0.00*	0.00	*0.01*	0.00	*0.00*	0.52	*0.24*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Government bal.																
Success rate	0.88	*0.92*	0.71	*0.70*	0.78	*0.79*	0.55	*0.57*	0.74	*0.73*	0.68	*0.64*	0.69	*0.64*	0.92	*0.93*
Signif indep	0.00	*0.00*	0.02	*0.04*	0.00	*0.00*	0.55	*0.51*	0.04	*0.09*	0.55	*NA*	0.02	*0.13*	0.00	*0.00*
Current account																
Success rate	0.62	*0.65*	0.69	*0.71*	0.76	*0.73*	0.75	*0.79*	0.65	*0.60*	0.63	*0.64*	0.74	*0.77*	0.85	*0.88*
Signif indep	0.16	*0.09*	0.05	*0.10*	0.00	*0.01*	0.01	*0.00*	0.15	*0.52*	0.21	*0.38*	0.01	*0.01*	0.00	*0.00*

The success rate is the percentage share of successes. Signif. indep. is the significance level of the $\chi 2$-statistic for independence between the direction of change of forecasts and of realisations. With numbers below 0.05 the null hypothesis of independence can be rejected at the 5 % significance level.

Table A19: Directional accuracy – current year (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
Success rate	0.86	*0.93*	0.83	*0.82*	0.75	*0.75*	0.80	0.74	*0.73*	1.00	0.80	0.88	*0.83*	0.86	0.83	*0.82*
Signif indep	0.00	*0.00*	0.00	*0.00*	0.00	*0.01*	0.04	0.04	*0.12*	0.00	0.06	0.00	*0.00*	0.05	0.00	*0.00*
Inflation																
Success rate	0.89	*0.96*	0.75	*0.86*	0.83	*0.86*	0.70	0.84	*0.91*	0.70	1.00	0.81	*0.88*	0.71	0.81	*0.82*
Signif indep	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.20	0.01	*0.03*	0.09	0.00	0.00	*0.00*	0.15	0.00	*0.00*
Investment																
Success rate	0.72	*0.75*	0.81	*0.82*	0.86	*0.93*	0.70	0.68	*0.82*	0.80	0.80	0.78	*0.83*	0.57	0.81	*0.89*
Signif indep	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.09	0.06	*0.04*	0.04	0.04	0.00	*0.00*	0.81	0.00	*0.00*
Unemployment rate																
Success rate	0.69	*0.75*	0.63	*0.59*	0.86	*0.82*	0.70	0.79	*0.82*	0.90	0.60	0.84	*0.92*	0.86	0.92	*0.89*
Signif indep	0.02	*0.04*	0.28	*0.67*	0.00	*0.00*	0.11	0.01	*0.04*	0.04	0.49	0.00	*0.00*	0.05	0.00	*0.00*
Government bal.																
Success rate	0.75	*0.75*	0.68	*0.65*	0.64	*0.61*	0.90	0.89	*0.82*	0.90	0.70	0.78	*0.83*	1.00	0.92	*0.93*
Signif indep	0.00	*0.01*	0.07	*0.18*	0.03	*0.13*	0.01	0.00	*0.07*	0.01	0.09	0.00	*0.00*	0.01	0.00	*0.00*
Current account																
Success rate	0.76	*0.85*	0.71	*0.73*	0.62	*0.62*	0.70	0.79	*0.82*	0.60	0.80	0.75	*0.75*	0.57	0.85	*0.88*
Signif indep	0.00	*0.00*	0.01	*0.01*	0.24	*0.32*	0.49	0.01	*0.04*	0.60	0.10	0.01	*0.01*	0.66	0.00	*0.00*

The success rate is the percentage share of successes. Signif. indep. is the significance level of the $\chi 2$-statistic for independence between the direction of change of forecasts and of realisations. With numbers below 0.05 the null hypothesis of independence can be rejected at the 5 % significance level.

Table A20: Directional accuracy – year ahead

(Results from the original study of 1999 displayed in italics below)

	Belgium		Denmark		Germany		Ireland		Greece		Spain		France		European Union	
GDP																
Success rate	0.69	*0.85*	0.87	*0.78*	0.71	*0.78*	0.58	*0.74*	0.74	*0.67*	0.67	*0.80*	0.74	*0.78*	0.77	*0.78*
Signif indep	0.01	*0.00*	0.00	*0.01*	0.01	*0.01*	0.29	*0.02*	0.02	*0.18*	0.16	*0.04*	0.00	*0.00*	0.00	*0.00*
Inflation																
Success rate	0.66	*0.67*	0.65	*0.65*	0.66	*0.78*	0.68	*0.78*	0.70	*0.73*	0.56	*0.70*	0.63	*0.74*	0.71	*0.81*
Signif indep	0.06	*0.07*	0.14	*0.20*	0.07	*0.00*	0.07	*0.01*	0.21	*0.42*	0.87	*0.49*	0.16	*0.03*	0.01	*0.00*
Investment																
Success rate	0.66	*0.52*	0.61	*0.65*	0.54	*0.59*	0.71	*0.61*	0.65	*0.60*	0.83	*0.70*	0.83	*0.70*	0.77	*0.74*
Signif indep	0.06	*0.93*	0.18	*0.11*	0.56	*0.38*	0.03	*0.35*	0.02	*0.26*	0.00	*0.20*	0.00	*0.03*	0.00	*0.01*
Unemployment rate																
Success rate	0.71	*0.73*	0.68	*0.78*	0.65	*0.69*	0.65	*0.91*	0.65	*0.33*	0.78	*0.70*	0.65	*0.62*	0.82	*0.77*
Signif indep	0.03	*0.04*	0.05	*0.01*	0.11	*0.10*	0.10	*0.00*	0.10	*0.05*	0.03	*0.11*	0.18	*0.91*	0.00	*0.01*
Government bal.																
Success rate	0.65	*0.54*	0.61	*0.70*	0.57	*0.68*	0.48	*0.61*	0.65	*0.67*	0.67	*0.55*	0.69	*0.54*	0.63	*0.71*
Signif indep	0.09	*0.88*	0.23	*0.07*	0.38	*0.05*	0.76	*0.38*	0.18	*0.18*	0.88	*0.34*	0.03	*0.70*	0.18	*0.03*
Current account																
Success rate	0.50	*0.65*	0.52	*0.43*	0.68	*0.62*	0.68	*0.61*	0.43	*0.67*	0.50	*0.70*	0.65	*0.62*	0.62	*0.81*
Signif indep	0.90	*0.11*	0.88	*0.31*	0.08	*0.26*	0.05	*0.44*	0.51	*0.05*	0.91	*0.20*	0.09	*0.34*	0.20	*0.00*

The success rate is the percentage share of successes. Signif. indep. is the significance level of the $\chi 2$-statistic for independence between the direction of change of forecasts and of realisations. With numbers below 0.05 the null hypothesis of independence can be rejected at the 5 % significance level.

Table A20: Directional accuracy – year ahead (continued)

(Results from the original study of 1999 displayed in italics below)

	Italy		Luxembourg		Netherlands		Austria	Portugal		Finland	Sweden	United Kingdom		euro area	European Union	
GDP																
Success rate	0.69	*0.74*	0.60	*0.63*	0.57	*0.56*	0.70	0.67	*0.90*	0.80	0.80	0.81	*0.83*	0.83	0.77	*0.78*
Signif indep	0.01	*0.01*	0.23	*0.10*	0.38	*0.60*	0.11	0.15	*0.01*	0.04	0.04	0.00	*0.00*	0.08	0.00	*0.00*
Inflation																
Success rate	0.71	*0.63*	0.57	*0.70*	0.77	*0.70*	0.90	0.83	*0.70*	0.70	0.70	0.74	*0.83*	0.67	0.71	*0.81*
Signif indep	0.01	*0.15*	0.29	*0.03*	0.00	*0.04*	0.01	0.02	*0.60*	0.26	0.20	0.01	*0.00*	0.41	0.01	*0.00*
Investment																
Success rate	0.60	*0.59*	0.83	*0.48*	0.69	*0.63*	0.70	0.61	*0.60*	1.00	0.80	0.68	*0.74*	0.67	0.77	*0.74*
Signif indep	0.14	*0.30*	0.00	*0.86*	0.02	*0.18*	0.20	0.17	*0.53*	0.00	0.04	0.04	*0.02*	0.27	0.00	*0.01*
Unemployment rate																
Success rate	0.50	*0.46*	0.79	*0.67*	0.71	*0.77*	0.60	0.61	*0.70*	0.80	0.70	0.94	*0.83*	0.67	0.82	*0.77*
Signif indep	0.90	*0.39*	0.00	*0.31*	0.02	*0.01*	0.49	0.49	*0.20*	0.11	0.20	0.00	*0.00*	0.41	0.00	*0.01*
Government bal.																
Success rate	0.57	*0.54*	0.50	*0.48*	0.60	*0.57*	0.90	0.72	*0.55*	1.00	0.80	0.52	*0.75*	0.67	0.63	*0.71*
Signif indep	0.49	*0.90*	0.58	*0.85*	0.23	*0.51*	0.01	0.07	*0.43*	0.00	0.04	0.88	*0.02*	0.27	0.18	*0.03*
Current account																
Success rate	0.56	*0.65*	0.63	*0.50*	0.44	*0.69*	0.50	0.67	*0.80*	0.50	0.40	0.71	*0.74*	0.50	0.62	*0.81*
Signif indep	0.26	*0.07*	0.25	*0.77*	0.33	*0.14*	1.00	0.16	*0.04*	1.00	0.49	0.02	*0.02*	1.00	0.20	*0.00*

The success rate is the percentage share of successes. Signif. indep. is the significance level of the $\chi 2$-statistic for independence between the direction of change of forecasts and of realisations. With numbers below 0.05 the null hypothesis of independence can be rejected at the 5 % significance level.

Table A21: Basic characteristics of the sample data (international context)

(Results from the original study of 1999 displayed in italics below)

	US		Japan		World		Rest World		European Union				European Union				Euro Area			
	GDP				Import volume				Export volume		Import volume		Export prices		Import prices		Exp. vol.	Imp. Vol.	Exp.prices	Imp.prices
Current year																				
Sample	74/05	*74/97*	74/05	*74/97*	74/05	*74/97*	74/05	*74/97*	69/05	*69/97*	69/05	*6997*	69/05	*69/97*	69/05	*69/97*	99/05	99/05	99/05	99/05
No of obs.	32	*24*	32	*24*	32	*24*	32	*24*	37	*29*	37	*29*	37	*29*	37	*29*	7	7	7	7
MV(F)	2.39	*2.22*	2.64	*3.25*	5.23	*4.85*	5.51	*5.15*	5.52	*5.53*	5.56	*5.47*	3.60	*4.40*	3.73	*4.60*	5.41	5.67	0.47	0.43
MV(R)	2.58	*2.30*	2.74	*3.36*	5.29	*5.01*	5.56	*5.15*	5.52	*5.82*	5.58	*5.74*	4.14	*5.10*	4.29	*5.23*	4.54	4.66	0.97	1.59
ME	-0.19	*-0.08*	-0.10	*-0.11*	-0.06	*-0.16*	-0.06	*-0.01*	-0.01	*-0.30*	-0.02	*-0.27*	-0.55	*-0.70*	-0.56	*-0.63*	0.87	1.01	-0.50	-1.16
STD(R)	2.20	*2.39*	2.35	*2.16*	4.17	*4.27*	4.78	*4.80*	4.03	*4.14*	4.92	*5.24*	5.63	*5.94*	9.12	*9.98*	4.00	4.06	2.28	3.86
Year ahead																				
Sample	75/05	*75/97*	75/05	*75/97*	74/05	*74/97*	74/05	*74/97*	70/05	*70/97*	70/05	*70/97*	70/05	*70/97*	70/05	*70/97*	99/05	99/05	99/05	99/05
No of obs.	31	*23*	31	*23*	31	*24*	31	*24*	36	*28*	36	*28*	36	*28*	36	*28*	7	7	7	7
MV(F)	2.44	*2.40*	3.17	*3.81*	5.55	*5.14*	5.85	*5.46*	5.75	*5.72*	5.62	*5.49*	3.72	*4.39*	3.71	*4.41*	5.60	5.99	1.31	0.93
MV(R)	2.79	*2.63*	2.87	*3.58*	5.75	*5.37*	6.15	*5.72*	5.60	*5.87*	5.38	*5.35*	4.09	*5.03*	4.34	*5.34*	4.63	4.87	1.09	1.54
ME	-0.35	*-0.23*	0.30	*0.23*	-0.20	*-0.22*	-0.30	*-0.26*	0.15	*-0.15*	0.24	*0.14*	-0.37	*-0.64*	-0.64	*-0.93*	0.97	1.11	0.23	-0.61
STD(R)	2.06	*2.26*	2.24	*1.92*	3.82	*3.73*	4.41	*4.18*	3.90	*4.01*	4.24	*4.42*	5.55	*5.89*	8.60	*9.39*	3.90	4.05	2.37	4.02

Table A22: Basic characteristics of the sample data (international context)

(Results from the original study of 1999 displayed in italics below)

	US		Japan		World		Rest World		European Union				European Union				Euro Area			
	GDP				Import volume				Export volume		Import volume		Export prices		Import prices		Exp. vol.	Imp. Vol.	Exp.prices	Imp.prices
Current year																				
MAV	3.04	*2.90*	3.06	*3.51*	5.88	*5.79*	6.33	*6.16*	5.85	*6.24*	6.41	*6.78*	4.86	*5.75*	5.92	*6.83*	4.54	4.74	1.89	2.79
MAE	0.74	*0.74*	1.01	*0.86*	2.14	*2.01*	2.48	*2.35*	1.96	*1.86*	2.21	*2.18*	1.44	*1.48*	2.15	*2.20*	2.56	2.76	1.44	1.96
RMSE	1.00	*1.03*	1.29	*1.15*	2.99	*2.85*	3.31	*3.21*	2.53	*2.41*	2.90	*2.76*	2.29	*2.46*	3.79	*4.07*	3.17	3.79	1.65	2.57
THEIL1	0.38	*0.36*	0.65	*0.60*	0.49	*0.46*	0.50	*0.50*	0.48	*0.45*	0.47	*0.42*	0.45	*0.44*	0.36	*0.35*	0.53	0.71	0.52	0.47
THEIL2	0.46	*0.44*	0.56	*0.54*	0.73	*0.68*	0.70	*0.68*	0.64	*0.59*	0.60	*0.54*	0.41	*0.42*	0.42	*0.42*	0.86	1.01	0.78	0.72
THEIL2*	0.41		0.51		0.61		0.61		0.59		0.55		0.39		0.39		0.63	0.77	0.56	0.52
% of positive errors	44		47		41		38		43		49		51		59		57	57	29	14
Year ahead																				
MAV	3.12	*3.07*	3.05	*3.58*	6.11	*5.76*	6.60	*6.16*	5.91	*6.26*	5.89	*6.01*	4.70	*5.58*	5.75	*6.68*	4.63	4.87	1.94	2.80
MAE	1.22	*1.13*	1.24	*1.18*	2.77	*2.57*	3.32	*2.96*	2.72	*2.67*	3.10	*3.19*	2.49	*2.73*	4.14	*4.56*	3.11	3.26	1.69	2.73
RMSE	1.48	*1.39*	1.60	*1.40*	3.84	*3.63*	4.20	*3.80*	3.56	*3.57*	3.97	*4.09*	4.01	*4.44*	6.94	*7.71*	3.82	4.02	1.82	3.24
THEIL1	0.49	*0.42*	0.80	*0.74*	0.84	*0.84*	0.83	*0.42*	0.73	*0.73*	0.71	*0.67*	0.79	*0.79*	0.76	*0.76*	0.68	0.69	0.63	0.63
THEIL2	0.73	*0.63*	0.72	*0.74*	1.02	*1.00*	0.97	*0.93*	0.93	*0.91*	0.95	*0.94*	0.73	*0.77*	0.82	*0.84*	1.06	1.07	0.83	0.87
THEIL2*	0.65		0.65		1.03		0.97		0.84		0.85		0.64		0.72		0.93	0.77	0.74	0.81
% of positive errors	35		58		48		45		58		53		53		61		71	57	57	43

