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Early-warning tools to forecast General Government deficit in the euro area: the role of intra-annual fiscal Indicators

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RESUMEN
Este artículo evalúa la conveniencia de utilizar un conjunto de indicadores fiscales de frecuencia intra anual como herramientas de alerta temprana de la evolución futura del déficit de las Administraciones Públicas en los principales países de la Unión Económica y Monetaria (Bélgica, Alemania, España, Francia, Italia, Holanda, Irlanda, Austria y Finlandia), así como del agregado del área del euro. Los indicadores se construyen sobre la base de cifras de la contabilidad pública de caja, y presentan frecuencias mensuales y trimestrales. La utilidad para la previsión y seguimiento de las cuentas públicas europeas, con las consiguientes implicaciones de política económica, quedan patentes, pues el artículo demuestra que el uso de los indicadores permite anticipar los desarrollos de las cuentas del conjunto de las Administraciones Públicas, tanto desde el punto de vista cuantitativo como cualitativo.

Palabras clave: Indicadores adelantados; previsión y seguimiento de variables fiscales; capacidad / necesidad de financiación de las Administraciones Públicas; Unión Económica y Monetaria.

ABSTRACT
In this paper I evaluate the usefulness of a set of fiscal indicators as early-warning-signal tools for annual General Government Net Lending developments for some EMU countries (Belgium, Germany, Spain, France, Italy, The Netherlands, Ireland, Austria, Finland) and an EMU aggregate. The indicators are mainly based on monthly and quarterly public accounts' figures. I illustrate how the dynamics of the indicators show a remarkable performance when anticipating general government accounts' movements, both in qualitative and in quantitative terms.

Keywords: Leading indicators; Fiscal forecasting and monitoring; General Government Deficit; European Monetary Union.

JEL classification: C53; E6; H6.

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1 Introduction

Forecasting[1] and monitoring fiscal variables' developments is currently an important policy issue in Europe. Not only because at the national level adherence of governments to announced budgetary targets creates a framework of stability, but also because of two additional reasons, related to supra-national considerations.

Firstly, the forecasting and monitoring of fiscal variables appears as crucial to the light of the operation of the Stability and Growth Pact (SGP) and related national laws, where countries are committed to submit to the European Commission multi-annual plans presenting forecasts for a certain number of years. Even in a policy framework where the prevalent reading of the SGP is a lax interpretation of the "close-to-balance or in surplus" clause (remind the current policy debate about SGP flexibilisation), the peer pressure at the EU level is positioned in making governments commit to the announced plans. Thus both the quality of forecasts published by national governments, and the monitoring tools employed by supra-national organisations, and private corporations, when assessing those projections, should be as accurate as possible.

Secondly, the relevance of fiscal forecasting and monitoring is evident for the appropriate implementation of monetary policy in the current EMU decentralised fiscal context. Inflation and other key macroeconomic variables' developments are clearly affected by the fiscal stance, so the availability of appropriate tools to assess deviations from expected outcomes, early in advance, are needed.

Within this general framework, any means of improving fiscal forecasting at the EMU level is warranted. The relevant official figures for the EU policy framework are prepared in annual terms, using as conceptual reference method the European System of Integrated Economic Accounts (ESA95). The delay in the availability of these figures makes difficult the early detection of a deterioration in the balances that could lead a given country to the danger area approaching the limits set forth by European fiscal rules. The lag in the collection of annual general government

[1] Fruitful discussions with Joao Nogueira Martins and Pablo García-Luna are gratefully acknowledge. Helpful comments from Mike Artis, Christian Dreger, Daniele Franco, Teresa García-Milà, Miguel Jiménez, Ana Lamo, José Marín, Alfonso Novales, Fabrice Orlandi, Diego Pedregal, Matteo Salto, José Luis Torres, Jean-Pierre Vidal, and seminar participants at the European Central Bank (Frankfurt), ESCB Working Group on Public Finance (Frankfurt), International Symposium on Forecasting (Dublin), UNED (Madrid), `centrA` (Seville), European University Institute (Florence), National Tax Association Meeting (Chicago), UCM (Madrid), and Bulgarian National Bank Conference (Varna) are also acknowledged. Any remaining errors are the sole responsibility of the author.

account's figures may take half a year before it is definitive and usable for policy analysis. In order to fill in this informational gap there is a running Eurostat project aiming at building up quarterly fiscal figures in ESA95 terms (European Commission, 2002a). Nevertheless, the project presents some shortcomings in terms of timing (it will only be completed by the end of 2005 in its first, preliminary version), but, specially, coverage (it will be limited to the sample starting in the first quarter of 1999) and timeliness (at least with one quarter of delay).

These unfavourable facts regarding intra-annual ESA95 *fiscal* information renders the monthly/quarterly-based revenue and expenditure cash data on central government and other sub-sectors of the general government as one of the most important pieces of direct information on fiscal variables when assessing the development of public finances in the short run. Public accounts' figures are published regularly and timely, with a wide coverage of revenue and expenditure categories. They can be used also as a companion to the quarterly ESA95-based Eurostat series once they are available.

The specific features of public sector budgeting and the recording of information on issues such as tax collection, or social payments, make necessary that the relevant recording period be the year. For example, in the case of tax and social contributions' collection, cash amounts are recorded in public sector accounts but they should be time-adjusted so that they are attributed to the period when the activity took place to generate the liability. This makes a monthly profile based on cash accounts not relevant for the monitoring of public sector development *within the year*.

Nevertheless, new incoming monthly and quarterly fiscal figures can be used by the analyst to infer likely changes in the final *annual* outcome of the relevant government sector/subsector. There is scope for infra-annual adjustments (for example, debt redemption payments are usually announced by governments at the beginning of the year), and a yearly inertia attached to certain months of the year (for example, the collection of income taxes effected in a given quarter of the year on a repeated basis) that can be exploited by the analyst. The use of those figures for monitoring purposes has to be done with sound statistical tools, and the necessary institutional knowledge of the data. In this paper I pose more emphasis on the statistical treatment, although in a following Section I review the institutional peculiarities of the database.