Table A23: Persistence in the forecast error (international context)

(Results from the original study of 1999 displayed in italics below)

	US		Japan		World		Rest World		European Union				European Union				Euro Area			
	GDP				Import volume				Export volume		Import volume		Export prices		Import prices		Exp. vol.	Imp. Vol.	Exp.prices	Imp.prices
Current year																				
ρ_1	-0.22		-0.21		-0.31		-0.23		-0.28		-0.09		0.14		0.13		-0.37	-0.14	-0.14	-0.03
Signif. ρ_1=0	0.19	*0.04*	0.22	*0.34*	0.06	*0.10*	0.17	*0.36*	0.08	*0.12*	0.58	*0.53*	0.38	*0.45*	0.41	*0.44*	0.23	0.65	0.64	0.93
ρ_2	-0.03		-0.25		-0.03		-0.01		0.09		-0.11		-0.21		-0.16		0.01	-0.30	-0.54	-0.57
Signif. ρ_2=0	0.42	*0.10*	0.15	*0.39*	0.17	*0.24*	0.39	*0.56*	0.17	*0.25*	0.66	*0.60*	0.27	*0.40*	0.41	*0.59*	0.49	0.51	0.14	0.13
ρ_3	-0.04		0.35		0.04		0.04		0.15		0.11		-0.05		-0.05		-0.35	-0.25	0.08	-0.10
Signif. ρ_3=0	0.61	0.20	0.04	0.45	0.31	0.42	0.58	0.76	0.21	0.30	0.72	0.52	0.44	0.57	0.59	0.77	0.34	0.51	0.26	0.24
Year ahead																				
ρ_1	-0.15		0.19		-0.25		-0.14		-0.29		-0.04		0.11		0.05		-0.53	-0.23	-0.12	-0.03
Signif. ρ_1=0	0.38	*0.35*	0.27	*0.34*	0.14	*0.24*	0.41	*0.64*	0.07	*0.17*	0.82	*0.91*	0.47	*0.58*	0.76	*0.80*	0.09	0.45	0.71	0.91
ρ_2	-0.18		-0.15		-0.10		-0.24		-0.10		-0.29		-0.01		0.00		0.25	-0.13	-0.30	-0.26
Signif. ρ_2=0	0.39	*0.32*	0.38	*0.56*	0.27	*0.48*	0.25	*0.65*	0.15	*0.21*	0.19	*0.10*	0.77	*0.85*	0.95	*0.97*	0.15	0.68	0.52	0.64
ρ_3	0.05		0.19		0.04		0.03		0.07		0.03		0.00		0.05		-0.40	-0.36	-0.31	-0.36
Signif. ρ_3=0	0.58	*0.48*	0.35	*0.75*	0.45	*0.63*	0.43	*0.82*	0.27	*0.34*	0.34	*0.18*	0.91	*0.96*	0.97	*0.98*	0.10	0.41	0.42	0.40

Table A24: Bias (international context)

(Results from the original study of 1999 displayed in italics below)

	US		Japan		World		Rest World		European Union				European Union				Euro Area			
	GDP				Import volume				Export volume		Import volume		Export prices		Import prices		Exp. vol.	Imp. Vol.	Exp.prices	Imp.prices
Current year																				
α	-0.19	*-0.08*	-0.10	*-0.11*	-0.06	*-0.16*	-0.06	*-0.01*	-0.01	*-0.30*	-0.02	*-0.27*	-0.55	*-0.70*	-0.56	*-0.63*	0.87	1.01	-0.50	-1.16
Signif. α=0	0.28	*0.71*	0.67	*0.65*	0.91	*0.79*	0.93	*0.99*	0.99	*0.52*	0.97	*0.61*	0.15	*0.13*	0.38	*0.41*	0.51	0.52	0.47	0.26
α_1	0.04	*0.04*	0.04	*0.04*	1.14	*1.14*	1.80	*1.80*	0.16	*0.16*	0.24	*0.24*	-1.55	*-1.55*	-1.81	*-1.81*				
α_2	-0.29	*-0.15*	-0.16	*-0.20*	-0.53	*-0.94*	-0.78	*-1.09*	-0.11	*-0.73*	-0.18	*-0.74*	0.07	*0.10*	0.20	*0.47*	0.87	1.01	-0.50	-1.16
Signif. α_1=α_2	0.05	*0.66*	0.43	*0.64*	0.00	*0.09*	0.00	*0.03*	0.60	*0.34*	0.47	*0.35*	0.00	*0.06*	0.00	*0.14*				
Year ahead																				
α	-0.35	*-0.23*	0.30	*0.23*	-0.20	*-0.22*	-0.30	*-0.26*	0.15	*-0.15*	0.24	*0.14*	-0.37	*-0.64*	-0.64	*-0.93*	0.97	1.11	0.23	-0.61
Signif. α=0	0.19	*0.43*	0.30	*0.44*	0.78	*0.77*	0.70	*0.75*	0.81	*0.83*	0.72	*0.86*	0.59	*0.46*	0.59	*0.54*	0.54	0.51	0.77	0.65
α_1	0.45	*0.44*	0.84	*0.83*	1.47	*1.46*	1.66	*1.66*	0.39	*0.39*	1.27	*1.27*	-2.64	*-2.63*	-4.19	*-4.19*				
α_2	-0.63	*-0.59*	0.11	*-0.09*	-0.88	*-1.23*	-1.10	*-1.41*	0.01	*-0.61*	-0.33	*-0.84*	0.92	*1.09*	1.37	*1.91*	0.97	1.11	0.23	-0.61
Signif. α_1=α_2	0.00	*0.09*	0.05	*0.14*	0.00	*0.08*	0.00	*0.06*	0.56	*0.48*	0.03	*0.19*	0.00	*0.03*	0.00	*0.04*				

Table A25: Efficiency (international context)

(Results from the original study of 1999 displayed in italics below)

	US		Japan		World		Rest World		European Union				European Union				Euro Area			
	GDP				Import volume				Export volume		Import volume		Export prices		Import prices		Exp. vol.	Imp. Vol.	Exp.prices	Imp.prices
Current year																				
α	0.40	*0.32*	0.02	*-0.29*	-1.57	*-2.14*	-2.07	*-2.18*	-0.24	*-0.10*	-1.13	*-1.24*	0.01	*0.07*	-0.54	*-0.76*	-0.08	1.43	0.30	0.87
Signif. α=0	0.14	*0.28*	0.96	*0.60*	0.26	*0.13*	0.15	*0.15*	0.80	*0.92*	0.24	*0.19*	0.99	*0.91*	0.40	*0.34*	0.98	0.73	0.70	0.38
β	0.91	*0.89*	1.03	*1.12*	1.31	*1.47*	1.39	*1.43*	1.04	*1.07*	1.21	*1.28*	1.15	*1.14*	1.29	*1.30*	0.85	0.57	1.42	1.66
Signif. β=1	0.31	*0.23*	0.81	*0.42*	0.20	*0.08*	0.10	*0.11*	0.76	*0.63*	0.16	*0.06*	0.07	*0.14*	0.00	*0.00*	0.80	0.53	0.54	0.23
Signif. α=0, β=1	0.33	*0.45*	0.89	*0.65*	0.44	*0.20*	0.26	*0.27*	0.96	*0.72*	0.37	*0.15*	0.07	*0.10*	0.00	*0.01*	0.79	0.67	0.64	0.26
Adj. R^2	0.79	*0.81*	0.68	*0.70*	0.48	*0.58*	0.53	*0.57*	0.58	*0.64*	0.65	*0.74*	0.85	*0.84*	0.87	*0.87*	0.20	-0.03	0.39	0.64
DW	1.95	*2.16*	2.13	*2.04*	2.61	*2.60*	2.46	*2.35*	2.53	*2.49*	2.19	*2.14*	1.84	*1.83*	1.72	*1.72*	2.66	1.98	2.12	1.93
Year ahead																				
α	0.00	*-0.52*	-0.06	*0.02*	3.58	*2.60*	2.28	*1.25*	1.21	*1.05*	1.68	*1.70*	-0.60	*-0.37*	-1.56	*-1.87*	2.27	2.73	-1.10	0.31
Signif. α=0	1.00	*0.38*	0.92	*0.99*	0.15	*0.34*	0.35	*0.61*	0.51	*0.62*	0.33	*0.37*	0.57	*0.80*	0.37	*0.43*	0.64	0.67	0.48	0.86
β	1.14	*1.31*	0.92	*0.93*	0.39	*0.54*	0.66	*0.52*	0.76	*0.84*	0.66	*0.66*	1.26	*1.23*	1.59	*1.63*	0.42	0.36	1.66	1.33
Signif. β=1	0.50	*0.15*	0.67	*0.77*	0.16	*0.36*	0.39	*0.67*	0.43	*0.65*	0.23	*0.29*	0.25	*0.41*	0.09	*0.14*	0.49	0.54	0.51	0.74
Signif. α=0, β=1	0.34	*0.26*	0.54	*0.71*	0.35	*0.63*	0.64	*0.86*	0.71	*0.88*	0.45	*0.55*	0.44	*0.53*	0.20	*0.28*	0.65	0.66	0.76	0.86
Adj. R^2	0.49	*0.64*	0.48	*0.44*	0.00	*0.01*	0.06	*0.11*	0.14	*0.16*	0.11	*0.12*	0.47	*0.42*	0.37	*0.32*	-0.13	-0.17	0.26	0.15
DW	2.23	*2.16*	1.49	*1.44*	2.07	*2.19*	1.93	*2.08*	2.46	*2.40*	1.96	*1.92*	1.90	*1.90*	2.05	*2.06*	2.57	2.00	2.00	2.00

Table A26: Unbiasedness and no serial correlation (international context)

	US	Japan	World	Rest World	European Union		European Union		Euro Area		Euro Area	
	GDP		Import volume		Export volume	Import volume	Export prices	Import prices	Export volume	Import volume	Export prices	Import prices
Current year												
α	-0.33	-0.24	-0.01	0.00	0.07	0.04	-0.46	-0.45	1.39	1.62	-0.80	-1.35
Signif. α=0	0.04	0.24	0.98	1.00	0.87	0.94	0.25	0.49	0.41	0.44	0.37	0.36
β	-0.22	-0.21	-0.32	-0.23	-0.28	-0.09	0.14	0.13	-0.37	-0.14	-0.14	-0.02
Signif. β=0	0.16	0.18	0.08	0.21	0.09	0.61	0.42	0.44	0.46	0.79	0.79	0.97
Signif. α=0, β=0	0.07	0.22	0.21	0.44	0.22	0.87	0.29	0.54	0.58	0.72	0.63	0.59
Year ahead												
α	-0.50	0.15	-0.34	-0.29	0.21	-0.04	-0.23	-0.53	1.45	1.62	0.08	-0.59
Signif. α=0	0.07	0.60	0.65	0.73	0.72	0.95	0.74	0.66	0.44	0.48	0.94	0.75
β	-0.15	0.19	-0.32	-0.18	-0.29	-0.04	0.11	0.05	-0.54	-0.23	-0.12	-0.04
Signif. β=0	0.40	0.29	0.13	0.41	0.09	0.82	0.51	0.78	0.28	0.65	0.83	0.95
Signif. α=0, β=0	0.17	0.43	0.31	0.70	0.22	0.97	0.74	0.86	0.45	0.72	0.97	0.94

Table A27: Directional accuracy (international context)

(Results from the original study of 1999 displayed in italics below)

	US		Japan		World		Rest World		European Union				European Union				Euro Area			
	GDP				Import volume				Export volume		Import volume		Export prices		Import prices		Exp. vol.	Imp. Vol.	Exp.prices	Imp.prices
Current year																				
Success rate(%)	0.84	*0.91*	0.84	*0.87*	0.90	*0.91*	0.81	*0.74*	0.75	*0.75*	0.86	*0.86*	0.89	*0.86*	0.92	*0.89*	0.67	0.83	1.00	1.00
Signif. indep.	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.22	0.08	0.01	0.01
Year ahead																				
Success rate(%)	0.70	*0.86*	0.67	*0.73*	0.66	*0.70*	0.72	*0.74*	0.80	*0.70*	0.74	*0.70*	0.83	*0.74*	0.83	*0.81*	0.83	0.83	1.00	1.00
Signif. indep.	0.00	*0.00*	0.07	*0.03*	0.08	*0.06*	0.01	*0.01*	0.00	*0.03*	0.00	*0.03*	0.00	*0.01*	0.00	*0.00*	0.08	0.08	0.01	0.01

ANNEX B

Table B1: Comparison of Commission, Consensus and IMF forecasts

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Sample	90/05	90/05	90/05	90/05	94/05	90/05	90/05	90/05	90/05	95/05	90/05	95/05	95/05	90/05
No of obs.	16	16	16	16	12	16	16	16	16	11	16	11	11	16
ME(COMM)	0.14	0.11	-0.06	-1.16	-0.30	-0.01	0.16	0.48	0.06	0.15	0.50	0.16	-0.09	0.09
ME(CONS)	0.17	0.04	-0.14	-1.72	-0.49	0.03	0.22	0.43	0.00	0.15	0.63	-0.26	-0.08	0.10
ME(IMF)	0.18	-0.05	0.07	-0.76	-0.41	0.04	0.18	0.45	0.13	0.16	0.59	-0.07	-0.04	0.10
MAE(COMM)	0.64	0.66	0.63	1.66	0.37	0.45	0.54	0.63	0.74	0.50	0.68	0.96	0.58	0.56
MAE(CONS)	0.80	0.64	0.59	2.22	0.51	0.49	0.59	0.63	0.67	0.60	0.87	1.17	0.63	0.56
MAE(IMF)	0.67	0.79	0.61	1.29	0.41	0.49	0.50	0.73	0.70	0.53	0.73	1.12	0.65	0.53
RMSE(COMM)	0.79	0.80	0.80	1.95	0.41	0.58	0.62	0.73	0.95	0.71	0.87	1.31	0.82	0.69
RMSE(CONS)	0.95	0.88	0.86	2.61	0.61	0.70	0.68	0.75	0.88	0.74	1.16	1.47	0.82	0.72
RMSE(IMF)	0.84	0.98	0.85	1.56	0.48	0.68	0.62	0.87	0.89	0.64	0.98	1.43	0.84	0.70
THEIL1(COMM)	0.48	0.56	0.46	0.70	0.84	0.46	0.43	0.56	0.76	0.65	0.59	0.60	0.63	0.49
THEIL1(CONS)	0.57	0.61	0.50	0.94	1.23	0.56	0.47	0.57	0.71	0.68	0.78	0.67	0.64	0.51
THEIL1(IMF)	0.53	0.60	0.45	0.68	1.16	0.56	0.43	0.64	0.73	0.56	0.73	0.66	0.64	0.49
THEIL2(COMM)	0.63	0.76	0.56	0.64	0.45	0.47	0.58	0.75	0.70	0.83	0.53	0.79	0.87	0.48
THEIL2(CONS)	0.75	0.83	0.61	0.85	0.66	0.57	0.64	0.78	0.66	0.86	0.71	0.88	0.88	0.49
THEIL2(IMF)	0.70	0.85	0.64	0.62	0.56	0.56	0.60	0.87	0.67	0.75	0.63	0.88	0.90	0.48
THEIL2*(COMM)	0.53	0.67	0.48	0.57	0.39	0.40	0.51	0.66	0.64	0.71	0.46	0.69	0.72	0.40
THEIL2*(CONS)	0.64	0.74	0.52	0.76	0.56	0.49	0.55	0.69	0.59	0.73	0.62	0.77	0.72	0.42
THEIL2*(IMF)	0.60	0.75	0.53	0.56	0.48	0.49	0.52	0.77	0.60	0.64	0.56	0.76	0.73	0.41
Success rate(COMM)	80	93	80	80	82	93	93	73	73	80	73	100	80	93
Success rate(CONS)	80	87	87	73	64	87	93	80	60	80	67	100	80	100
Success rate(IMF)	80	87	80	73	73	93	93	80	73	70	80	100	80	100
% of positive errors(COMM)	50	69	44	25	17	50	63	81	50	64	81	55	45	63
% of positive errors(CONS)	56	56	44	25	17	56	69	69	44	55	69	36	55	56
% of positive errors(IMF)	56	38	44	31	0	56	69	75	63	64	75	36	64	75

Table B1: Comparison of Commission, Consensus and IMF forecasts (continued)

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Year ahead														
Sample	91/05	91/05	90/05	91/05	94/05	91/05	90/05	90/05	91/05	95/05	91/05	95/05	95/05	90/05
No of obs.	15	15	16	15	12	15	16	16	15	11	15	11	11	16
ME(COMM)	0.41	0.16	0.36	-2.00	-0.41	0.12	0.48	0.80	0.07	0.36	0.73	-0.07	0.22	0.40
ME(CONS)	0.59	0.10	0.37	-2.32	-0.47	0.28	0.50	0.82	0.25	0.43	1.07	-0.33	0.23	0.42
ME(IMF)	0.59	-0.06	0.85	-1.74	-0.45	0.35	0.74	1.03	0.40	0.43	1.05	0.13	0.24	0.51
MAE(COMM)	1.04	0.68	0.93	2.40	0.49	0.68	0.86	0.98	0.92	0.71	0.91	1.27	0.80	0.86
MAE(CONS)	1.25	0.78	1.00	2.72	0.55	0.83	0.96	1.02	1.04	0.86	1.31	1.33	0.77	0.89
MAE(IMF)	1.18	0.94	1.32	2.31	0.48	0.77	1.07	1.18	1.04	1.11	1.37	1.35	0.83	0.99
RMSE(COMM)	1.25	0.91	1.14	2.88	0.54	0.95	1.04	1.14	1.18	0.95	1.19	1.59	1.06	1.17
RMSE(CONS)	1.49	1.02	1.26	3.30	0.66	1.16	1.20	1.15	1.24	1.03	1.73	1.73	1.04	1.23
RMSE(IMF)	1.50	1.22	1.65	2.69	0.59	1.06	1.41	1.34	1.33	1.22	1.83	1.59	1.04	1.36
THEIL1(COMM)	0.67	0.62	0.59	0.99	0.64	0.60	0.64	0.77	0.67	0.74	0.72	0.78	0.75	0.77
THEIL1(CONS)	0.89	0.87	0.75	0.94	0.71	0.73	0.82	0.83	0.80	0.87	1.02	0.81	0.77	0.82
THEIL1(IMF)	0.85	0.90	0.86	0.97	0.72	0.72	0.94	0.93	0.84	0.93	1.06	0.78	0.81	0.88
THEIL2(COMM)	0.96	0.88	0.80	1.04	0.57	0.73	0.97	1.17	0.84	1.23	0.77	0.99	1.13	0.81
THEIL2(CONS)	1.14	0.99	0.89	1.19	0.70	0.88	1.12	1.19	0.89	1.34	1.12	1.08	1.11	0.85
THEIL2(IMF)	1.22	1.16	1.27	1.00	0.66	0.84	1.29	1.38	0.98	1.39	1.13	0.92	1.11	0.94
THEIL2*(COMM)	0.82	0.77	0.68	0.92	0.50	0.62	0.83	1.04	0.76	1.07	0.68	0.86	0.93	0.68
THEIL2*(CONS)	0.89	0.79	0.65	0.92	0.50	0.66	0.94	0.98	0.72	1.03	0.87	0.87	0.91	0.67
THEIL2*(IMF)	0.97	0.95	1.09	0.79	0.47	0.63	1.08	1.14	0.80	1.10	0.86	0.73	0.91	0.73
Success rate(COMM)	64	86	67	50	55	57	73	60	50	70	64	80	80	80
Success rate(CONS)	57	79	73	57	64	57	67	60	50	50	50	70	80	73
Success rate(IMF)	50	71	53	64	82	57	47	47	50	60	50	80	90	87
% of positive errors(COMM)	67	47	75	13	17	53	63	81	40	55	73	45	55	69
% of positive errors(CONS)	60	67	69	20	25	40	63	81	53	55	73	45	64	63
% of positive errors(IMF)	67	47	75	20	17	47	69	81	53	64	67	55	55	69

Table B2: Comparison of Commission and Consensus forecasts: Proportion of positive forecast differentials

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
%	63	56	63	69	67	56	63	81	56	64	50	91	45	50
GDP - Year ahead														
%	47	53	44	60	67	47	56	38	40	64	40	82	55	56

Table B3: Comparison of Commission and Consensus forecasts: Bias

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP-current year														
α (COMM)	0.14	0.11	-0.06	-1.16	-0.30	-0.01	0.16	0.48	0.06	0.15	0.50	0.16	-0.09	0.09
Signif. α=0 (COMM)	0.50	0.61	0.79	0.01	0.01	0.93	0.31	0.00	0.80	0.50	0.02	0.70	0.73	0.63
α (CONS)	0.17	0.04	-0.14	-1.72	-0.49	0.03	0.22	0.43	0.00	0.15	0.63	-0.26	-0.08	0.10
Signif. α=0 (CONS)	0.49	0.86	0.54	0.00	0.00	0.87	0.21	0.02	1.00	0.54	0.02	0.58	0.78	0.61
GDP-year ahead														
α (COMM)	0.41	0.16	0.36	-2.00	-0.41	0.12	0.48	0.80	0.07	0.36	0.73	-0.07	0.22	0.40
Signif. α=0 (COMM)	0.21	0.51	0.22	0.00	0.00	0.64	0.06	0.00	0.84	0.22	0.01	0.89	0.52	0.18
α (CONS)	0.59	0.10	0.37	-2.32	-0.47	0.28	0.50	0.82	0.25	0.43	1.07	-0.33	0.23	0.42
Signif. α=0 (CONS)	0.13	0.73	0.26	0.00	0.01	0.38	0.10	0.00	0.45	0.18	0.01	0.56	0.50	0.18

Table B4: Comparison of Commission and Consensus forecasts: Unbiasedness and no serial correlation

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP-current year														
α(COMM)	0.21	0.13	0.00	-1.69	-0.24	-0.03	0.18	0.59	0.03	0.06	0.42	0.08	-0.08	0.03
Signif. α=0(COMM)	0.35	0.56	0.99	0.01	0.11	0.85	0.31	0.01	0.90	0.81	0.09	0.86	0.80	0.88
Signif. α=0(COMM)-bootstrap	0.32	0.54	0.98	0.00	0.12	0.89	0.32	0.00	0.89	0.77	0.12	0.80	0.80	0.87
β(COMM)	-0.17	-0.27	-0.06	-0.40	0.15	0.30	-0.23	-0.35	0.28	0.12	0.23	-0.20	-0.01	-0.05
Signif. β=0(COMM)	0.56	0.34	0.82	0.15	0.68	0.31	0.41	0.20	0.32	0.72	0.41	0.58	0.97	0.85
Signif. β=0(COMM)-bootstrap	0.66	0.39	0.98	0.13	0.36	0.10	0.45	0.21	0.12	0.39	0.19	0.67	0.76	1.00
Signif. α=0, β=0(COMM)	0.56	0.58	0.97	0.02	0.05	0.58	0.49	0.02	0.58	0.88	0.04	0.84	0.96	0.97
α(CONS)	0.26	0.09	-0.06	-1.48	-0.54	0.00	0.27	0.55	0.02	0.04	0.46	-0.37	-0.02	0.06
Signif. α=0(CONS)	0.32	0.71	0.79	0.08	0.01	0.99	0.16	0.01	0.92	0.88	0.14	0.51	0.94	0.76
Signif. α=0(CONS)-bootstrap	0.30	0.74	0.75	0.09	0.01	0.99	0.14	0.01	0.92	0.85	0.18	0.61	0.92	0.78
β(CONS)	-0.24	-0.38	0.07	0.13	0.01	0.10	-0.35	-0.41	0.26	0.09	0.39	-0.04	-0.07	0.05
Signif. β=0(CONS)	0.38	0.17	0.80	0.66	0.97	0.73	0.20	0.14	0.34	0.78	0.14	0.91	0.85	0.85
Signif. β=0(CONS)-bootstrap	0.43	0.13	0.53	0.39	0.75	0.46	0.18	0.13	0.13	0.48	0.04	0.83	0.95	0.62
Signif. α=0, β=0(CONS)	0.45	0.37	0.92	0.03	0.00	0.94	0.24	0.03	0.63	0.94	0.02	0.79	0.98	0.93
GDP-year ahead														
α(COMM)	0.52	0.27	0.54	-2.57	-0.30	0.08	0.64	1.06	0.08	0.37	0.70	-0.17	0.32	0.20
Signif. α=0(COMM)	0.16	0.32	0.09	0.01	0.12	0.79	0.04	0.00	0.82	0.27	0.06	0.77	0.41	0.52
Signif. α=0(COMM)-bootstrap	0.14	0.31	0.14	0.01	0.12	0.78	0.03	0.00	0.79	0.19	0.05	0.82	0.36	0.60
β(COMM)	-0.30	-0.34	-0.23	-0.21	0.23	0.24	-0.36	-0.37	0.03	-0.28	-0.02	-0.14	-0.27	0.39
Signif. β=0(COMM)	0.32	0.24	0.37	0.46	0.50	0.44	0.20	0.20	0.93	0.40	0.94	0.69	0.44	0.14
Signif. β=0(COMM)-bootstrap	0.34	0.23	0.39	0.53	0.19	0.17	0.18	0.20	0.66	0.42	0.85	0.83	0.47	0.03
Signif. α=0, β=0(COMM)	0.30	0.38	0.20	0.01	0.02	0.67	0.10	0.01	0.97	0.47	0.08	0.89	0.57	0.18
α(CONS)	0.55	0.11	0.54	-1.72	-0.36	0.11	0.67	0.98	0.21	0.32	0.62	-0.32	0.33	0.23
Signif. α=0(CONS)	0.23	0.71	0.12	0.07	0.06	0.74	0.06	0.01	0.58	0.41	0.20	0.63	0.40	0.49
Signif. α=0(CONS)-bootstrap	0.23	0.73	0.12	0.11	0.10	0.78	0.03	0.01	0.58	0.40	0.30	0.71	0.38	0.54
β(CONS)	0.03	-0.30	-0.11	0.33	0.40	0.34	-0.32	-0.23	0.15	0.10	0.42	0.05	-0.21	0.36
Signif. β=0(CONS)	0.91	0.31	0.68	0.22	0.17	0.25	0.25	0.43	0.61	0.78	0.14	0.89	0.56	0.18
Signif. β=0(CONS)-bootstrap	0.67	0.29	0.79	0.07	0.06	0.06	0.23	0.50	0.34	0.47	0.03	0.56	0.63	0.04
Signif. α=0, β=0(CONS)	0.40	0.57	0.29	0.00	0.00	0.40	0.14	0.01	0.69	0.57	0.02	0.86	0.63	0.21

Table B5: Comparison of Commission and Consensus forecasts: Regressions of COMM forecast errors on CONS forecasts

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Constant	-0.27	0.09	-0.25	-0.58	-0.78	-0.01	-0.24	0.34	-0.46	-0.59	1.26	-0.63	-0.83	0.14
P-value	0.62	0.90	0.50	0.61	0.02	0.98	0.56	0.36	0.42	0.43	0.02	0.68	0.39	0.70
Consensus forecast	0.21	0.01	0.12	-0.12	0.17	0.00	0.19	0.08	0.26	0.37	-0.31	0.25	0.31	-0.03
P-value	0.42	0.98	0.52	0.58	0.10	1.00	0.29	0.68	0.32	0.30	0.11	0.58	0.43	0.86
GDP - Year ahead														
Constant	-2.36	-0.74	-0.12	-3.32	-1.15	-0.01	-0.94	0.42	-1.01	-4.62	1.32	-4.87	-1.89	1.44
P-value	0.14	0.57	0.90	0.10	0.02	0.99	0.30	0.65	0.38	0.01	0.30	0.13	0.30	0.21
Consensus forecast	1.22	0.39	0.23	0.28	0.25	0.05	0.61	0.18	0.47	2.06	-0.22	1.45	0.79	-0.45
P-value	0.08	0.48	0.60	0.47	0.08	0.91	0.12	0.67	0.33	0.00	0.63	0.13	0.24	0.34

Table B6: Comparison of Commission and Consensus forecasts: Squared-error loss differentials (with small sample correction)

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Mean differential	-0.27	-0.13	-0.10	-3.00	-0.20	-0.16	-0.08	-0.04	0.12	-0.04	-0.58	-0.42	-0.01	-0.04
P-value	0.17	0.69	0.63	0.02	0.08	0.15	0.31	0.58	0.32	0.49	0.12	0.25	0.93	0.77
GDP - Year ahead														
Mean differential	-0.66	-0.21	-0.30	-2.59	-0.15	-0.43	-0.36	-0.03	-0.14	-0.17	-1.59	-0.46	0.05	-0.14
P-value	0.32	0.49	0.39	0.15	0.40	0.28	0.24	0.85	0.70	0.28	0.05	0.29	0.76	0.61

Table B7: Comparison of Commission and Consensus forecasts: Test for forecast encompassing (with small sample correction)

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Constant	-0.04	0.11	0.02	-0.95	0.01	-0.04	0.00	0.00	0.13	0.02	-0.18	-0.07	0.02	0.05
P-value	0.76	0.17	0.41	0.97	0.45	0.78	0.44	0.54	0.04	0.30	0.90	0.67	0.35	0.20
GDP - Year ahead														
Constant	-0.18	0.02	-0.04	-0.76	0.10	-0.15	-0.14	0.01	0.08	0.01	-0.52	-0.10	0.05	-0.02
P-value	0.75	0.46	0.63	0.82	0.19	0.82	0.87	0.46	0.31	0.47	0.96	0.68	0.25	0.55

Table B8: Comparison of Commission and Consensus forecasts: Regressions of realisations on COMM and CONS forecasts

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Commission forecast	1.50	0.70	0.93	1.33	0.72	1.53	1.21	2.19	0.13	1.03	1.41	2.67	0.67	0.60
P-value	0.02	0.08	0.16	0.02	0.01	0.02	0.09	0.03	0.89	0.27	0.01	0.08	0.62	0.27
Consensus forecast	-0.83	0.28	-0.04	-0.26	0.17	-0.53	-0.45	-1.36	0.86	-0.40	-0.17	-2.10	0.03	0.45
P-value	0.27	0.57	0.96	0.69	0.52	0.38	0.58	0.19	0.50	0.71	0.76	0.21	0.98	0.45
GDP - Year ahead														
Commission forecast	1.75	0.97	1.50	1.40	0.73	2.24	2.90	0.73	1.07	1.19	1.63	2.79	0.03	1.08
P-value	0.01	0.09	0.06	0.05	0.00	0.01	0.00	0.57	0.21	0.03	0.00	0.04	0.98	0.24
Consensus forecast	-2.21	-0.36	-0.90	-0.81	0.13	-1.45	-2.61	0.15	-0.58	-2.30	-0.45	-3.97	0.19	0.37
P-value	0.04	0.64	0.42	0.41	0.65	0.15	0.01	0.93	0.66	0.02	0.44	0.06	0.91	0.72

Table B9: Comparison of Commission and Consensus forecasts: RMSE of forecast combination: $y^{COMM} + a(y^{COMM} - y^{CONS})$

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
RMSE(COMM)	0.79	0.80	0.80	1.95	0.41	0.58	0.62	0.73	0.95	0.71	0.87	1.31	0.82	0.69
RMSE(a=-0.5)	0.84	0.79	0.81	2.24	0.47	0.63	0.63	0.74	0.90	0.71	1.00	1.37	0.81	0.68
RMSE(a=-0.25)	0.81	0.78	0.80	2.08	0.43	0.60	0.62	0.73	0.92	0.71	0.93	1.33	0.82	0.68
RMSE(a=0.1)	0.79	0.82	0.80	1.90	0.42	0.57	0.62	0.73	0.96	0.71	0.85	1.31	0.82	0.70
RMSE(a=0.25)	0.78	0.85	0.81	1.84	0.43	0.56	0.62	0.73	0.99	0.72	0.82	1.31	0.83	0.72
RMSE(a=0.5)	0.79	0.92	0.84	1.77	0.48	0.56	0.64	0.73	1.04	0.74	0.79	1.32	0.84	0.75
GDP - Year ahead														
RMSE(COMM)	1.25	0.91	1.14	2.88	0.54	0.95	1.04	1.14	1.18	0.95	1.19	1.59	1.06	1.17
RMSE(a=-0.5)	1.35	0.93	1.18	3.05	0.53	1.04	1.11	1.14	1.18	0.97	1.44	1.65	1.04	1.19
RMSE(a=-0.25)	1.29	0.91	1.16	2.96	0.51	1.00	1.07	1.14	1.17	0.95	1.31	1.62	1.05	1.18
RMSE(a=0.1)	1.24	0.91	1.14	2.86	0.56	0.94	1.02	1.14	1.19	0.95	1.15	1.59	1.07	1.17
RMSE(a=0.25)	1.22	0.92	1.14	2.83	0.60	0.92	1.00	1.14	1.20	0.95	1.09	1.58	1.07	1.17
RMSE(a=0.5)	1.21	0.95	1.14	2.79	0.69	0.89	0.98	1.15	1.25	0.97	1.01	1.58	1.09	1.18