The use of monthly and quarterly State's revenues is quite developed in the literature for the US, and to a lesser extent the UK. The empirical works for the US case tend to focus on forecasting State tax revenue given the need to achieve an end-of-year balanced budget at the State level. Just to signal a few examples, see Fullerton (1989) or Lawrence *et al.* (1998), and the references quoted therein. On the contrary, public accounts' figures in the EMU have been the subject of little attention in the academic literature, and are scarcely mentioned in any official report from pan-European organizations. Some exceptions are Kinnunen (1999) and Moulin *et al* (2004). Using Finnish data Kinnunen (1999) concluded that the estimated time series models produced quite plausible forecasts for the short-term developments of some *central* government revenue and expenditure items in national accounts terms. Nevertheless, she also concluded that the volatile character of the analysed series made difficult the estimation of underlying structural components. Moulin *et al.* (2004), analysing the case of France, used monthly cash figures for the Central Government to monitor the annual outcome, in the US literature tradition. Camba-Mendez and Lamo (2004), on different grounds, provide estimates for quarterly balances for Germany and Italy, on the basis of annual general government deficits and quarterly GDP, focusing on the study of structural deficits.

This paper attempts at filling in the existing gap in the literature for the EMU. The purpose is to see whether there is some valuable information in some selected countries' infra-annual fiscal information that could be used to improve the forecasting and monitoring of annual general government deficit in ESA95 terms, the relevant policy variable at EMU level. To do so I focus on some Net borrowing/lending series for nine selected euro area countries: Belgium, Germany, Spain, France, Italy, The Netherlands, Ireland, Austria, and Finland, that amount to almost 95% of euro area GDP. The available series are referred mainly to the central government sector, with some exceptions. I restrict the analysis to the balance between revenues and expenditures to make clear the point of the paper. The methodology was purposely kept simple (regression analysis, basic time series methods) to stress the information content of the database, and to potentially attract the attention of policy-makers. In this sense, the adopted methodology consists of two steps: (i) in a first step univariate forecasts of monthly/quarterly indicators are obtained, and the annual counterpart is computed; (ii) in a second step, a regression at the annual level is run between the target variable (General Government deficit) and the indicator series, so that a quarterly estimate of the annual General Government deficit can be obtained upon the basis of the forecast values of the indicators in step (i).

The forecasting performance of the indicators is checked both in quantitative (size of forecast errors) and qualitative (likely evolution of target variables) terms. In addition, the forecasting ability of the indicator-based approach is presented against the track record of EU Commission's general government deficit forecasts over the last ten years, and an alternative combining both indicator-based estimates and EU Commission provided estimates. Finally, I construct a simple, synthetic indicator for the euro area as a whole, that turns out to be a quite accurate predictor of the evolution of the euro area fiscal stance in the short run.

The paper is organised as follows. Section 2 sets forth the data employed in the analysis, and presents some illustrative qualitative evidence. The qualitative results are substantiated in Section 3 by means of the estimation of econometric models. The forecasting performance of these models is checked in Section 4. In Section 5 I present and analyse the aggregate EMU indicator. Finally, Section 6 concludes.

2 Data description

2.1 Public Accounts and National Accounts

The preparation and monitoring of annual budget in each EMU country tends to be based on a specific definition (or even several different definitions) of budget deficit, calculated according to national practices. The accounting procedures, methods of compilation of data, timing of recording of transactions, as well as the coverage of budgets differ from country to country. It is common to refer to these figures as the Public Accounts. In the context of the International Monetary Fund SDDS project, there has been an attempt to unify these methods, and making national practices transparent. In contrast, as already mentioned above, the budgetary surveillance at the European Union level is based on a harmonised concept of deficit. In the context of the excessive deficit procedure, budget deficit means Net Borrowing/Net Lending of the General Government as defined by ESA95.

The detailed accounting rules and conventions involved in the compilation of the Net Borrowing/Net Lending of the General Government, and the differences between National Accounts and Public Accounts, are important, as will become clear in the next paragraphs. For a deeper analysis the interested reader can consult European Commission(1996, 2002b) for National Accounts-related matters, and http://dsbb.imf.org for public accounts specific features.

The first important difference regards the coverage of each system. On the one hand, in National Accounts, the relevant sector is the General Government sector which covers Central Government, State governments, Local governments and Social Security funds. On the other hand, Public Accounts typically covers only the State or the Central Government, which weight on General Government depends on the institutional characteristics of each country. Moreover, even the concepts of State or Central Government are not the same in Public Accounts and in National Accounts because, while sectors are defined on a functional basis in the latter, the Public Accounts coverage is on an institutional basis. As an implication of this principle, the coverage of Public Accounts may change over time, because of legal and institutional changes, while the coverage of National Accounts tends to be more stable.

The second relevant discrepancy regards the calculation of the deficit. The Net Borrowing/Lending in ESA95 is the difference between revenue and expenditure, which includes current and capital transactions and exclude all financial transactions. Public accounts frequently include financial transactions, such as capital injections or privatisation receipts. Moreover, while transactions are recorded in National Accounts on an accruals basis, Public Accounts are often compiled at the time of the cash flows.

The third relevant difference regards frequency and timeliness in the availability of new figures. Public Accounts' figures present a major advantage in terms of frequency and timeliness, as they are typically published monthly with short lags, and they are not subject to revisions. On the contrary, National Accounts figures are only available with a considerable delay, and are subject to frequent and substantial revisions.

[INSERT Table 1]

In this paper, I focus on a set of mainly Public Accounts-based monthly/quarterly central and general government balance series for Belgium, Germany, Spain, France, Italy, The Netherlands, Ireland, Austria, and Finland. For these countries I was able to find publicly available and lengthy time series. Definitions and sources are displayed in Table 1. For details on the definitions and precise coverage the interested reader can consult directly the national sources, as stated in Table 1. I will refer to the selected series as *indicators*. It is worth mentioning that some corrections had to be done regarding sizable outliers and missing values in the series. For France the values for January-February of 1970, and 1976 to 1993 were missing, and thus were interpolated using a monthly Unobserved Components model. In the case of The Netherlands, 1986 and 1987 presented huge values totally out of line with the historical series, and the decision was to smooth out the corresponding quarters by taking 4-order centered moving averages; in the first and second quarters of 1994 two huge outliers in revenue were marked as missing and interpolated. For Austria the missing values in the fourth quarter of 1985 and 1989 were interpolated as well . In the case of

Ireland a huge negative outlier in July 1999 was followed by a huge outlier in December 1999 of the opposite sign: the solution taken was that both values where treated as missing and interpolated. The time series were interpolated in a standard fashion by estimating Unobserved Components Models.

I selected one indicator of Net Lending/Net Borrowing for each of the nine countries with monthly/quarterly periodicity[2]. All series were converted into the quarterly frequency in order to guarantee homogeneity, given that some series (fully or partially) where only available at that frequency (see Table 1). Figure 1 shows the plot of the selected indicators.

[INSERT Figure 1]

Finally, the source of all annual National Accounts data for General Government is the EU Commission database AMECO, and covers the period 1970-2003, but for Spain, Austria, and Finland where the starting date is 1980. The following convention is adopted for homogeneity: ESA79 figures are taken for the period 1970 to 1990, while ESA95 figures are taken for the years 1991 to 2003, but for Spain, where ESA95 figures where only available from 1996 on.

The impact of UMTS one-off proceeds relative to the allocation of mobile licenses (UMTS) was removed from the Net Lending / Net Borrowing series. The exact amounts were for Germany in 2000 50.8 billions euro, for Spain 0.52 bill. euro in 2000, for Italy 13.8 bill euro in 2000, for The Netherlands 2.7 bn euro in 2000, for Austria 0.81 bn euro in 2000, for Belgium 0.45 bn euro in 2001, for France 1.2 bn euro in 2001 and 0.62 bn euro in 2002, and for Ireland 0.21 bn euro in 2002. As for the indicator series, corrections were needed in several cases to avoid distortions in the statistical analysis. For Germany the amount of 50.8 bn euro (2.5% of GDP) was subtracted in the third quarter of 2000, given it was apparently assigned to that quarter; the alternative of removing the huge outlier from the quarterly series, marking it as a missing observation and finding an interpolated value produced the same results. For Italy the amount of 13.8 bn euro (1.2% of GDP) was distributed uniformly in the four quarters of 2000, to guarantee that the annual counterpart reflected the negative amount. The same solution was adopted with the UMTS proceeds in The

[2]I also analysed other indicators for the main six EMU countries. For Belgium the Treasury Financing Requirement (monthly, for the whole considered period). For Germany the Central Government balance in Public Accounts terms. For France the *Solde général d'exécution*. For Italy the General Government Borrowing Requirement. In all the cases the results where almost identical to the ones presented in the paper with the selected indicators.

Netherlands (amounting to a 0.7% of GDP). For the rest of countries no corrective action was taken, given that no amount was bigger that 0.4% of GDP, and that it was not clear where to assign the intervention from the time series analysis point of view.

2.2 Some preliminary evidence

With a set of simple statistical evidence, it is possible to notice the perceptible comovement between the selected indicator series and the variable of reference, the General Government Net Borrowing/Net Lending of each country in ESA terms.

Figure 2 presents the evolution of the General Government deficit series and the Indicators, for the set of countries under study. The message one can draw from the figure is that of an apparent comovement between the Indicators and the General Government variables. One can take this evidence as a rough indication for the potential long-run link between the Indicator series and the ESA balances. Notice that this evidence is based on the level of the variables as a percentage of GDP. It seems to hold irrespective of the fiscal decentralization process that has been a characteristic of the period for most EMU countries.

[INSERT Figure 2]

Another piece of complementary evidence is related to the percentage of times that the changes in the General Government deficit series in ESA terms presented the same sign that the changes in the selected Indicator series based (mainly) on Public Accounts figures. The percentages were 70% for Belgium, 100% for Germany, 79% for Spain, 70% for France, 76% for Italy, 85% for The Netherlands, 73% for Ireland, 74% percent for Austria and, finally, 95% for Finland. Thus, changes in the Indicators are quite similar to changes in ESA General Government variables. This fact suggests that added to the long-run relationship, there might be a short-run relation between the series, reflected in common short-run dynamics. Even if there were differences in the evolution of the levels (around a long-run relationship) that might persist for some years (as it is apparent from Figure 2 - see for example the case of Belgium in the first half of the nineties), the important issue when dealing with short-term forecasting is whether the direction of change of the indicator and the variable to be indicated is the same.

Notice that the point is not to stress that the indicator anticipates the variable to be indicated, but rather that there seems to be some kind of contemporaneous comovement. Nevertheless, given the Indicator variables are observed with anticipation (as monthly/quarterly realisations are available within the year), the common patterns might be useful when forecasting annual General Government series. These two insights can be substantiated in a quantitative fashion by estimating quantitative models for each country, using as a predetermined variable the indicator, and as endogenous variable the General Government deficit. Note that an indicator series can be deemed as predetermined in that it is updated quarterly, and thus its annual value is known in advance of the General Government variable. For a general methodological perspective on leading indicators see Lahiri and Moore (1993).

3 Quantitative evidence

I estimate in this Section *Error Correction Models* (see Engle and Granger (1987)), designed to capture both short- and long-run relationships. In a preliminary stage, following the usual methodology, tests on the order of integration of the series were performed, showing that the null hypothesis of a unit root in the series could not be rejected in all cases[3]. Taking account of the potential presence of cointegration, the general specification for the estimated Error Correction Models is given by the following expression:

$$\Delta \frac{GG_t}{GDP_t} = \alpha_1 \Delta \frac{Indicator_t}{GDP_t} + \alpha_2 \left(\frac{Indicator_{t-1}}{GDP_{t-1}} + \alpha_3 \frac{GG_{t-1}}{GDP_{t-1}} \right) + \sum \omega_i \, \xi_t^i + u_t \qquad (1)$$

where Δ stands for the first difference operator ($\Delta X_t = X_t - X_{t-1}$), and GG for the General Government deficit. ξ_t^i refers to a vector of dummy variables. In order to account for the methodological changeover from ESA79 standards to ESA95 ones, a dummy was included at the time of the change when it turned out to be statistically significant. For Germany a step variable in 1990 was needed to account for the impact of unification. Additional dummy variables are mentioned in Table 2, where all estimation results are displayed.

[INSERT Table 2]

[3] Results are available from the author upon request. Nevertheless, given the small sample available (annual data from 1970 to 2003), and the potential presence of structural breaks (policy changes) the results from the standard ADF have to be taken with caution. Given that the final aim of the estimated regressions is forecasting, the point of whether a first-difference or a level specification is used is not particularly relevant for this paper.