Table B10: Comparison of Commission and IMF forecasts: Proportion of positive forecast differentials

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
%	56	69	50	81	67	63	50	56	56	45	50	82	55	63
GDP - Year ahead														
%	33	60	38	47	58	40	19	25	33	73	40	36	64	44

Table B11: Comparison of Commission and IMF forecasts: Bias

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP-current year														
α (COMM)	0.14	0.11	-0.06	-1.16	-0.30	-0.01	0.16	0.48	0.06	0.15	0.50	0.16	-0.09	0.09
Signif. α=0 (COMM)	0.50	0.61	0.79	0.01	0.01	0.93	0.31	0.00	0.80	0.50	0.02	0.70	0.73	0.63
α (IMF)	0.18	-0.05	0.07	-0.76	-0.41	0.04	0.18	0.45	0.13	0.16	0.59	-0.07	-0.04	0.10
Signif. α=0 (IMF)	0.41	0.83	0.74	0.05	0.00	0.80	0.26	0.04	0.57	0.44	0.01	0.88	0.90	0.57
GDP-year ahead														
α (COMM)	0.41	0.16	0.36	-2.00	-0.41	0.12	0.48	0.80	0.07	0.36	0.73	-0.07	0.22	0.40
Signif. α=0 (COMM)	0.21	0.51	0.22	0.00	0.00	0.64	0.06	0.00	0.84	0.22	0.01	0.89	0.52	0.18
α (IMF)	0.59	-0.06	0.85	-1.74	-0.45	0.35	0.74	1.03	0.40	0.43	1.05	0.13	0.24	0.51
Signif. α=0 (IMF)	0.13	0.86	0.03	0.01	0.00	0.21	0.03	0.00	0.26	0.26	0.02	0.80	0.46	0.14

Table B12: Comparison of Commission and IMF forecasts: Unbiasedness and no serial correlation

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP-current year														
α(COMM)	0.21	0.13	0.00	-1.69	-0.24	-0.03	0.18	0.59	0.03	0.06	0.42	0.08	-0.08	0.03
Signif. α=0(COMM)	0.35	0.56	0.99	0.01	0.11	0.85	0.31	0.01	0.90	0.81	0.09	0.86	0.80	0.88
Signif. α=0(COMM)-bootstrap	0.32	0.54	0.98	0.00	0.12	0.89	0.32	0.00	0.89	0.77	0.12	0.80	0.80	0.87
β(COMM)	-0.17	-0.27	-0.06	-0.40	0.15	0.30	-0.23	-0.35	0.28	0.12	0.23	-0.20	-0.01	-0.05
Signif. β=0(COMM)	0.56	0.34	0.82	0.15	0.68	0.31	0.41	0.20	0.32	0.72	0.41	0.58	0.97	0.85
Signif. β=0(COMM)-bootstrap	0.66	0.39	0.98	0.13	0.36	0.10	0.45	0.21	0.12	0.39	0.19	0.67	0.76	1.00
Signif. α=0, β=0(COMM)	0.56	0.58	0.97	0.02	0.05	0.58	0.49	0.02	0.58	0.88	0.04	0.84	0.96	0.97
α(IMF)	0.21	-0.03	0.17	-1.12	-0.43	0.01	0.24	0.50	0.10	0.08	0.52	-0.21	0.03	0.08
Signif. α=0(IMF)	0.39	0.91	0.45	0.02	0.00	0.95	0.14	0.05	0.70	0.73	0.07	0.69	0.93	0.69
Signif. α=0(IMF)-bootstrap	0.36	0.85	0.43	0.01	0.00	0.92	0.15	0.05	0.74	0.73	0.09	0.80	0.96	0.76
β(IMF)	-0.10	-0.27	-0.30	-0.38	-0.19	0.18	-0.46	-0.23	0.11	0.06	0.20	-0.17	-0.22	-0.14
Signif. β=0(IMF)	0.71	0.34	0.26	0.17	0.44	0.53	0.09	0.40	0.68	0.85	0.48	0.64	0.53	0.62
Signif. β=0(IMF)-bootstrap	0.83	0.37	0.27	0.16	0.32	0.28	0.07	0.48	0.42	0.63	0.23	0.77	0.55	0.71
Signif. α=0, β=0(IMF)	0.66	0.62	0.42	0.06	0.00	0.80	0.13	0.13	0.83	0.90	0.03	0.84	0.80	0.82
GDP-year ahead														
α(COMM)	0.52	0.27	0.54	-2.57	-0.30	0.08	0.64	1.06	0.08	0.37	0.70	-0.17	0.32	0.20
Signif. α=0(COMM)	0.16	0.32	0.09	0.01	0.12	0.79	0.04	0.00	0.82	0.27	0.06	0.77	0.41	0.52
Signif. α=0(COMM)-bootstrap	0.14	0.31	0.14	0.01	0.12	0.78	0.03	0.00	0.79	0.19	0.05	0.82	0.36	0.60
β(COMM)	-0.30	-0.34	-0.23	-0.21	0.23	0.24	-0.36	-0.37	0.03	-0.28	-0.02	-0.14	-0.27	0.39
Signif. β=0(COMM)	0.32	0.24	0.37	0.46	0.50	0.44	0.20	0.20	0.93	0.40	0.94	0.69	0.44	0.14
Signif. β=0(COMM)-bootstrap	0.34	0.23	0.39	0.53	0.19	0.17	0.18	0.20	0.66	0.42	0.85	0.83	0.47	0.03
Signif. α=0, β=0(COMM)	0.30	0.38	0.20	0.01	0.02	0.67	0.10	0.01	0.97	0.47	0.08	0.89	0.57	0.18
α(IMF)	0.64	-0.09	1.43	-1.57	-0.69	0.20	0.98	1.17	0.26	0.34	1.04	0.02	0.34	0.16
Signif. α=0(IMF)	0.17	0.80	0.00	0.05	0.00	0.53	0.02	0.01	0.50	0.46	0.06	0.97	0.40	0.61
Signif. α=0(IMF)-bootstrap	0.16	0.83	0.00	0.06	0.00	0.55	0.01	0.01	0.51	0.48	0.07	0.96	0.39	0.73
β(IMF)	-0.12	-0.22	-0.49	0.23	-0.44	0.27	-0.30	-0.13	0.20	0.04	0.13	0.11	-0.12	0.50
Signif. β=0(IMF)	0.69	0.45	0.04	0.39	0.13	0.35	0.28	0.67	0.49	0.91	0.66	0.75	0.73	0.05
Signif. β=0(IMF)-bootstrap	0.88	0.49	0.03	0.20	0.07	0.11	0.27	0.81	0.25	0.69	0.38	0.41	0.90	0.01
Signif. α=0, β=0(IMF)	0.37	0.72	0.00	0.01	0.00	0.37	0.06	0.00	0.52	0.69	0.05	0.95	0.68	0.06

Table B13: Comparison of Commission and IMF forecasts: Regressions of COMM forecast errors on IMF forecasts

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Constant	-0.14	-0.37	-0.24	0.20	-0.72	0.03	-0.28	0.25	-0.40	-0.32	0.97	-0.59	-0.82	0.12
P-value	0.78	0.59	0.52	0.87	0.02	0.94	0.49	0.50	0.47	0.68	0.02	0.69	0.45	0.71
IMF forecast	0.14	0.24	0.11	-0.27	0.14	-0.02	0.21	0.14	0.22	0.23	-0.19	0.23	0.30	-0.02
P-value	0.55	0.46	0.55	0.24	0.12	0.92	0.24	0.49	0.35	0.53	0.17	0.60	0.49	0.90
GDP - Year ahead														
Constant	-3.12	-1.99	-1.10	-2.79	-1.21	1.00	-2.04	0.33	-1.29	-2.01	1.04	-1.51	-1.88	1.36
P-value	0.04	0.10	0.35	0.23	0.00	0.50	0.06	0.77	0.26	0.07	0.22	0.53	0.37	0.35
IMF forecast	1.50	0.96	0.61	0.16	0.27	-0.30	0.98	0.20	0.57	1.01	-0.11	0.40	0.78	-0.40
P-value	0.02	0.08	0.20	0.72	0.01	0.55	0.02	0.68	0.22	0.03	0.69	0.54	0.32	0.50

Table B14: Comparison of Commission and IMF forecasts: Squared-error loss differentials (with small sample correction)

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Mean differential	-0.08	-0.31	-0.08	1.37	-0.06	-0.13	0.00	-0.23	0.10	0.10	-0.20	-0.32	-0.04	-0.01
P-value	0.71	0.32	0.63	0.08	0.44	0.20	0.98	0.12	0.53	0.59	0.44	0.20	0.78	0.95
GDP - Year ahead														
Mean differential	-0.67	-0.66	-1.42	1.05	-0.06	-0.21	-0.93	-0.50	-0.37	-0.60	-1.94	0.02	0.04	-0.47
P-value	0.42	0.14	0.13	0.40	0.57	0.62	0.15	0.06	0.46	0.09	0.10	0.96	0.84	0.14

Table B15: Comparison of Commission and IMF forecasts: Test for forecast encompassing (with small sample correction)

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Constant	0.06	0.09	0.16	1.44	0.01	-0.02	0.05	-0.06	0.13	0.09	-0.01	-0.07	0.06	0.05
P-value	0.27	0.26	0.09	0.01	0.36	0.65	0.11	0.84	0.10	0.18	0.52	0.78	0.17	0.16
GDP - Year ahead														
Constant	-0.15	-0.11	-0.13	1.18	0.03	0.01	-0.32	-0.16	0.09	-0.07	-0.45	0.23	0.09	-0.12
P-value	0.69	0.76	0.67	0.03	0.31	0.48	0.92	0.92	0.34	0.70	0.85	0.18	0.18	0.78

Table B16: Comparison of Commission and IMF forecasts: Regressions of realisations on COMM and IMF forecasts

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
Commission forecast	1.14	0.97	0.66	0.57	0.21	1.32	1.54	1.94	0.34	0.39	1.43	1.94	0.64	0.47
P-value	0.04	0.03	0.51	0.23	0.42	0.04	0.03	0.00	0.63	0.59	0.00	0.12	0.44	0.51
IMF forecast	-0.29	-0.21	0.27	0.79	0.71	-0.35	-0.83	-1.10	0.55	0.43	-0.14	-1.18	0.07	0.52
P-value	0.62	0.68	0.81	0.21	0.03	0.61	0.28	0.08	0.52	0.62	0.62	0.36	0.94	0.45
GDP - Year ahead														
Commission forecast	1.46	1.03	1.38	0.91	1.03	0.99	1.97	0.85	1.14	0.77	1.53	0.31	0.23	1.36
P-value	0.01	0.02	0.00	0.16	0.00	0.20	0.00	0.22	0.05	0.17	0.00	0.86	0.79	0.06
IMF forecast	-1.98	-0.98	-1.05	-0.03	-0.31	0.32	-1.96	-0.02	-0.75	-0.85	-0.16	0.26	-0.08	0.01
P-value	0.02	0.10	0.12	0.98	0.35	0.78	0.00	0.99	0.38	0.14	0.61	0.89	0.94	0.99

Table B17: Comparison of Commission and IMF forecasts: RMSE of forecast combination: $y^{COMM} + a(y^{COMM} - y^{IMF})$

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year														
RMSE(COMM)	0.79	0.80	0.80	1.95	0.41	0.58	0.62	0.73	0.95	0.71	0.87	1.31	0.82	0.69
RMSE(a=-0.5)	0.84	0.85	0.79	2.03	0.41	0.62	0.64	0.77	0.90	0.68	0.99	1.37	0.81	0.68
RMSE(a=-0.25)	0.81	0.81	0.79	1.98	0.41	0.59	0.63	0.75	0.92	0.69	0.92	1.34	0.81	0.68
RMSE(a=0.1)	0.79	0.81	0.81	1.95	0.42	0.57	0.62	0.72	0.96	0.72	0.86	1.31	0.83	0.70
RMSE(a=0.25)	0.79	0.82	0.81	1.95	0.43	0.57	0.62	0.72	0.99	0.74	0.85	1.30	0.84	0.71
RMSE(a=0.5)	0.80	0.86	0.83	1.99	0.46	0.57	0.63	0.71	1.03	0.78	0.85	1.30	0.87	0.74
GDP - Year ahead														
RMSE(COMM)	1.25	0.91	1.14	2.88	0.54	0.95	1.04	1.14	1.18	0.95	1.19	1.59	1.06	1.17
RMSE(a=-0.5)	1.40	1.00	1.32	2.89	0.55	1.01	1.21	1.23	1.23	1.01	1.50	1.58	1.03	1.25
RMSE(a=-0.25)	1.31	0.94	1.22	2.87	0.54	0.98	1.12	1.18	1.19	0.97	1.33	1.59	1.04	1.21
RMSE(a=0.1)	1.23	0.90	1.12	2.89	0.54	0.95	1.01	1.13	1.18	0.94	1.14	1.60	1.07	1.16
RMSE(a=0.25)	1.21	0.90	1.10	2.92	0.56	0.95	0.97	1.11	1.19	0.94	1.09	1.61	1.09	1.15
RMSE(a=0.5)	1.18	0.92	1.09	2.98	0.59	0.96	0.91	1.09	1.23	0.95	1.04	1.62	1.12	1.14