The following results can be highlighted from Table 2. Firstly, it is worth noticing that the long-run part is significant in all cases. Given the Engle and Granger (1987) representation theorem, if the coefficients attached to the long-run term turn out to be significant (and around one for all countries), then there is evidence for cointegration. Secondly, the short-run coefficient turns out to be significant as well in all cases: the dynamics of the General Government deficit and the Indicators are related, in most cases with a coefficient close to unity, being Italy an exception to this with a coefficient of 0.36. Thirdly, the goodness of fit measures are reasonable in terms of the percentage of variance explained by the regression models (the R^2 ranges from a minimum of 60% in France, to the 90% of Germany), as well as the diagnosis measures that show no remaining autocorrelation or heteroskedasticity in the residuals.

The validity check for the proposed quarterly variables to be useful (leading) indicators of the behaviour of the General Government Net Lending/ Borrowing lies in their ability to be useful in the process of anticipating in advance its future developments. Predictability tests can be performed based on the in-sample fit of the above regressions, or they can be based on the out-of-sample fit obtained from a sequence of recursive or rolling regressions. Following the advice of Inoue and Kilian (2004) I include two in-sample tests of predictability in Table 2. I include a standard F test for the null hypothesis of $\alpha_1 = 0$ and $\alpha_2 = 0$, i.e. a test for the influence of the indicator on the target variable. In addition, I include the Pesaran-Timmerman (1992)[4] statistic for the null hypothesis of independence between $\Delta \frac{GG_t}{GDP_t}$ and $\Delta \frac{\hat{GG_t}}{GDP_t}$, where $\Delta \frac{\hat{GG_t}}{GDP_t} \equiv \hat{\alpha}_1 \Delta \frac{Indicator_t}{GDP_t} + \hat{\alpha}_2 \left(\frac{Indicator_{t-1}}{GDP_{t-1}} + \hat{\alpha}_3 \frac{GG_{t-1}}{GDP_{t-1}} \right) + \sum \hat{\omega}_i \; \xi_t^i$. Both tests confirm the result already signalled that the indicators do have a strong information content in predicting the general government deficit as a percentage of GDP. In the case of the Pesaran and Timmerman test the null of independence is rejected clearly in all cases, while in the F-test case the joint null of $\alpha_1 = 0$ and $\alpha_2 = 0$ is also

[4]Let $\hat{X}_t \equiv \frac{\hat{GG_t}}{GDP_t}$ be a predictor of $X_t \equiv \frac{GG_t}{GDP_t}$. Define $y_t \equiv X_t - X_{t-1}$ and $y_t^p \equiv \hat{X}_t - X_{t-1}$. Introduce the indicator variables I_t^y ($I_t^y = 1$ if $y_t > 0$, $I_t^y = 0$ if $y_t \leq 0$), $I_t^{y^p}$ ($I_t^{y^p} = 1$ if $y_t^p > 0$, $I_t^{y^p} = 0$ if $y_t^p \leq 0$), and I_t^{y,y^p} ($I_t^{y,y^p} = 1$ if $y_t \; y_t^p > 0$, $I_t^{y,y^p} = 0$ if $y_t \; y_t^p \leq 0$). The proportion of times that the sign of y_t is correctly predicted is $\hat{P} = T^{-1} \sum_{t=1}^{T} I_t^{y,y^p}$. Let $\hat{P}_y = T^{-1} \sum_{t=1}^{T} I_t^y$ and $\hat{P}_{y^p} = T^{-1} \sum_{t=1}^{T} I_t^{y^p}$, then an estimator of $P_* = Prob(I_t^{y,y^p} = 1)$ is $\hat{P}_* = \hat{P}_y \hat{P}_{y^p} + (1 - \hat{P}_y)\,(1 - \hat{P}_{y^p})$. The Pesaran and Timmerman (1992) non-parametric test for the null hypothesis that y_t and y_t^p are independently distributed is computed as:

$$PT = \frac{\hat{P} - \hat{P}_*}{\{V(\hat{P}) - V(\hat{P}_*)\}^{1/2}} \sim N(0,1)$$

where $V(\hat{P}) = T^{-1}\hat{P}_*(1-\hat{P}_*)$ and $V(\hat{P}_*) = T^{-1}((2\hat{P}_y - 1)^2 \hat{P}_{y^p}(1-\hat{P}_{y^p})) + T^{-1}((2\hat{P}_{y^p} - 1)^2 \hat{P}_y(1-\hat{P}_y)) + 4T^{-2}(\hat{P}_y \hat{P}_{y^p}$ $(1-\hat{P}_y)(1-\hat{P}_{y^p}))$.

clearly rejected.

Nevertheless, given the constraints a real-time forecaster would be facing when making use of the described models, in the next Section I add an out-sample forecasting exercise. To do so, I follow a two-steps approach:

- Given new incoming quarterly information for a certain indicator it is possible to update its value for the current year by means of (univariate) forecasts of the remaining quarters to complete the final annual outcome. When the fourth quarter is available, the annual figure for the indicator is available, and there is no need for forecasts.

- Given this updated annual value of the indicator *in each quarter*, it is possible to obtain an annual estimate of the General Government deficit by means of estimated regressions of the kind displayed in equation (1), upon the basis of data available up to that quarter.

4 Forecasting performance exercise

4.1 Alternative methods

In order to check the accuracy of the estimates I compare the annual estimates based on the regressions in (1), updated four times a year, with the actual outcome of the annual General Government deficit. Instead of just analysing the shape and behaviour of the so-generated forecast errors' time series, I analyse them in conjunction with some alternatives of obtaining estimates of the objective variable based on different techniques and information sets.

I consider the following alternative ways: (i) estimates based on the regression in (1); (ii) estimates taken from European Commission bi-annual forecast reports; (iii) a combination of (i) and (ii) ; (iv) estimates based on the previous available annual figure (random walk forecast)[5].