Table B18: Comparison of Commission and OECD forecasts

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year															
Sample	75/05	75/05	71/05	75/05	81/05	86/05	71/05	71/05	81/05	75/05	95/05	86/05	95/05	95/05	73/05
No of obs.	31	31	35	31	25	20	35	35	25	31	11	20	11	11	33
ME(COMM)	0.07	0.08	0.15	-0.68	-0.12	-0.20	0.09	0.35	-0.94	0.03	0.15	0.24	0.16	-0.09	0.01
ME(OECD)	0.08	-0.22	0.08	-0.48	-0.15	-0.12	0.10	0.06	-0.48	-0.07	0.05	0.14	0.00	0.03	0.12
MAE(COMM)	0.71	0.66	0.79	1.60	0.68	0.55	0.54	0.81	1.35	0.76	0.50	0.70	0.96	0.58	0.69
MAE(OECD)	0.71	0.63	0.72	1.30	0.66	0.49	0.58	0.70	1.21	0.74	0.47	0.74	0.76	0.54	0.63
RMSE(COMM)	0.89	0.86	1.07	1.92	0.87	0.77	0.72	1.16	1.90	0.98	0.71	0.87	1.31	0.82	0.89
RMSE(OECD)	0.86	0.75	0.89	1.61	0.82	0.73	0.83	1.02	1.55	0.87	0.60	0.93	1.17	0.73	0.86
THEIL1(COMM)	0.50	0.39	0.44	0.67	0.63	0.62	0.36	0.45	0.91	0.70	0.65	0.62	0.60	0.63	0.46
THEIL1(OECD)	0.54	0.34	0.36	0.64	0.62	0.59	0.40	0.39	0.73	0.56	0.56	0.72	0.55	0.61	0.45
THEIL2(COMM)	0.62	0.55	0.59	0.58	0.54	0.55	0.44	0.62	0.96	0.68	0.83	0.47	0.79	0.87	0.50
THEIL2(OECD)	0.61	0.48	0.48	0.49	0.52	0.52	0.49	0.54	0.63	0.56	0.73	0.50	0.73	0.82	0.46
THEIL2*(COMM)	0.55	0.47	0.54	0.54	0.51	0.49	0.40	0.56	0.87	0.61	0.71	0.43	0.69	0.72	0.44
THEIL2*(OECD)	0.55	0.40	0.44	0.46	0.48	0.46	0.45	0.49	0.59	0.49	0.62	0.47	0.63	0.67	0.41
Success rate(COMM)	83	90	85	87	88	89	88	85	75	70	80	74	100	80	88
Success rate(OECD)	80	90	79	83	79	95	88	88	75	77	80	79	100	80	88
% of positive errors(COMM)	52	61	51	39	36	40	57	69	32	42	64	65	55	45	61
% of positive errors(OECD)	48	45	51	35	32	55	60	63	48	39	45	60	36	55	64
GDP - Year ahead															
Sample	76/05	76/05	71/05	76/05	82/05	87/05	71/05	71/05	82/05	76/05	95/05	87/05	95/05	95/05	74/05
No of obs.	30	30	35	30	24	19	35	35	24	30	11	19	11	11	32
ME(COMM)	0.12	0.07	0.45	-1.07	-0.11	-0.13	0.38	0.65	-0.60	0.01	0.36	0.41	-0.07	0.22	0.25
ME(OECD)	0.16	-0.15	0.30	-1.09	-0.20	-0.13	0.25	0.29	-0.52	-0.04	0.22	0.51	-0.21	0.04	0.07
MAE(COMM)	0.96	0.85	1.21	2.14	0.87	0.79	0.83	1.25	1.98	1.03	0.71	0.95	1.27	0.80	1.07
MAE(OECD)	0.97	0.86	1.16	2.22	0.78	0.78	0.86	1.37	1.93	1.09	0.69	1.02	1.23	0.87	1.02
RMSE(COMM)	1.22	1.13	1.64	2.50	1.23	1.06	1.15	1.72	2.47	1.25	0.95	1.19	1.59	1.06	1.38
RMSE(OECD)	1.28	1.10	1.60	2.55	1.04	1.03	1.22	1.84	2.52	1.34	0.88	1.30	1.66	1.04	1.43
THEIL1(COMM)	0.68	0.61	0.69	0.92	0.81	0.65	0.58	0.69	0.86	0.76	0.74	0.77	0.78	0.75	0.72
THEIL1(OECD)	0.76	0.56	0.63	0.91	0.67	0.62	0.61	0.75	0.88	0.75	0.69	0.82	0.74	0.76	0.75
THEIL2(COMM)	0.88	0.78	0.89	0.80	0.76	0.72	0.71	0.90	1.00	0.81	1.23	0.65	0.99	1.13	0.81
THEIL2(OECD)	0.92	0.75	0.87	0.78	0.64	0.69	0.75	0.97	1.09	0.86	1.15	0.71	1.04	1.14	0.81
THEIL2*(COMM)	0.80	0.67	0.80	0.71	0.66	0.55	0.62	0.80	0.85	0.68	0.95	0.53	0.80	0.93	0.73
THEIL2*(OECD)	0.83	0.65	0.77	0.70	0.55	0.53	0.66	0.86	0.89	0.72	0.90	0.58	0.83	0.93	0.71
Success rate(COMM)	72	86	71	59	74	67	74	71	48	55	70	67	80	80	81
Success rate(OECD)	69	83	65	59	78	61	74	71	57	66	60	61	90	70	84
% of positive errors(COMM)	57	47	66	30	29	47	63	71	38	47	55	63	45	55	59
% of positive errors(OECD)	57	50	60	37	38	47	69	54	46	50	55	74	36	55	47

Table B19: Comparison of Commission and OECD forecasts: Proportion of positive forecast differentials

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year															
%	58	61	71	65	60	45	57	89	60	74	82	60	82	45	58
GDP - Year ahead															
%	47	60	77	70	63	58	69	71	54	70	73	37	64	64	63

Table B20: Comparison of Commission and OECD forecasts: Bias

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP-current year															
α (COMM)	0.07	0.08	0.15	-0.68	-0.12	-0.20	0.09	0.35	-0.94	0.03	0.15	0.24	0.16	-0.09	0.01
Signif. α=0 (COMM)	0.68	0.60	0.43	0.05	0.50	0.26	0.47	0.08	0.01	0.89	0.50	0.23	0.70	0.73	0.95
α (OECD)	0.08	-0.22	0.08	-0.48	-0.15	-0.12	0.10	0.06	-0.48	-0.07	0.05	0.14	0.00	0.03	0.12
Signif. α=0 (OECD)	0.63	0.11	0.61	0.10	0.38	0.48	0.50	0.72	0.13	0.66	0.78	0.53	1.00	0.91	0.41
GDP-year ahead															
α (COMM)	0.12	0.07	0.45	-1.07	-0.11	-0.13	0.38	0.65	-0.60	0.01	0.36	0.41	-0.07	0.22	0.25
Signif. α=0 (COMM)	0.61	0.75	0.11	0.02	0.66	0.62	0.05	0.02	0.24	0.96	0.22	0.14	0.89	0.52	0.31
α (OECD)	0.16	-0.15	0.30	-1.09	-0.20	-0.13	0.25	0.29	-0.52	-0.04	0.22	0.51	-0.21	0.04	0.07
Signif. α=0 (OECD)	0.51	0.45	0.27	0.02	0.35	0.59	0.22	0.35	0.33	0.87	0.44	0.09	0.70	0.91	0.79

Table B21: Comparison of Commission and OECD forecasts: Unbiasedness and no serial correlation

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP-current year															
α(COMM)	0.00	0.00	0.12	-0.88	-0.19	-0.14	0.07	0.38	-0.61	-0.04	0.06	0.18	0.08	-0.08	0.00
Signif. α=0(COMM)	1.00	1.00	0.52	0.02	0.26	0.45	0.61	0.05	0.13	0.84	0.81	0.35	0.86	0.80	0.99
Signif. α=0(COMM)-bootstrap	1.00	0.98	0.50	0.01	0.26	0.46	0.61	0.06	0.16	0.86	0.77	0.44	0.80	0.81	0.99
β(COMM)	0.21	-0.01	0.05	-0.11	0.06	0.32	0.18	-0.31	0.35	0.12	0.12	0.44	-0.20	-0.01	-0.22
Signif. β=0(COMM)	0.24	0.97	0.76	0.53	0.76	0.19	0.30	0.06	0.09	0.51	0.72	0.06	0.58	0.97	0.23
Signif. β=0(COMM)-bootstrap	0.14	0.90	0.60	0.61	0.59	0.06	0.16	0.05	0.03	0.35	0.39	0.02	0.66	0.74	0.25
Signif. α=0, β=0(COMM)	0.49	1.00	0.75	0.05	0.48	0.24	0.48	0.06	0.01	0.78	0.88	0.07	0.84	0.96	0.48
α(OECD)	0.00	-0.24	0.07	-0.45	-0.21	-0.09	0.07	0.02	-0.49	-0.08	-0.04	0.15	-0.06	0.08	0.10
Signif. α=0(OECD)	0.99	0.09	0.68	0.16	0.21	0.60	0.65	0.90	0.16	0.64	0.83	0.47	0.89	0.78	0.52
Signif. α=0(OECD)-bootstrap	0.92	0.11	0.69	0.16	0.21	0.61	0.69	0.98	0.15	0.64	0.90	0.57	0.95	0.79	0.57
β(OECD)	0.29	0.05	-0.08	0.02	0.09	0.33	0.22	-0.12	0.01	0.27	0.05	0.38	-0.01	0.13	-0.02
Signif. β=0(OECD)	0.10	0.80	0.64	0.93	0.65	0.17	0.21	0.47	0.97	0.16	0.87	0.09	0.97	0.72	0.91
Signif. β=0(OECD)-bootstrap	0.03	0.61	0.71	0.77	0.52	0.04	0.10	0.55	0.77	0.07	0.60	0.02	0.69	0.37	1.00
Signif. α=0, β=0(OECD)	0.24	0.18	0.84	0.31	0.37	0.30	0.38	0.77	0.32	0.31	0.97	0.16	0.99	0.89	0.81
GDP-year ahead															
α(COMM)	0.12	0.09	0.46	-0.78	-0.21	0.02	0.38	0.52	-0.67	0.07	0.37	0.41	-0.17	0.32	0.11
Signif. α=0(COMM)	0.62	0.68	0.13	0.11	0.42	0.94	0.07	0.07	0.23	0.77	0.27	0.16	0.77	0.41	0.64
Signif. α=0(COMM)-bootstrap	0.61	0.70	0.10	0.13	0.43	0.89	0.06	0.05	0.26	0.77	0.19	0.18	0.78	0.37	0.65
β(COMM)	0.04	0.05	-0.06	0.26	-0.01	0.35	0.01	0.02	-0.03	0.19	-0.28	0.25	-0.14	-0.27	0.25
Signif. β=0(COMM)	0.83	0.79	0.74	0.17	0.95	0.11	0.95	0.91	0.89	0.30	0.40	0.32	0.69	0.44	0.15
Signif. β=0(COMM)-bootstrap	0.68	0.63	0.84	0.08	0.88	0.03	0.79	0.77	0.93	0.18	0.42	0.15	0.84	0.46	0.08
Signif. α=0, β=0(COMM)	0.86	0.87	0.30	0.03	0.71	0.27	0.16	0.13	0.47	0.56	0.47	0.14	0.89	0.57	0.26
α(OECD)	0.23	-0.11	0.32	-0.67	-0.29	0.01	0.27	0.09	-0.61	0.06	0.14	0.38	-0.32	0.16	-0.05
Signif. α=0(OECD)	0.35	0.62	0.27	0.17	0.19	0.95	0.22	0.75	0.28	0.81	0.66	0.17	0.61	0.64	0.82
Signif. α=0(OECD)-bootstrap	0.37	0.60	0.23	0.21	0.17	0.91	0.20	0.77	0.29	0.84	0.63	0.23	0.66	0.66	0.79
β(OECD)	-0.03	0.12	-0.07	0.32	-0.08	0.34	-0.13	0.18	0.03	0.12	-0.08	0.51	-0.15	-0.28	0.30
Signif. β=0(OECD)	0.86	0.52	0.70	0.09	0.71	0.12	0.47	0.23	0.90	0.50	0.82	0.03	0.67	0.40	0.07
Signif. β=0(OECD)-bootstrap	0.96	0.34	0.78	0.03	0.82	0.04	0.54	0.15	0.71	0.36	0.99	0.00	0.81	0.42	0.03
Signif. α=0, β=0(OECD)	0.64	0.68	0.52	0.02	0.41	0.29	0.41	0.42	0.51	0.77	0.90	0.01	0.81	0.61	0.19

Table B22: Comparison of Commission and OECD forecasts: Regressions of COMM forecast errors on OECD forecasts

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year															
Constant	0.10	0.40	0.23	0.25	-0.06	0.15	-0.10	0.52	-1.68	-0.10	-0.31	1.21	0.34	-0.55	-0.15
P-value	0.76	0.13	0.42	0.65	0.86	0.75	0.66	0.10	0.00	0.74	0.65	0.01	0.80	0.55	0.54
OECD forecast	-0.02	-0.18	-0.04	-0.25	-0.03	-0.12	0.08	-0.09	0.33	0.07	0.24	-0.37	-0.05	0.19	0.09
P-value	0.92	0.13	0.69	0.04	0.83	0.43	0.31	0.48	0.07	0.60	0.46	0.01	0.89	0.60	0.38
GDP - Year ahead															
Constant	-0.33	0.53	0.45	-0.59	0.06	0.87	0.19	0.25	-2.13	-0.31	-1.26	2.54	-1.17	-2.48	0.38
P-value	0.61	0.21	0.49	0.51	0.90	0.31	0.65	0.59	0.04	0.50	0.24	0.01	0.57	0.16	0.38
OECD forecast	0.22	-0.24	0.00	-0.13	-0.08	-0.34	0.07	0.19	0.59	0.17	0.72	-0.76	0.32	1.07	-0.07
P-value	0.46	0.21	1.00	0.53	0.67	0.22	0.61	0.26	0.09	0.42	0.13	0.02	0.59	0.13	0.71

Table B23: Comparison of Commission and OECD forecasts: Squared-error loss differentials (with small sample correction)

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year															
Mean differential	0.05	0.17	0.37	1.11	0.09	0.06	-0.18	0.29	1.22	0.19	0.14	-0.10	0.36	0.14	0.06
P-value	0.66	0.45	0.37	0.12	0.32	0.36	0.28	0.08	0.27	0.18	0.34	0.54	0.05	0.32	0.62
GDP - Year ahead															
Mean differential	-0.15	0.07	0.14	-0.26	0.42	0.06	-0.17	-0.42	-0.28	-0.24	0.12	-0.27	-0.22	0.04	-0.13
P-value	0.57	0.80	0.55	0.77	0.29	0.51	0.34	0.54	0.76	0.38	0.44	0.10	0.53	0.91	0.56

Table B24: Comparison of Commission and OECD forecasts: Test for forecast encompassing (with small sample correction)

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year															
Constant	0.18	0.28	0.34	1.70	0.10	0.06	-0.03	0.29	1.69	0.20	0.10	0.01	0.30	0.12	0.29
P-value	0.04	0.04	0.13	0.00	0.03	0.04	0.66	0.01	0.07	0.02	0.13	0.46	0.02	0.08	0.02
GDP - Year ahead															
Constant	0.09	0.27	0.22	0.41	0.38	0.04	0.01	0.10	0.11	-0.01	0.11	-0.07	0.05	0.13	0.08
P-value	0.21	0.06	0.03	0.13	0.02	0.18	0.41	0.39	0.40	0.52	0.09	0.80	0.41	0.23	0.24

Table B25: Comparison of Commission and OECD forecasts: Regressions of realisations on COMM and OECD forecasts

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year															
Commission forecast	-0.12	-0.08	-0.57	0.44	0.29	0.31	0.96	0.22	1.46	-0.18	-0.55	1.91	-0.23	-0.32	0.42
P-value	0.80	0.81	0.09	0.25	0.57	0.71	0.04	0.62	0.07	0.64	0.70	0.00	0.85	0.79	0.11
OECD forecast	1.23	1.17	1.41	0.72	0.75	0.76	-0.04	0.82	-0.77	1.01	1.39	-0.49	1.11	1.02	0.51
P-value	0.03	0.00	0.00	0.04	0.17	0.35	0.93	0.06	0.32	0.01	0.38	0.35	0.32	0.39	0.07
GDP - Year ahead															
Commission forecast	0.78	0.65	0.29	0.91	-0.32	-0.44	1.14	0.98	1.99	0.85	0.51	0.11	0.47	0.87	-0.12
P-value	0.05	0.12	0.61	0.16	0.47	0.77	0.02	0.07	0.06	0.10	0.67	0.90	0.69	0.46	0.87
OECD forecast	-0.02	0.44	0.63	0.21	1.15	1.61	-0.19	-0.17	-1.59	-0.03	-0.28	1.84	0.08	-0.94	0.90
P-value	0.96	0.15	0.27	0.73	0.01	0.24	0.66	0.69	0.15	0.95	0.82	0.12	0.94	0.50	0.14

Table B26: Comparison of Commission and OECD forecasts: RMSE of forecast combination: $y^{COMM} + a(y^{COMM} - y^{OECD})$

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
GDP - Current year															
RMSE(COMM)	0.89	0.86	1.07	1.92	0.87	0.77	0.72	1.16	1.90	0.98	0.71	0.87	1.31	0.82	0.89
RMSE(a=-0.5)	0.85	0.76	0.94	1.85	0.85	0.74	0.74	1.07	1.98	0.90	0.67	0.92	1.25	0.79	0.82
RMSE(a=-0.25)	0.87	0.81	1.00	1.87	0.85	0.75	0.72	1.10	1.94	0.94	0.69	0.89	1.28	0.80	0.84
RMSE(a=0.1)	0.91	0.88	1.11	1.95	0.88	0.78	0.72	1.18	1.89	1.00	0.72	0.87	1.33	0.83	0.91
RMSE(a=0.25)	0.93	0.92	1.16	2.00	0.90	0.79	0.72	1.22	1.87	1.03	0.74	0.86	1.36	0.84	0.96
RMSE(a=0.5)	0.97	1.00	1.25	2.09	0.93	0.81	0.73	1.30	1.85	1.09	0.76	0.85	1.42	0.87	1.04
GDP - Year ahead															
RMSE(COMM)	1.22	1.13	1.64	2.50	1.23	1.06	1.15	1.72	2.47	1.25	0.95	1.19	1.59	1.06	1.38
RMSE(a=-0.5)	1.23	1.08	1.59	2.57	1.11	1.03	1.17	1.73	2.52	1.27	0.94	1.24	1.60	1.05	1.34
RMSE(a=-0.25)	1.21	1.09	1.61	2.53	1.16	1.04	1.15	1.71	2.49	1.25	0.94	1.21	1.59	1.05	1.36
RMSE(a=0.1)	1.22	1.15	1.66	2.49	1.26	1.07	1.15	1.73	2.46	1.25	0.95	1.18	1.60	1.07	1.40
RMSE(a=0.25)	1.24	1.19	1.68	2.49	1.31	1.08	1.15	1.75	2.45	1.26	0.96	1.17	1.61	1.07	1.42
RMSE(a=0.5)	1.28	1.28	1.73	2.49	1.40	1.10	1.17	1.79	2.44	1.28	0.97	1.15	1.63	1.09	1.47

ANNEX C

WHY AND HOW TO IMPLEMENT BOOTSTRAP TESTS TO OBTAIN MORE ACCURATE CONFIDENCE INTERVALS OF FORECAST ERRORS?