As shown in Artis and Marcelino (2001) or Kereman (1999), the forecast record of the European Commission is among the best of the international organizations producing regular forecasts for European countries (others include the International Monetary Fund and the OECD). The European Commission forecasts make use of all available information at the time the forecasts is done, and are based on a bottom-up approach, not forecasting directly the deficit/surplus but rather computing

[5]I also computed estimates of the General Government deficit based on estimates of its components: Central Government (obtained from a regression of the kind of (1), Local Government and Social Security (obtained from annual random walks). The results of this disaggregated approach were worse that those obtained with the aggregated one, thus signalling that this disaggregated approach was not particularly useful.

it as the difference between revenues and expenditures. In addition, fiscal forecasts are produced in a framework in which macroeconomic models and experts' judgement are an important ingredient. In this sense, European Commission forecasts can be deemed as *full information forecasts* in terms of employed data and projection methods. When comparing the Indicator-based forecasts with the Commission ones, I do not have in mind an accuracy comparison, but I rather try to ascertain how close the Indicator-based forecasts are to full information based projections[6]. This is the reason I also provide a forecast combination alternative, with fixed weights 2/3 for the EU Commission forecasts and 1/3 to the indicator-based alternative. Symmetric weights (1/2-1/2) produced similar results, but I wanted to stress with the non-symmetry the potential use of indicator-based forecasts as companions to model-based, full-information alternatives.

The alternatives differ in the forecast method employed, and the amount of information used, but also in the periodicity forecasts are produced. On the one hand, the availability of quarterly data for the indicators permit having four estimates of the General Government deficit for a given year (one attached to the regression run with each quarterly update), with different information sets. On the other hand, the European Commission publishes forecasts in Spring (normally around May) and Autumn (normally around November) of each year, both for the year in course (current year), and a year ahead. Finally, the random walk alternative do not have intra-annual updates, as it is based directly on annual data.

4.2 Design of the forecasting exercise

The paper is focused on how updating quarterly information helps in anticipating the likely evolution of annual deficit outcomes. With this aim in mind, I do evaluate the performance of the proposed indicator-based methods (and the alternatives described above) according to their ability to forecast *annual outcomes* for the current year and a year ahead, given quarterly updates

[6]Notice that I am just picking up the estimates for the deficit ratio to GDP published by the EU Commission. In the predictive ability exercise I do not internalise the employed methods (mixture of econometric and judgemental), neither I do have information on the available information set at the time the forecast was done on macroeconomic variables, policy measures announced and internalised, fiscal variables (that do depend on macro variables), maybe even information on the fiscal indicators presented here. Given that I cannot control for all these factors, thus preventing me from making a real-time comparison, trying to read my results as a direct comparison would not be fair. In this sense I refer to the EU Commission projections as control forecasts for the performance of the proposed intra-annual fiscal indicators, not being interested in its own performance, but rather being interested in observing the comparative behaviour of my forecasts.

of the information. This exercise is in line with the typical forecasting exercise in international organisations (for example, the EU Commission, the International Monetary Fund, or the OECD) and budgeting practices in many European countries (where a revision on official deficit targets is published by mid-year). The usual forecasting comparison for a panel of quarterly horizons would not be that interesting for practical policy purposes, and would hide the potential relevance of intra-annual updates for the annual forecast. Thus, I designed the following forecasting exercise for the period 1994-2003[7] for all selected alternatives:

- Construct *current year* forecasts: using information up to quarter j of a given year t construct an estimate of the annual general government deficit of year t. To this end estimates/actuals for the rest of quarters of year t are needed. Thus, for each year t four estimates are produced, with different forecast origins, but the same final horizon.

- Construct *year ahead* forecasts: using information up to quarter j of a given year t construct an estimate of the annual general government deficit of year $t+1$. To this end estimates/actuals for the rest of quarters of year t and year $t+1$ are needed. Thus, for each year $t+1$ four estimates (at the most) are produced, with different forecast origins, but the same final horizon.

Several clarifications are needed regarding implications of this design, in particular for the information set available to each alternative when generating *current year* and *year ahead* forecasts.

Firstly, as regards the timing of EU Commission forecasts. Given that the EU Commission only publishes bi-annual reports (Spring and Autumn), I adopted the following convention to assign a forecast to each of the four quarters in a given year: (i) for the first quarter of year t, I take $t-1$ Autumn forecasts; (ii) for the second quarter of year t, I take year t Spring forecasts; (iii) for the third quarter of year t, I take again Spring forecasts done at t; (iv) finally, for the fourth quarter of year t, year t Autumn forecasts. This quarterly allocation is consistent with the information available to a real-time forecaster wanting to use available EU Commission *forecasts* in a particular quarter[8]. Secondly, regarding the annual random walk alternative forecasts for *current year t* and

[7]The sample window 1994-2003 was selected to guarantee at least ten years for the estimation of the shorter sample regression, that was the one for Spain where the sample starts in the first quarter of 1984. Notice that for Austria is 1980, for Germany 1979 and for Finland 1982.

[8]The publishing date of the reports and the closing date for the included information in them, changed over the period under study, including in different editions different quarterly information (see Kereman, 1999, for the years 1994-1998, and the publishing dates of EU Commission forecast reports for the years 1999 to 2003).

year ahead forecast $t+1$ use information up to year $t-1$ (i.e. no intra annual update is done).

Notice that at each quarter j of year t it is possible to build up an estimate for the General Government deficit for year $t+q$, based on an information set including all available information up that point, i.e. $\{t,j\}$ for alternatives with intra-annual update (full use of available information), and $\{t-1,0\}$ for alternatives with no intra-annual update (not using quarterly updates, so I adopt the convention $j=0$). Notice also that q is equal to 0 for *current year* forecasts, and equal to 1 for the *year ahead* ones, so that it cannot be interpreted as a forecast horizon: if there is no intra-annual update, what is called *current year* forecasts are predictions at horizon 1 (in terms of years), while *year ahead* forecasts are predictions at horizon 2 (again, in terms of years). For alternatives with quarterly updates, *current year* forecasts can again be deemed as predictions at horizon 1 and *year ahead* forecasts at horizon 2, again in yearly terms, although some information of the forecasted year is used in the case of *current year* predictions.

Thus, I denote as:

$$e^m_{t+h,\{\tau,j\}} = X_{t+h} - \hat{X}^m_{t+h,\{\tau,j\}} \tag{2}$$

the forecast error associated to a forecast $\hat{X}^m_{t+h,\{\tau,j\}}$ elaborated with method m for year $t+h$, with available information set $\{\tau,j\}$. In case no intra-annual update is used $\tau=t$ and $j=0$, while in case intra-annual update is available $\tau=t+1$ and $j\neq 0$.

I present the results for the whole set of forecasts (i.e. $j=1,2,3,4$ for all the years in the forecast set) and for a disaggregation of them. On the one hand I select all forecasts performed with information up to the first and second quarter of a given year t for that year t (current year forecasts) and year $t+1$ (year ahead forecasts), i.e. I set j equal to 1 and 2. On the other hand, I show the results for the set of forecasts with $j=3$ and $j=4$. The reason for presenting the three sets of forecasts is practical and allows me to answer some questions relevant to the analyst: is there a signal of deterioration/improvement already in the first half of the year? is there a gain in forecast accuracy when information for the second half of the year is used? by how much?

4.3 Out-sample forecast performance measures

The comparison is carried out along two dimensions: quantitative and qualitative. The quantitative measures look at the size of the forecast errors (RMSE, Diebold and Mariano (1995) tests), while a qualitative one looks at the sign of the direction of change. Both quantitative and qualitative measures are complementary in a policy exercise like the one carried out here.

The first, standard forecasting performance measure will be the ratio of the Root Mean Squared Errors (RMSE) of the different alternatives with respect to the annual random walk alternative, that I take as the numeraire. In terms of the definition in equation (2), the RMSE for a set of forecasts generated at quarter j of year t at horizon h with alternative m is:

$$RMSE^{\,m,\,h} = \sqrt{\sum_{\tau=t}^{T}\sum_{i=j}^{J}\left(e^{m}_{\tau+h,\{\tau+1,i\}}\right)^2} \equiv \sqrt{\sum_{n=1}^{N}\left(e^{m,\,h}_{n}\right)^2} \tag{3}$$

Notice that there are $J-j+1$ estimates available for each year, i.e. a total of $N \equiv (T-t+1)\times(J-j+1)$ forecast errors. Thus, the set of forecast errors $\{e^{m,\,h}_n\}_{n=1}^{N}$ is an ordered vector where the first $J-j+1$ elements are estimates for the general government deficit in year $t+h$, the next subset of $J-j+1$ estimates are referred to year $t+h+1$, and so on. Upon the basis of (3) one can define the usual ratios of the RMSE of each method m to the random walk RMSE.

The ratio of RMSEs is a deterministic criterion and might be misleading in some cases because the differences among alternatives may not be significant from a statistical point of view. That is why the second forecasting measure I employ is a statistic by Diebold and Mariano (1995), to test for the null hypothesis of no difference in the accuracy of two competing forecasts. Consider the time series of forecast errors $\{e^{m,h}_n\}_{n=1}^{N}$. The idea of the test is to assess the expected loss associated with each of the forecasts (or its negative, accuracy). Let the time-n loss associated with a forecast generated with alternative m be an arbitrary function of the realization and prediction, $g(e^{m,h}_n)$. The null hypothesis of equal forecast accuracy for two forecasts is $E[g(e^{m,h}_n)] = E[g(e^{m',h}_n)]$, or $E[d^{\{m,m'\},h}_n] = 0$, where $d^{\{m,m'\},h}_n \equiv g(e^{m,h}_n) - g(e^{m',h}_n)$ is the loss differential. Thus, the "equal accuracy" null hypothesis is equivalent to the null hypothesis that the population mean of the loss-differential series is 0. The asymptotic test Diebold and Mariano (1995) put forward is:

$$DM^{\{m,m'\},h} = \frac{\bar{d}^{\{m,m'\},h}}{\sqrt{\hat{V}(\bar{d}^{\{m,m'\},h})}} \;\sim\; N(0,1) \tag{4}$$

where $\bar{d}^{\{m,m'\},h} = N^{-1}\sum_{t=1}^{N} d^{\{m,m'\},h}_n$ is the sample mean loss differential, and $\hat{V}(d^{\{m,m'\},h}_n) = N^{-1}(\hat{\gamma}_0 + 2\sum_{k=1}^{h-1}(1-k/h)\hat{\gamma}_j)$, where $\hat{\gamma}_k$ is an estimate of the k-th order autocovariance of the series $d^{\{m,m'\},h}_n$ that can be estimated as $\hat{\gamma}_k = N^{-1}\sum_{n=k+1}^{N}\left(d^{\{m,m'\},h}_n - \bar{d}^{\{m,m'\},h}\right)\left(d^{\{m,m'\},h}_{n-k} - \bar{d}^{\{m,m'\},h}\right)$, for $k = 1,...,h-1$. $\hat{V}(d^{\{m,m'\},h}_n)$ is a consistent estimate of the asymptotic variance $V(d^{\{m,m'\},h}_n)$. A Newey-West (1987) type estimator is used. Regarding loss function specification, I take the standard quadratic loss $g(e) = e^2$, and the absolute loss $g(e) = |e|$. I will only show the results for the absolute loss case, for the results where identical with both loss function specifications.

I also tried the correction to the test suggested by Harvey *et al.* (1997) for the case of small samples, and the results where again barely the same, and are not shown either.

The Diebold-Mariano test could be biased when parameter uncertainty is taken into account (West, 1996; West and McCracken, 1998; Clark and McCraken, 2001; Corradi, Swanson, and Olivetti, 2001). Given that I am checking the forecasting performance of the indicators against EU Commission forecasts (taken from published reports), it is not possible for me to assess the parameter uncertainty associated to the latter set of projections. I make sure that a reasonable proportion of the sample is employed when the first out-of-sample forecast is computed to reduce the bias generated by ignoring parameter uncertainty (the forecasting exercise is performed on the moving window 1994-2003, while the full sample covers 1970-2003).

Finally, the third forecasting measure focus on whether the indicators are accurate in predicting the direction of change of the target variable under consideration. In this case I provide a simple approximation by analyzing the percentage of correctly signed predictions.

4.4 Computation of quarterly forecasts for the indicator series

To generate General Government deficit forecasts based on Error Correction regressions it is necessary to have as an input forecasts for the indicator variables. I check different standard, univariate alternatives: (i) Unobserved Components Models; (ii) ARIMA models; (iii) a quarterly random walk alternative.

Unobserved components models and ARIMA models are described in detail in Table 3. On the one hand, ARIMA-based were obtained with the automatic modelling program TRAMO/SEATS (see Gómez and Maravall, 1996). On the other hand, Unobserved Components models were selected according to a goodness of fit criterion.

From the results in Table 3 some facts can be highlighted: (i) significant estimates of the trend-cycle components were obtained for all countries, indicating that it is possible to find underlying smooth components useful for monitoring purposes; regarding modelling alternatives, both approaches produced quite similar estimates of the underlying structural components, in particular the trend-cycle ones; (ii) there was no signal of remaining autocorrelation in the residuals; (iii) for Italy, Ireland, Austria, Finland, and to a lesser extent France, signals of non-modelled ARCH structure in the residuals is found: this is related in some of the cases with outliers that go into the residual component, and in other cases (in particular Italy) to higher residual variance in the last part of the sample, as compared to the beginning of the sample.