1. INTRODUCTION

Time samples of forecast errors are typically short, too short to allow for accurate inference on the biasness or serial correlation of the forecasts based on usual parametric tests. Standard tests are always valid asymptotically (where the number of observations n grows very large) whatever the form of the residuals distribution under the assumption identically independently distributed residuals (IID). Some other tests ("t-test", "F-test") calibrated for smaller sample size crucially rely on the assumption of normally independently distributed (NID) residuals for the test size to be correct[16]. Thus, the use of t-test or F-test with small samples where there is no reason that residuals are NID involves a risk of distorted size, low power and wrong inference.

Two different issues may arise in a small sample framework. First, inference on small samples is always less precise insofar as the standard error of the estimated coefficient is larger with fewer observations (the test power is lower). Bootstrapping the test statistics, i.e. to resample the data randomly and compute the distribution of the bootstrapped statistics, is unlikely to help with this first issue, since the standard OLS regression framework is still used.

Second, inference can be unreliable in all the cases where residuals are not well behaved, e.g. if the model is misspecified or if there are big measurement errors yielding outliers (such situations yield residuals that are not white noise). Then, bootstrapping the test statistics can be more robust than standard parametric inference in those problematic settings. In particular, bootstrapping can potentially lead to tests that are less sensitive to distortion caused by heteroskedasticity[17] and autocorrelation in the residuals.

The exact distribution of a test statistics for a given finite sample is never known, but it can be accurately approximated with some parametric distributions that take into account the number of observations, in order to compute the P-value of the test (marginal significance level) under the null hypothesis. A certain degree of approximation is always involved where some

[16] See below in the next paragraphs a reminder on test power vs. size.

[17] See for instance Timmermann (2007). The case of heteroskedasticity should be viewed only as a particular case among all situations in which it can make sense to use the bootstrap (e.g. true model non linear, outliers with a statistics of interest sensitive to outliers, etc.)

inference is made on the basis of the tabulated distributions, because the underlying assumptions on the shape of the residuals distribution are generally not met in practice with economic time series, and it is very difficult to obtain accurate HAC[18] statistics with small samples, albeit valid asymptotically.

The basic intuition is that bootstrap methods provide other estimates of the test distribution, which might be *in some cases* at least as reliable as asymptotic approximations, but less sensitive to departures from the linear regression assumptions in small samples.

Asymptotic distribution and sample distribution of a test statistics:

Suppose we reject H0 (null hypothesis) whenever an estimated test statistics â is abnormal, that is in the very upper tail of its asymptotic cumulative distribution function F^{∞}. We reject if the P-value $P(\hat{a}) = 1 - F^{\infty}(\hat{a})$ is smaller than α, α being the significance level or size of the test (1- α is the confidence level). We use F^{∞} because we only know F^{∞} while the 'true' F is unknown.
Obviously, the accuracy of the test will strongly rely on the quality of the approximation of the distribution F of â with its asymptotic distribution F^{∞}. The bootstrap provides other estimates F^{b} of F that is different from F^{∞} and, might yield more accurate tests at finite distance. The advantage of the bootstrap is that F^{b} is directly computed with Monte-Carlo experiments on the basis of the data sample and potentially does not require any distributional assumption.

(More technical developments are in smaller font size and framed throughout this note).

To be fair, the bootstrap is obviously most useful in cases where standard errors of the statistics of interest *cannot* be analytically computed, nor approximated, and tests are unavailable, e.g. with principal component analysis statistics[19] or with many non-linear models. In the context of the linear model applied to the estimation of the stochastic process of forecast errors, there is no particular reason why a linear model estimated with OLS estimators would be irrelevant, especially where a first-order autocorrelation term is introduced in the regression. Even if the residuals' empirical distribution is not perfectly normal, parametric test statistics remain quite well behaved at finite distance. A bootstrap analysis in such a context should be seen as potentially allowing to shed some light on the robustness of standard tests but it is unlikely to provide tests that are both superior in size and power in a general context. Monte-Carlo simulations show indeed that tests based on OLS estimates often remain valid where the residual are not NID and are generally as accurate as the best bootstrap tests. Where standard and bootstrap tests results would disagree, it is often not possible to know for sure which one is right, but it casts some doubts on the validity of the former tests results.

Furthermore, there are many ways to bootstrap the statistics of interest and all the methods do necessarily lead to accurate tests, because all bootstrap distributions are not necessarily as accurate as the approximations valid under asymptotic theory. The literature provides some

[18] Standard heteroskedasticity and autocorrelation consistent (HAC) estimators usually lead to distorted tests with small samples, cf. Kiefer et al. (2000).

[19] See Grenouilleau (2006) for an implementation of the bootstrap in the context of principal component analysis.

insights on theoretical results for several types of bootstrap methods, but their properties might usefully be checked with Monte-Carlo simulations for given test statistics of interest and sample size.

We introduce in this annex a variety of appropriate bootstrap tests that can be applied to both the assessment of the bias and correlation of forecast errors. The properties of the statistics are systematically checked with Monte-Carlo simulations.

2. SOME BOOTSTRAP STATISTICS AND THEIR ASSESSMENT IN THE CONTEXT OF FORECAST ERROR REGRESSIONS

We first introduce the forecast error regression framework that will be used. Second, we suggest two standard bootstrap statistics and explain how to assess them.

2.1. Test inference based on forecast error regressions

2.1.1. The forecast error regression

A forecast is usually considered as optimal if it is unbiased and serially uncorrelated. The aim of the statistical exercise is thus to apply appropriate tests to check whether forecasts are biased or correlated over time. A simple regression involving the forecast errors can be used as a basis for statistical testing:

$e_t = b + r.e_{t-1} + \varepsilon_t$ where b is the bias (constant term) and r the autocorrelation of the forecast errors. The residual term ε_t is assumed to be a white noise.

Tests on b and r based on their regression estimate and standard error estimate should help us to answer the question whether the forecasts are optimal or not. With the t-test, if b and/or r are larger in absolute terms than some thresholds (estimated) we conclude that the forecasts exhibit bias and/or correlation and the forecasts are thus not optimal.

Student t-test: (case of the bias b)

If $\left|\hat{b} / \hat{\sigma}(\hat{b})\right| > t_{n-1}^{1-\alpha/2}$, where $\hat{b}$ is the estimate of b, $\hat{\sigma}$ the estimated variance of $\hat{b}$ and $t_n^{1-\alpha}$ the tabulated Student t for a sample size n and a confidence level of 1-α, we reject the null hypothesis H0 that b is not different from zero (we consider that b is indeed different from zero).

One should notice in this OLS framework that:

- If the second term with r is omitted although some autocorrelation at order 1 do exist, the estimate for the standard error of b is biased downwards and the t-test on b is unreliable[20]

[20] It becomes oversized, i.e. it tends to reject too often H0 where it is true.

unless more sophisticated estimators of the standard error are used (e.g. Cochrane-Orcutt procedure, HAC estimators).

In practice, one should use the regression without second term only if there is no sign what so ever that the residuals may be autocorrelated. Given that most tests for the autocorrelation of residuals lack power, the inference on the basis of the regression on the constant without evidence that there is absolutely no correlation in the residuals[21] (very unlikely for economic time series) has chances to prove sometimes wrong. Moreover, standard HAC estimators are not necessarily reliable with small sample.

- Even if the second term is included, autocorrelations at order higher than 1 may affect test results. Actually, the presence of higher-order autocorrelation could be tested.

- More generally, if the residuals are not normal (for instance heteroskedastic), the t-test might be distorted for small samples.

- In a small sample context, r is underestimated with OLS but this does not affect the test size for r (t- and F-tests remain correctly sized with normal residuals).

2.1.2. The meaning of statistical testing

In non-statistical terms, it is crucial to realise that whether forecasts may be biased and correlated or not, we will never know for sure. Our aim is to find a test that is reliable enough in the sense that:

- it does not reject the null hypothesis where it is true (correct decision) more frequently than the confidence level 1-α or the significance level α would suggest (minimise the *test size* or the significance *'type-I error'*),

- it rejects the null where it is indeed false (correct decision) as often as possible (maximise the *test power* or minimise *'type II error'*).

There is a trade-off between both properties: while the test size decreases, the test power also declines. That is one of the reasons why one chooses to work with a given size (e.g. confidence level of 95 %) and not to raise it above that level in order to maximise the test power for that particular size. Using a test size of 5%, one implicitly considers that the most important is that the null is not rejected where it is true. In the context of forecasts evaluation, choosing a given size means that we prefer to be sure that we will conclude that the forecasts are optimal whenever they are truly optimal and do not care too much if we infer from the test they are optimal although they are not in reality.

[21] Like in Timmermann (2006) or Keereman (1999).

2.2. Standard bootstrapped statistics

2.2.1. Bootstrapping pairs or residuals

In the case of economic time series, there are two different ways of bootstrapping, i.e. resampling randomly with replacement, a regression model[22]: one can bootstrap the pairs (x_i,y_i) where the series of y_i is regressed on that of x_i, or one can bootstrap the residuals of the regression $\hat{\varepsilon}_i = y_i - x_i.\hat{\beta}$ where β is the vector of regression coefficients.

Bootstrap data sets

Pairwise bootstrap: the set is of the form (for B bootstrap replicates):

$$\left\{\left(x_{i1}, y_{i1}\right), \left(x_{i2}, y_{i2}\right), \ldots, \left(x_{iB}, y_{iB}\right)\right\} \quad \text{(Method PW)}$$

Residual bootstrap, the set is of the form (for B bootstrap replicates):

$$\left\{\left(x_1, x_1.\hat{\beta} + \hat{\varepsilon}_{i1}\right), \left(x_2, x_2.\hat{\beta} + \hat{\varepsilon}_{i2}\right), \ldots, \left(x_B, x_B.\hat{\beta} + \hat{\varepsilon}_{iB}\right)\right\} \quad \text{(Method RB)}$$

In the case of a lagged dependent variable (e.g. autocorrelation), it is important to treat the latter variable as x_i and not as y_{i-1}. Otherwise, the use of method PW would completely destroy the correlation that we try to capture with the estimation of the first-order autocorrelation[23]. Otherwise, it is necessary to use a more complex sampling scheme in the case of method PW: the moving-blocks bootstrap. The design consists in sampling from continuous blocks of observations (of the same size l). The idea is to choose a block size large enough so that we retain the correlation present in observations less than l units apart. A drawback of this method is that the performance of the test depends on the relevance of the chosen blocks length (but it can be monitored with Monte-Carlo experiments).

Which method is better? The answer depends on how relevant and well-specified the linear model is. In general, if the assumption that the residuals are orthogonal to the endogenous variables holds (as implied by the linear regression model), the residuals have the same distribution no matter what the x_i are. Then, bootstrapping the residuals is likely to perform very well and, in practice, the assumption does not have to hold perfectly for the residuals bootstrap to give good results. On the other hand, even if this strong assumption does not hold at all, bootstrapping pairs is likely to perform reasonably well, since it is no much sensitive to more restrictive assumptions[24].

In short, it is useful to test both methods for the statistics of interest with Monte-Carlo experiments in a small sample context, since it is difficult to infer from the analysis of residuals from a small sample a departure from the linear regression model hypothesis.

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[22] See Efron (1993), p. 113, and more specifically Freedman (1981).

[23] Efron (1993) p. 100.

[24] Goncalves et al. (2004) show that pairwise bootstrap is more robust to conditional heteroskedasticity in the residuals than residuals bootstrap.

2.2.2. The bootstrapped coefficient β percentile

Through the use of the bootstrap, we can avoid having to make distribution assumptions about the regression residuals and this might improve test inference particularly in a small-sample context, where residuals are far from complying with strong distributional assumptions.

The basic intuition behind bootstrap methods is that the computation of the statistics of interest for many bootstrap samples allows us to obtain a good empirical approximation of the (unknown) distribution of the statistics, or at least as good as that inferred from standard asymptotical distributions. Tests can thus be performed directly with the empirical bootstrap distribution instead of relying on standard tabulated distributions valid under strong assumptions.

The simplest bootstrap estimate is that of the regression coefficients. An 'empirical' distribution of the coefficients $\beta' = [b \quad r]$ can be estimated directly from the data rather than relying on asymptotic distributions. The bootstrap least-square estimate $\hat{\beta}^*$ of $\beta' = [b \quad r]$ is the minimiser of the residual squared error for the bootstrap data. From the set of bootstrapped coefficients $\hat{\beta}^*$, we obtain bootstrapped percentiles which approximate its distribution function.

The 'percentile' confidence interval at a level of 1-2α is then: $\left(\hat{\beta}^{*\alpha}, \hat{\beta}^{*1-\alpha}\right)$ where $\hat{\beta}^{*\alpha}$ and $\hat{\beta}^{*1-\alpha}$ are respectively the α and 1-α quantiles of the empirical distribution of $\hat{\beta}^*$.

Based on this confidence interval, one can test the null hypothesis that the coefficients are not significantly different from zero. The null is rejected where 0 does not fall within the interval.

Another solution (based on asymptotic approximation provided by the central limit theorem) is to use the bootstrap standard error (i.e. standard error of bootstrap estimates) $s(\hat{\beta}^*) = \left(\frac{1}{B-1} \sum_{j=1}^{B} \left(\hat{\beta}^*(b) - \overline{\beta}^* \right)^2 \right)^{1/2}$ with $\overline{\beta}^* = \frac{1}{B} \sum_{j=1}^{B} \hat{\beta}^*(b)$ in the usual asymptotic confidence interval, preferably centred[25] on the bias-corrected estimate $\hat{\beta} - (\overline{\beta}^* - \hat{\beta}) = 2\hat{\beta} - \overline{\beta}^*$: $\left(2\hat{\beta} - \overline{\beta}^* - s(\hat{\beta}^*) t_{1-\alpha}, 2\hat{\beta} - \overline{\beta}^* + s(\hat{\beta}^*) t_{1-\alpha}\right)$.

These bootstrap statistics are only first-order accurate: the probabilities beyond the tails converge to the intended significance level α at a rate of $n^{-1/2}$. More accurate intervals can be constructed based on more sophisticated algorithm (BCa or ABC algorithms[26]), which converge at a rate of n^{-1} to the expected significance level as well as the method described in the following section. Dedicated methods for the autoregression model, in particular the wild bootstrap, could also be used[27].

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[25] MacKinnon (2002).

[26] Efron (1993), p. 178. An extension of this note could usefully provide an implementation of the BCa algorithm.

[27] See Hansen (1999) or Goncalves *et al*. (2004).

2.2.3. *The bootstrap percentile-t for regression coefficients*[28]

This solution consists in the approximate tabulation of the distribution of our statistics of interest with the data sample (instead of using the standard t-statistics table).

For each of the bootstrap samples $\{e^b\}_{1\le b\le B}$ obtained with method 1 (with moving blocks) or 2, we obtain $\hat{\beta}^*(b)$ and its estimated standard error $\hat{\sigma}^*(b)$. We compute $Z^*(b) = \dfrac{\hat{\beta}^*(b) - \hat{\beta}}{\hat{\sigma}^*(b)}$. The empirical distribution of Z* obtained with the bootstrap has the property to produce for very large B a test table which fits the data at hand unlike the t-table used in the case of the original t-test statistics for the OLS coefficients $Z = \dfrac{\hat{\beta}}{\hat{\sigma}(\hat{\beta})}$, which applies to all samples of fixed size n under the assumption of NID residuals.

Then, the bootstrap-t confidence interval is: $\left(\hat{\beta} - \hat{t}^{*1-\alpha}.\hat{\sigma}(\hat{\beta}), \hat{\beta} - \hat{t}^{*\alpha}.\hat{\sigma}(\hat{\beta})\right)$ where the quantiles $\hat{t}^{*\alpha}$ and $\hat{t}^{*1-\alpha}$ are such that $\sum_{b=1}^{B} I_{\{Z^*(b)<\hat{t}^{*\alpha}\}} / B = \alpha$ and $\sum_{b=1}^{B} I_{\{Z^*(b)>\hat{t}^{*1-\alpha}\}} / B = \alpha$ [29].

Alternatively, in order to test the null that the coefficients are not significantly different from zero, we just need to compare the t-statistics $\hat{z}^{1-2\alpha}$ of the original sample coefficients to their respective bootstrap quantiles. The null is rejected where $\hat{z}^{1-2\alpha}$ does not fall within the interval of the quantiles $\left(\hat{t}^{*\alpha}, \hat{t}^{*1-\alpha}\right)$.

In practice, this method, which became more and more popular in the course of the 90s due to its asymptotic behaviour, can give somewhat erratic results and can be heavily influenced by a few outlying points[30], while intervals based on bootstrapped statistics of interest are less erratic and more accurate if they are improved with more sophisticated algorithms to compute the critical values.

2.2.4. *A non parametric bootstrap percentile-F*

Bootstrapping the F-test has rarely been implemented in the literature, except if this pseudo F-test is performed with the *parametric* bootstrap[31] (i.e. resampling the residuals from a Gaussian distribution): the F-test requires the normality of the residuals distribution and might give erratic results relaxing this assumption.

The properties of a *non-parametric* bootstrap percentile-F computed exactly in the same way as the percentile-t (i.e. comparing the F-stat of the original sample to the distribution of the F-

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[28] It is also called t-interval (Efron) or bootstrap with asymptotic refinement.

[29] I is the usual indicative function: I_{test}=1 if the test result is true or else 0.

[30] Efron (1993), p. 160.

[31] See an example in Davidson (1998).

stat of the bootstrapped data[32]) are quite problematic. The problem could be that the sets of residuals drawn randomly with replacement from a set of Gaussian residuals might exhibit empirical distributions that do not suit the approximation of the upper tail of the percentile-F. The results of Monte-Carlo simulations show indeed that the non-parametric bootstrap percentile-F is not well behaved even with valid resampling schemes. The test is seriously distorted even with Gaussian residuals under the null: the size of the test is virtually zero.

3. COMPARED PERFORMANCES OF BOOTSTRAP STATISTICS WITH MONTE-CARLO EXPERIMENTS

3.1. Data generating processes

The empirical distributions of the forecast errors observed for most countries are usually not too far from a Gaussian distribution, however many irregularities are visible, especially at the tails. If conventional tests cannot be challenged under the assumption of normally-distributed first-order autocorrelated residuals where the model allows for such autocorrelation (as in the case of the weak efficiency regression), it is interesting to monitor to what extent the following relaxation of this hypothesis affects the behaviour of bootstrap tests compared to standard tests:

- Uniform errors: instead of drawing the residuals from a Gaussian, we draw them from a uniform appropriately scaled so that the variance is normalised to one (this can be viewed as an extreme case of fat tails),

- Gaussian errors with outliers: outliers appear randomly with a frequency of 2.5% (on average one per sample of 40 observations) and are generated with a normal distribution of standard deviation ten times larger than other residual (generated series are normalised to have unit variance).

- Heteroskedastic residuals: we allow for GARCH(1,1) residuals in the form of $\varepsilon_t = \sqrt{h_t}.v_t$ where v_t is i.i.d. from a Gaussian standardized distribution and $h_t = \omega + \alpha.(\varepsilon_{t-1})^2 + \beta.h_{t-1}$. The unconditional variance of the residuals is standardized to one as for the other DGP[33]. The settings of (α, β) are taken from[34] {(0.5,0);(0.3,0.65),(0.2,0.79);(0.05,0.94)}.

Given the size of available forecast errors country sets, a (small) fixed sample size of 40 has been chosen for all experiments. The number of Monte-Carlo replications is set at 10,000, due to computational resources limitation. Thus, the test accuracy can be monitored with a hardly sufficient precision at the second digit (in particular the standard tests size with Gaussian residuals might slightly deviate from 5% at a confidence level of 95% with random

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[32] See Timmermann (2006, 2007) for such a pseudo F-test on forecast errors.

[33] Thus $\omega = 1 - (\alpha + \beta)$ since the unconditional variance of a GARCH(1,1) process is $\omega/(1 - \alpha - \beta)$.

[34] We follow Goncalves *et al.* (2004) specification.

sampling). The number of bootstrap replications should be set so that $\alpha.(B+1)$ is an integer if the test is to be exact[35]. We choose here 199, bearing in mind that the accuracy of bootstrap test is evaluated with a Monte-Carlo of bootstrap.

3.2. Some comments on the results

Detailed results are displayed below.

Under the assumption of Gaussian residuals, the parametric sample tests are as expected almost perfectly sized. The F-test (simultaneous nullity of the bias and first-order autocorrelation coefficients) and the t-test for the autocorrelation coefficient exhibit a slight distortion (undersized) with a size of 4% (instead of 5% at 95% confidence level), which is most likely linked to the bias in the autocorrelation estimation in small samples. The bootstrap tests are generally well behaved except the percentile-F that is already severely distorted with a size of nil. Some of them are almost as accurate as standard tests, which is a good performance given the efficiency and unbiasness of the latter. The residuals bootstrap tests are (asymptotic approximation of the b-percentile and the percentile-t) are almost exactly sized for the bias coefficient, while they are slightly oversized for the autocorrelation coefficient. It is noteworthy that the power of those tests is at least as great as that of standard test and notably greater in the case of the autocorrelation coefficient. The corresponding pairwise bootstrap tests are about as accurate for the autocorrelation coefficient, but slightly oversized in the case of the bias coefficient. The b-percentile bootstrap test seems more accurate under its asymptotic approximation.

Under a uniform distribution, the parametric tests are perfectly sized: apparently the slight increase in size due to the relaxation of the Gaussian hypothesis compensates perfectly the slight downward bias previously reported. Again, the b-percentile (asymptotic approximation) and the percentile-t bootstrap tests are almost as accurate. This time, the pairwise tests are more accurately sized, but the residuals tests exhibit a greater power for the autocorrelation coefficient.

Under the assumption of outliers, the parametric tests are no longer as well behaved. They are slightly undersized for both coefficients and their power is substantially lowered for the autocorrelation coefficient. The b-percentile (asymptotic approximation) and the percentile-t residuals bootstrap tests are, on the other hand, correctly sized except the percentile-t that is oversized for the bias coefficient (8%). The pairwise b-percentile test behaviour is almost identical to that of standard tests. The pairwise percentile-t test is slightly more oversized for the bias coefficient (9%).

Under a heteroskedastic distributions with no ($\beta=0$) or medium volatility persistence ($\beta=0.65$), all pairwise bootstrap tests give similar results and clearly outperform standard tests as well as residuals bootstrap tests. They exhibit the best size performance for the correlation coefficient (8%), albeit at the cost of a lower power than other tests. Their size for the bias coefficient is only slightly distorted compared to other tests (6-7% vs. 4% for standard tests

[35] Davidson and MacKinnon (2000). In our case it is however not strictly necessary given that the tests will not be exact since the underlying statistics is only asymptotically pivotal.

and 5% for the residuals percentile-t test). The F-test is also very distorted (size of 10% for the joint hypothesis of nullity of both coefficients).

Where the volatility persistence grows very large (β=0.79, 0.94), the pairwise bootstrap tests are better behaved than other tests only for the autocorrelation coefficient. Differences in size with the standard tests become nevertheless small (for the best pairwise test 7% vs. 8% for standard tests). For the bias coefficient, the usual residuals bootstrap tests and the standard tests perform better than the pairwise bootstrap tests (size of 5% vs. 6-7%). The superiority of pairwise bootstrap tests is thus no longer obvious where the variance autocorrelation grows large. Indeed, standard parametric tests are reasonably accurate under very persistent heteroskedastic processes[36].

In summary, where residuals exhibit both a Gaussian distribution or homoskedastic distributions with fat or irregular tails, the b-percentile (asymptotic approximation) and the percentile-t residuals bootstrap tests perform well and should allow for reliable inference and, in some cases, slightly more reliable than standard sample test. It is noteworthy that their power is often greater to reject the null for the autocorrelation coefficient. Under heteroskedastic distributions for the residuals, the pairwise bootstrap tests work well for low or moderate volatility persistence, whereas standard tests together with the residuals percentile-t test work better under persistent volatility.

All in all, the residuals percentile-t test produces fairly reliable results under many DGP and provides an interesting alternative to standard parametric tests in the context of assessing the bias and the autocorrelation of forecast errors based on a relatively small number of observations.

[36] These results are valid for relatively small n (n = 40 in our experiments). Goncalves et al. (2004) report a deterioration in the accuracy for large n.

3.3. Detailed Monte-Carlo simulations results

3.3.1. Gaussian residuals

Residuals bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	5%	8%	21%	41%	4%	4%	4%	4%
10%		5%	9%	21%	40%	6%	6%	6%	6%
20%		5%	9%	21%	40%	16%	16%	16%	16%
30%		5%	9%	21%	40%	35%	36%	36%	35%
0%	b-percentile	5%	8%	20%	39%	7%	7%	7%	7%
10%	(asymptotic	5%	9%	19%	36%	12%	12%	12%	11%
20%	approximation)	5%	8%	18%	34%	26%	26%	26%	26%
30%		4%	7%	17%	32%	49%	48%	49%	48%
0%	b-percentile	8%	12%	27%	49%	5%	5%	4%	5%
10%	(non asymptotic)	9%	13%	27%	49%	4%	4%	3%	4%
20%		9%	13%	28%	49%	9%	9%	9%	9%
30%		9%	14%	29%	50%	22%	23%	23%	23%
0%	percentile-t	5%	9%	23%	43%	6%	7%	7%	7%
10%		6%	10%	22%	41%	12%	13%	12%	12%
20%		6%	10%	22%	40%	27%	27%	27%	27%
30%		5%	10%	21%	39%	50%	50%	51%	49%
		F-stat				percentile-F			
0%	Test: Bias = 0	4%	7%	17%	34%	0%	0%	0%	0%
10%	& Autocorr. = 0	8%	12%	23%	43%	0%	0%	0%	0%
20%		17%	22%	37%	57%	0%	0%	0%	0%
30%		35%	42%	57%	74%	0%	0%	0%	0%

Pairwise bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	5%	9%	21%	41%	4%	4%	5%	4%
10%		6%	9%	21%	41%	6%	6%	6%	6%
20%		5%	9%	21%	41%	16%	16%	16%	16%
30%		5%	9%	21%	39%	35%	35%	35%	35%
0%	b-percentile	6%	10%	22%	42%	6%	6%	6%	6%
10%	(asymptotic	6%	9%	22%	42%	7%	8%	8%	7%
20%	approximation)	6%	10%	22%	42%	18%	18%	18%	19%
30%		6%	10%	23%	41%	37%	38%	37%	37%
0%	b-percentile	7%	11%	23%	43%	7%	7%	7%	8%
10%	(non asymptotic)	7%	11%	23%	43%	9%	9%	9%	9%
20%		7%	11%	24%	42%	20%	19%	20%	20%
30%		7%	11%	24%	41%	39%	39%	38%	39%
0%	percentile-t	6%	10%	23%	43%	6%	6%	7%	6%
10%		6%	10%	22%	43%	9%	9%	9%	9%
20%		6%	11%	23%	42%	20%	20%	20%	21%
30%		6%	11%	24%	42%	40%	40%	40%	40%
		F-stat				percentile-F			
0%	Test: Bias = 0	4%	7%	17%	35%	0%	0%	0%	0%
10%	& Autocorr. = 0	7%	11%	23%	43%	0%	0%	0%	0%
20%		17%	22%	37%	58%	0%	0%	0%	0%
30%		35%	41%	56%	74%	0%	0%	0%	0%

3.3.2. *Uniform residuals*

Residuals bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	5%	9%	20%	39%	5%	5%	5%	5%
10%		5%	8%	20%	40%	6%	6%	6%	6%
20%		5%	9%	20%	39%	16%	16%	16%	16%
30%		6%	9%	20%	39%	35%	36%	35%	36%
0%	b-percentile	5%	9%	19%	37%	7%	7%	7%	7%
10%	(asymptotic	5%	8%	19%	37%	11%	11%	11%	11%
20%	approximation)	5%	8%	17%	34%	25%	25%	25%	25%
30%		5%	7%	16%	32%	47%	48%	47%	48%
0%	b-percentile	8%	12%	25%	47%	5%	5%	5%	5%
10%	(non asymptotic)	8%	12%	26%	48%	4%	3%	3%	4%
20%		9%	13%	27%	49%	9%	8%	8%	8%
30%		9%	13%	28%	50%	22%	22%	21%	22%
0%	percentile-t	5%	9%	21%	40%	7%	7%	7%	7%
10%		5%	9%	21%	41%	12%	12%	11%	12%
20%		5%	9%	21%	39%	26%	26%	26%	26%
30%		5%	8%	20%	38%	49%	50%	49%	49%
		F-stat				percentile-F			
0%	Test: Bias = 0	5%	8%	16%	33%	0%	0%	0%	0%
10%	& Autocorr. = 0	8%	11%	23%	43%	0%	0%	0%	0%
20%		17%	22%	36%	57%	0%	0%	0%	0%
30%		36%	42%	55%	75%	0%	0%	0%	0%

Pairwise bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	5%	9%	21%	40%	5%	5%	5%	5%
10%		6%	9%	20%	40%	6%	6%	7%	7%
20%		5%	9%	20%	39%	16%	16%	16%	16%
30%		5%	9%	21%	39%	35%	36%	35%	35%
0%	b-percentile	5%	10%	22%	41%	6%	6%	6%	6%
10%	(asymptotic	6%	10%	21%	41%	7%	8%	8%	8%
20%	approximation)	6%	10%	21%	40%	17%	17%	17%	17%
30%		6%	10%	22%	40%	36%	37%	36%	36%
0%	b-percentile	6%	10%	22%	42%	7%	7%	7%	7%
10%	(non asymptotic)	7%	10%	22%	41%	8%	8%	8%	8%
20%		7%	10%	22%	41%	19%	18%	19%	18%
30%		7%	10%	23%	40%	38%	38%	38%	38%
0%	percentile-t	4%	9%	22%	41%	6%	6%	5%	6%
10%		5%	9%	21%	42%	7%	8%	8%	8%
20%		5%	9%	21%	41%	18%	18%	18%	18%
30%		5%	10%	22%	41%	38%	38%	38%	37%
		F-stat				percentile-F			
0%	Test: Bias = 0	5%	7%	17%	33%	0%	0%	0%	0%
10%	& Autocorr. = 0	8%	11%	23%	43%	0%	0%	0%	0%
20%		17%	22%	36%	57%	0%	0%	0%	0%
30%		35%	41%	56%	74%	0%	0%	0%	0%