Following the forecasting scheme described above, I performed a predictive ability exercise. Model-based alternatives tend to outperform a random walk competitor but for the case of Finland, but are almost non distinguishable among themselves in terms of RMSE ratio and Diebold-Mariano test. In any case, even if the differences were minor, I selected as an input to the annual regressions the quarterly method that produced the best quarterly-based annual forecasts in terms of RMSE and Diebold-Mariano statistics: this led to selecting the Unobserved Components alternative for Belgium and Italy, the ARIMA model for Germany, Spain, France, The Nehterlands, Ireland and Austria, and the quarterly random walk for Finland.

[INSERT Table 3]

4.5 Discussion of the results

In table 4 I present the ratios of RMSEs for all countries. The reading of the ratios is the standard one. A ratio of 1 indicates that the model forecasts are as good as the random walk (no-change) forecasts, while a ratio below 1 signals that the alternatives are better, and above 1 that they are worse.

Several salient features are worth mentioning: (i) all methods with intra-annual update outperform the annual random walk; (ii) there seems to be an efficient use of the quarterly information as the case of $\{j = 3, J = 4\}$ always present a better performance than the case $\{j = 1, J = 2\}$; nevertheless, with information up to the second quarter the forecasts for the whole year tend to present a reasonable accuracy record; (iii) Indicator-based forecasts present a performance which is quite close to the EU Commission one, and even in the cases of Germany, France, The Netherlands and Ireland outperform it; (v) current year forecasts tend to be more accurate than year ahead forecasts, as would be expected, but a reasonable performance in year ahead forecasts is detected; it is worth mentioning that predictive ability of indicator-based alternatives is closer to EU Commission in current year than in year ahead forecasts.

Finally, according to the RMSE ratios, the combination of indicator-based forecasts and EU forecasts is the one with smaller current year errors in six out of nine considered countries, and in the three others its performance is quite close to the best alternative (either the EU Commission or the indicator-based one). Regarding year ahead forecasts the advantages of forecast combination are less perceptible, but for three cases.

[INSERT Table 4]

The gains of the forecast combination alternative are more perceptible from Table 5, where I show the Diebold-Mariano test for the null hypothesis of equal forecast accuracy of two alternative methods, using the absolute value loss function. Each cell contains the value of the Diebold-Mariano statistic, where the loss differentials input to the test convey the form $g(e^m) - g(e^{m'})$, with m being labelled in the horizontal axis ($m =$ "Comb" and $m =$ "Regres") and m' in the vertical one ($m =$ "Regres" and $m =$ "EU Com").

Overall, for all countries, and horizons, the forecast combination is the alternative with less associated loss: either the loss is lower in statistical terms, or the difference is not significant from an statistical point of view.

In addition, the results of the test confirm the basic insights already mentioned before. In statistical terms, some differences between EU Commission forecasts and those from the indicator-based alternative do exist, but are not quite ample. For example, for $j = 1$ and $J = 4$ and current year forecasts, EU Commission forecasts dominate for Austria and Finland, while indicator-based do so in the cases of Germany and Ireland, and the rest of the cases are not different in statistical terms (at 95% and 99% significance levels). On other grounds, the losses associated to forecasts using information of the second half of the year are quite similar across methods, being the basic differences in the projections made with information of the first half of the year.

[INSERT Table 5]

Finally, in Table 6 I present the percentage of correctly predicted changes of the General Government deficit. This table displays information quite relevant for the real-time analyst, and not only a forecast accuracy record as it was the case with the two previously shown measures. The main messages are again repeated as regards: (i) the comparative behaviour of indicator-based forecasts and EU Commission ones; (ii) current year forecasts are quite informative, and also year ahead but with a significant minor record of correctly predicted changes; (iii) improved accuracy in the case $j = 3, J = 4$ versus $j = 1, J = 2$, but with an important amount of changes already captured in the first half of the year; (iv) the combination approach appears as a useful alternative in many cases.

In the case of the indicator-based alternative, the percentage of correctly predicted changes for current year is above 75% for all countries, but for the case of The Netherlands where is close to 65%, when I take all the quarters, and quite more if I focus on the $j = 3, J = 4$ case. As regards year ahead forecasts, the percentages are lower by 20 percentage points, but still range above 40-50% in most cases, specially when forecasts are generated in the third and fourth quarters of the previous year. Notice that if instead of computing the exact number of correctly predicted changes, we were to compute this very number ± a small range (say 0.2 points) the percentage of year ahead forecasts would have increased substantially.

[INSERT Table 6]

5 A simple fiscal leading indicator for the euro area

An immediate question arises: can the results obtained for individual countries' indicators be extrapolated to obtain an aggregate measure of the *euro area fiscal stance*? Given the current policy framework in which there is a single monetary authority preoccupied by EMU aggregates such as inflation or GDP, having an aggregate indication of the evolution of fiscal policy might be useful. The indicators for the analyzed countries showed a reasonable degree of information. This was the case even considering the very high proportion of estimated variance allocated to the irregular components, that could be interpreted as country-specific shocks (institutional peculiarities, policy events, etc). In addition, seasonal patterns at the country level turned out to be very strong, being the main cause of seasonal patterns different legislations across countries (for example, regarding the different dating of revenue collection or timing of debt payments). Intuitively, aggregation might wash out country-specific shocks and country-specific seasonal patterns.

Even being all series in billion of euro, direct aggregation of the national indicators would not be fully correct given that, as already mentioned in the data section, national definitions are not fully homogenous. That is why I propose to base the aggregation of intra-annual indicators on the trend components (obtained from a standard Unobserved Components decompositions or an ARIMA structural model). By removing the irregular and seasonal components, one might guess that regular institutional patterns and the irregular ones would be to some extent removed, resulting in a rather more homogenous measure of deficit across countries.