3.3.3. *Residuals with outliers*

Residuals bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	4%	13%	39%	64%	3%	4%	3%	3%
10%		4%	12%	38%	63%	4%	5%	5%	5%
20%		4%	13%	38%	64%	12%	13%	13%	13%
30%		4%	13%	37%	61%	33%	34%	33%	34%
0%	b-percentile	4%	13%	38%	62%	6%	6%	5%	5%
10%	(asymptotic	4%	11%	35%	60%	10%	10%	10%	10%
20%	approximation)	3%	11%	33%	58%	27%	27%	28%	27%
30%		3%	10%	31%	54%	56%	56%	55%	56%
0%	b-percentile	9%	22%	51%	71%	4%	4%	4%	4%
10%	(non asymptotic)	10%	22%	51%	71%	3%	3%	4%	4%
20%		10%	22%	51%	72%	10%	10%	10%	10%
30%		11%	23%	52%	72%	28%	28%	27%	27%
0%	percentile-t	8%	20%	47%	68%	5%	6%	5%	5%
10%		8%	19%	46%	67%	10%	10%	10%	10%
20%		8%	19%	45%	67%	26%	26%	26%	26%
30%		8%	18%	43%	64%	54%	54%	53%	54%
		F-stat				percentile-F			
0%	Test: Bias = 0	3%	10%	31%	58%	0%	0%	0%	0%
10%	& Autocorr. = 0	6%	13%	39%	65%	0%	0%	0%	0%
20%		14%	25%	53%	74%	0%	0%	0%	0%
30%		33%	46%	69%	83%	0%	0%	0%	0%

Pairwise bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	4%	13%	39%	64%	3%	3%	3%	3%
10%		4%	13%	39%	63%	4%	4%	4%	4%
20%		4%	14%	39%	63%	13%	13%	13%	13%
30%		4%	12%	38%	61%	32%	32%	32%	33%
0%	b-percentile	4%	14%	39%	64%	3%	3%	4%	4%
10%	(asymptotic	4%	14%	40%	63%	5%	5%	5%	5%
20%	approximation)	5%	14%	40%	62%	15%	15%	15%	15%
30%		4%	13%	39%	60%	36%	36%	35%	36%
0%	b-percentile	8%	19%	46%	68%	7%	8%	8%	8%
10%	(non asymptotic)	7%	19%	46%	67%	10%	11%	11%	10%
20%		8%	19%	47%	67%	23%	22%	23%	22%
30%		8%	19%	45%	66%	41%	42%	41%	42%
0%	percentile-t	9%	21%	47%	68%	5%	6%	5%	5%
10%		8%	20%	47%	67%	8%	8%	8%	8%
20%		9%	21%	47%	67%	22%	22%	22%	22%
30%		9%	20%	47%	66%	43%	43%	42%	43%
		F-stat				percentile-F			
0%	Test: Bias = 0	3%	9%	31%	58%	0%	0%	0%	0%
10%	& Autocorr. = 0	5%	14%	39%	64%	0%	0%	0%	0%
20%		14%	25%	53%	74%	0%	0%	0%	0%
30%		33%	46%	68%	82%	0%	0%	0%	0%

3.3.4. *Heteroskedastic residuals*

GARCH(1,1) residuals in the form of $\varepsilon_t = \sqrt{h_t}.v_t$ where v_t is i.i.d. from a Gaussian standardized distribution and $h_t = \omega + \alpha.(\varepsilon_{t-1})^2 + \beta.h_{t-1}$, unconditional variance of the residuals set to one.

$(\alpha, \beta) = (0.5, 0)$

Residuals bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	4%	9%	21%	41%	12%	13%	13%	13%
10%		4%	8%	22%	40%	14%	14%	15%	15%
20%		4%	8%	20%	39%	22%	22%	22%	22%
30%		4%	8%	19%	37%	34%	35%	33%	33%
0%	b-percentile	4%	8%	21%	39%	17%	17%	17%	17%
10%	(asymptotic	4%	8%	19%	36%	20%	20%	21%	21%
20%	approximation)	3%	7%	17%	34%	31%	30%	30%	30%
30%		3%	6%	16%	30%	44%	45%	43%	43%
0%	b-percentile	7%	12%	28%	49%	12%	12%	12%	12%
10%	(non asymptotic)	7%	13%	28%	49%	11%	11%	11%	12%
20%		7%	12%	29%	49%	16%	16%	15%	16%
30%		8%	13%	28%	48%	25%	25%	25%	25%
0%	percentile-t	5%	10%	24%	43%	16%	17%	17%	17%
10%		5%	10%	23%	42%	20%	20%	21%	21%
20%		4%	9%	22%	40%	31%	31%	31%	31%
30%		4%	9%	20%	37%	45%	45%	44%	44%
		F-stat				percentile-F			
0%	Test: Bias = 0	10%	14%	25%	41%	0%	0%	0%	0%
10%	& Autocorr. = 0	13%	17%	29%	47%	0%	0%	0%	0%
20%		21%	26%	40%	57%	0%	0%	0%	0%
30%		34%	39%	51%	67%	0%	0%	0%	0%

Pairwise bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	4%	9%	21%	41%	13%	13%	13%	13%
10%		4%	9%	21%	41%	15%	14%	14%	14%
20%		4%	8%	20%	39%	22%	22%	22%	21%
30%		4%	7%	19%	37%	34%	34%	33%	33%
0%	b-percentile	6%	12%	26%	47%	8%	7%	8%	8%
10%	(asymptotic	6%	12%	27%	48%	9%	9%	8%	8%
20%	approximation)	6%	12%	26%	47%	13%	14%	13%	13%
30%		7%	12%	27%	47%	23%	22%	22%	22%
0%	b-percentile	6%	11%	26%	48%	8%	8%	8%	8%
10%	(non asymptotic)	6%	12%	27%	49%	9%	9%	9%	8%
20%		7%	12%	27%	48%	14%	15%	14%	14%
30%		7%	11%	27%	47%	26%	25%	24%	24%
0%	percentile-t	6%	12%	27%	47%	8%	8%	9%	8%
10%		6%	12%	27%	48%	10%	10%	9%	9%
20%		6%	12%	27%	47%	14%	15%	15%	14%
30%		6%	12%	28%	47%	24%	23%	24%	23%
		F-stat				percentile-F			
0%	Test: Bias = 0	11%	14%	24%	41%	0%	0%	0%	0%
10%	& Autocorr. = 0	14%	18%	30%	47%	0%	0%	0%	0%
20%		21%	26%	39%	56%	0%	0%	0%	0%
30%		34%	38%	51%	67%	0%	0%	0%	0%

$(\alpha, \beta) = (0.3, 0.65)$

Residuals bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	4%	12%	32%	53%	9%	9%	10%	10%
10%		5%	12%	31%	50%	10%	10%	12%	11%
20%		5%	12%	29%	45%	19%	18%	19%	18%
30%		4%	11%	27%	42%	31%	30%	30%	30%
0%	b-percentile	4%	12%	30%	50%	13%	13%	13%	14%
10%	(asymptotic	4%	11%	28%	47%	17%	16%	17%	17%
20%	approximation)	4%	10%	25%	41%	27%	27%	27%	27%
30%		3%	9%	22%	36%	42%	41%	41%	40%
0%	b-percentile	7%	17%	38%	60%	9%	9%	10%	10%
10%	(non asymptotic)	8%	17%	38%	58%	8%	8%	9%	8%
20%		8%	17%	37%	55%	13%	12%	13%	13%
30%		8%	16%	35%	52%	21%	21%	21%	21%
0%	percentile-t	5%	14%	34%	54%	13%	12%	13%	13%
10%		5%	13%	33%	51%	17%	16%	17%	17%
20%		5%	13%	30%	46%	28%	28%	28%	27%
30%		4%	12%	27%	41%	43%	42%	42%	42%
		F-stat				percentile-F			
0%	Test: Bias = 0	8%	14%	30%	50%	0%	0%	0%	0%
10%	& Autocorr. = 0	10%	17%	36%	54%	0%	0%	0%	0%
20%		19%	26%	45%	62%	0%	0%	0%	0%
30%		30%	39%	56%	70%	0%	0%	0%	0%

Pairwise bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	4%	12%	32%	52%	9%	10%	10%	10%
10%		5%	12%	30%	50%	11%	11%	11%	10%
20%		5%	11%	29%	47%	18%	18%	18%	18%
30%		5%	11%	26%	42%	31%	31%	30%	30%
0%	b-percentile	6%	14%	35%	55%	7%	7%	7%	7%
10%	(asymptotic	6%	14%	34%	53%	8%	8%	8%	7%
20%	approximation)	6%	14%	33%	51%	13%	14%	13%	13%
30%		6%	14%	31%	47%	24%	23%	23%	22%
0%	b-percentile	6%	15%	36%	56%	7%	8%	8%	8%
10%	(non asymptotic)	7%	15%	34%	54%	9%	9%	9%	8%
20%		7%	15%	34%	52%	14%	15%	14%	14%
30%		7%	15%	31%	47%	26%	25%	25%	24%
0%	percentile-t	6%	15%	35%	55%	7%	8%	8%	8%
10%		6%	15%	34%	53%	9%	9%	9%	8%
20%		7%	14%	34%	52%	15%	15%	14%	14%
30%		6%	15%	31%	47%	25%	24%	24%	23%
		F-stat				percentile-F			
0%	Test: Bias = 0	8%	14%	30%	49%	0%	0%	0%	0%
10%	& Autocorr. = 0	11%	17%	35%	53%	0%	0%	0%	0%
20%		18%	26%	44%	62%	0%	0%	0%	0%
30%		31%	39%	55%	70%	0%	0%	0%	0%

$(\alpha, \beta) = (0.2, 0.79)$

Residuals bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	5%	21%	48%	65%	8%	9%	9%	8%
10%		5%	20%	45%	61%	10%	9%	9%	10%
20%		5%	19%	42%	56%	19%	18%	17%	17%
30%		5%	18%	38%	50%	32%	32%	31%	30%
0%	b-percentile	5%	20%	47%	62%	12%	12%	12%	12%
10%	(asymptotic	5%	19%	42%	58%	16%	15%	15%	16%
20%	approximation)	4%	16%	38%	50%	27%	27%	26%	26%
30%		4%	15%	32%	43%	44%	43%	42%	42%
0%	b-percentile	8%	26%	55%	70%	9%	9%	9%	9%
10%	(non asymptotic)	8%	26%	52%	68%	8%	7%	7%	7%
20%		8%	25%	50%	64%	13%	12%	11%	12%
30%		9%	25%	47%	59%	23%	22%	22%	21%
0%	percentile-t	6%	23%	49%	65%	11%	12%	11%	11%
10%		5%	22%	46%	62%	16%	15%	15%	16%
20%		5%	20%	43%	56%	28%	27%	27%	27%
30%		5%	19%	38%	49%	45%	44%	43%	43%
		F-stat				percentile-F			
0%	Test: Bias = 0	7%	20%	45%	61%	0%	0%	0%	0%
10%	& Autocorr. = 0	10%	24%	49%	66%	0%	0%	0%	0%
20%		19%	33%	57%	71%	0%	0%	0%	0%
30%		32%	47%	67%	78%	0%	0%	0%	0%

Pairwise bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	4%	21%	48%	65%	9%	8%	8%	8%
10%		4%	21%	45%	61%	10%	10%	10%	9%
20%		5%	19%	41%	56%	18%	18%	17%	17%
30%		5%	18%	37%	49%	32%	32%	31%	30%
0%	b-percentile	6%	23%	49%	66%	7%	6%	6%	7%
10%	(asymptotic	6%	23%	47%	62%	9%	8%	8%	8%
20%	approximation)	6%	21%	44%	58%	15%	15%	14%	14%
30%		7%	20%	40%	52%	27%	27%	26%	24%
0%	b-percentile	7%	24%	50%	67%	8%	8%	8%	8%
10%	(non asymptotic)	6%	23%	48%	64%	10%	9%	8%	8%
20%		7%	22%	45%	58%	17%	16%	16%	15%
30%		7%	21%	41%	53%	30%	30%	28%	27%
0%	percentile-t	6%	23%	49%	66%	8%	7%	7%	8%
10%		6%	23%	47%	62%	10%	10%	9%	8%
20%		6%	22%	44%	58%	17%	17%	16%	15%
30%		7%	21%	40%	52%	29%	29%	27%	26%
		F-stat				percentile-F			
0%	Test: Bias = 0	7%	20%	44%	63%	0%	0%	0%	0%
10%	& Autocorr. = 0	11%	26%	50%	65%	0%	0%	0%	0%
20%		19%	34%	57%	71%	0%	0%	0%	0%
30%		32%	48%	67%	77%	0%	0%	0%	0%

$(\alpha, \beta) = (0.05, 0.94)$

Residuals bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	5%	20%	52%	72%	8%	8%	8%	7%
10%		5%	21%	50%	70%	11%	10%	10%	10%
20%		5%	20%	49%	67%	20%	20%	19%	18%
30%		5%	19%	45%	65%	38%	37%	37%	35%
0%	b-percentile	5%	20%	49%	70%	12%	12%	12%	11%
10%	(asymptotic	4%	19%	47%	67%	16%	16%	16%	16%
20%	approximation)	4%	18%	44%	62%	29%	30%	29%	27%
30%		4%	16%	39%	57%	49%	49%	49%	47%
0%	b-percentile	8%	26%	57%	76%	9%	9%	9%	8%
10%	(non asymptotic)	8%	26%	57%	76%	8%	8%	8%	7%
20%		9%	27%	56%	74%	13%	14%	13%	12%
30%		9%	26%	54%	73%	27%	27%	26%	25%
0%	percentile-t	6%	23%	53%	72%	12%	11%	11%	10%
10%		5%	22%	51%	70%	17%	16%	16%	16%
20%		6%	22%	49%	66%	30%	30%	30%	28%
30%		5%	20%	45%	63%	50%	49%	50%	48%
		F-stat				percentile-F			
0%	Test: Bias = 0	8%	20%	48%	69%	0%	0%	0%	0%
10%	& Autocorr. = 0	11%	26%	55%	74%	0%	0%	0%	0%
20%		20%	37%	65%	80%	0%	0%	0%	0%
30%		37%	53%	76%	88%	0%	0%	0%	0%

Pairwise bootstrap

Bias (% of std) ►		0%	10%	20%	30%	0%	10%	20%	30%
▼ Autocorr. (% of std)		Test: Bias = 0				Test: Autocorrelation = 0			
0%	t-stat	5%	21%	52%	73%	8%	9%	8%	7%
10%		5%	21%	51%	71%	10%	10%	9%	9%
20%		5%	19%	48%	69%	20%	20%	20%	19%
30%		5%	19%	46%	66%	37%	37%	36%	35%
0%	b-percentile	6%	22%	51%	72%	7%	7%	7%	6%
10%	(asymptotic	6%	22%	50%	70%	8%	8%	8%	8%
20%	approximation)	6%	21%	48%	68%	17%	17%	17%	17%
30%		6%	21%	46%	65%	33%	33%	32%	32%
0%	b-percentile	7%	23%	52%	72%	8%	8%	8%	8%
10%	(non asymptotic)	7%	23%	51%	70%	9%	9%	9%	9%
20%		7%	22%	49%	68%	19%	19%	19%	18%
30%		7%	21%	47%	64%	35%	35%	34%	34%
0%	percentile-t	7%	23%	51%	71%	8%	8%	8%	7%
10%		6%	24%	50%	69%	10%	10%	10%	10%
20%		6%	22%	48%	68%	19%	20%	19%	19%
30%		7%	22%	47%	65%	36%	36%	34%	35%
		F-stat				percentile-F			
0%	Test: Bias = 0	7%	20%	48%	70%	0%	0%	0%	0%
10%	& Autocorr. = 0	10%	25%	55%	74%	0%	0%	0%	0%
20%		20%	36%	65%	82%	0%	0%	0%	0%
30%		37%	53%	76%	88%	0%	0%	0%	0%

4. CONCLUSION

Inference on the bias or serial correlation of the forecast errors based on usual parametric tests may not be accurate, particularly where time samples of forecasts are typically short. A solution in order to obtain more accurate standard tests can be to bootstrap the latter statistics, i.e. to resample the data randomly and compute the test with the distribution of the bootstrapped statistics. In this annex, we introduce classical bootstrap tests that can be used for the evaluation of both the bias and the correlation of the Commission biyearly economic forecasts. The tests are screened with Monte-Carlo simulations. In particular, the percentile-t residuals bootstrap test exhibit correct size and reasonable power under a variety of data generating processes.

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