Thus, I proceed to the aggregation of the trend components (i.e. seasonally adjusted series minus the irregular). Using as weights for each country's deficit the country GDP weight on EMU GDP, I aggregate the obtained estimates for the General Government deficit as a percentage of GDP based on individual indicators' trends[9]. For the regression analysis I used the EMU aggregate obtained from individual country trends estimated with the full quarterly sample. For the out-of-sample exercise I use again the cross section of national data and aggregate individual country trend forecasts for each relevant horizon. The General Government EMU aggregated deficit is simply the sum of national ESA General Government deficits in billions of euro.

[INSERT Table 7]

The results are presented in Table 7, and confirm the strong predictive ability of the trend-based EMU indicator on the aggregate EMU deficit in ESA terms. In the Table I display two panels, comprising all the measures applied to individual country indicators throughout the paper.

Firstly, Panel A demonstrate the existence of cointegration between the indicator and the ESA General Government aggregate, as the estimated long-term relationship and error correction term turned out to be significant. Around 20% of the disequilibrium is corrected in a year, while the reaction of current year changes in the General Government deficit to indicator changes is above one, being estimated in 1.3 for the whole sample. The coefficient of determination is quite high (91%) and the residual variance is only 7%. Finally, the results of the PT and F tests stress the strength of the estimated relationship.

Secondly, Panel B shows out-sample predictive ability measures for indicator-based regressions, EU Commission and the combination of both. Some findings can be highlighted: (i) current year forecasts resulted to be quite accurate, according to the low RMSE ratios and the high percent of correctly predicted changes, specially for indicator-based regressions; (ii) on the contrary, year ahead forecasts suggest a poor record in terms of correctly anticipated changes for all alternatives, although the RMSE ratios are well below one, thus outperforming the random walk forecasts; (iii) in terms of the results of the Diebold and Mariano test, both indicator-based and forecast combination alternatives dominate EU Commission current year forecasts, while are not statistically different among themselves.

[9]Using common factor analysis or principal components analysis to combine individual country forecasts would be an alternative to the direct aggregation (of trends) presented here. A principal components analysis of the set of nine country trends led to the detection of two components with eigenvalues presenting an absolute value larger than one. Aggregation of the two dominant components produced similar results to the direct aggregation of trends.

Finally, in figure 3 I present an illustration that exemplifies the real-time usefulness of the aggregate indicator, focusing on the fiscal loosening episode that started in 2001 for the main EMU countries. In all panels of the figure I show General Government deficit actual values (the thick solid line) together with the forecasts from the indicator-based and the EU Commission alternatives that would have been available to an analyst at the end of the first and fourth quarters of 2001, 2002 and 2003 respectively.

The direct comparison of left and right panels is quite enlightening. The first left and right panels are the most informative ones, as they show the detection of the change in trend that occurred in 2001, after six years of continued fiscal consolidation: in this case, the indicator-based alternative would have signalled the deterioration already in the first quarter of 2001, and the fourth quarter information would have already forecast a deficit ratio below 2%. These two messages contrast with the information an analyst would have inferred by looking at the right panel. The same story is repeated in the second row of panels, while the need for monthly/quarterly information is also clear even in the third panel as regards EU Commission forecasts available by the end of March 2002. The same exercise performed at the individual country level led to the same type of conclusions.

[INSERT Figure 3]

6 Conclusions

Annual fiscal forecasts are usually produced by annual models that combine estimated relationships linking fiscal to macroeconomic variables, and judgement based on fiscal expertise. The main claim of this paper is that the existing infra-annual fiscal information should be somewhat included by the relevant agencies in the preparation of their annual forecasts and its intra-annual updates, either formally, through some kind of combination econometric method, or as another piece to be taken, explicitly, in the judgemental analysis. As a by-product, another claim of the paper is that monthly/quarterly available fiscal data could be included in macroeconomic studies, given its close adherence to general government dynamics.

In this paper I show that the analyzed infra-annual indicators contain valuable information to monitor and forecast General Government Net Lending / Net Borrowing developments. I provide quantitative and qualitative results that strongly support this finding. Purposely, I focus on deficit indicators for the main EMU countries (Belgium, Germany, Spain, France, Italy, The Netherlands, Ireland, Austria, Finland), that could be used as early-warning-signal tools for the deficit of the General Government sector as a whole. An immediate extension of this paper would be extending the analysis to other general government sectors, and to a disaggregation of revenue and expenditure categories. Given the results in this paper, both avenues look promising.

An additional contribution of this paper is the extension of individual countries' results to a simple EMU aggregate, where again I show the usefulness of considering explicitly intra-annual information in the monitoring and forecasting process. Given the current monetary setup in the euro area, the availability of real-time measures of the aggregate fiscal stance should be a valuable input into the policy decision process.

References

Artis M., & Marcelino M. (2001). Fiscal forecasting: the track record of the IMF, OECD and EC, *Econometrics Journal*, 4, 20-36.

Camba-Méndez G., & Lamo A. (2004). Short-term monitoring of fiscal policy discipline, *Journal of Applied Econometrics*, 19, 247-265.

Clark, T. E., & McCraken, M. W. (2001). Tests of equal forecast accuracy and encompassing for nested models, *Journal of Econometrics*, 105, 85-110.

Corradi, V., Swanson, N. R., & Olivetti, C. (2001). Predictive ability with cointegrated variables. *Journal of Econometrics*, 105, 315-358.

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

Engle R., & Granger C. J. (1987). Cointegration and Error Correction: Representation, Estimation and Testing, *Econometrica*, 55, 251-276.

European Commission (1996). European System of National and Regional Accounts in the Community, Council Reg. No 2223/96, Official Journal of the Eur. Comm. L 310, 30 Nov.

European Commission (2002a). Reg. (EC) No 1221/2002 of the European Parliament and of the Council of 10 June 2002 on quarterly non-financial accounts for general government.

European Commission (2002b). *ESA95 manual on government deficit and debt, Methods and Nomenclatures series*, European Commission, Luxembourg.

Fullerton T. M. (1989). A composite approach to forecasting state government revenues: Case study of the Idaho sales tax, *International Journal of Forecasting*, 5, 373-380.

Gómez V., & Maravall A. (1996). Programs TRAMO and SEATS. Instructions for the User, Working Paper 9628, Research Department, Bank of Spain.

Harvey D., Leybourne S., & Newbold P. (1997). Testing the Equality of Prediction Mean Squared Errors, *International Journal of Forecasting*, 13, 281-291.

Keereman F. (1999). The track record of the Commission Forecasts, *Economic Papers* 137.

Inoue A., & Kilian L. (2004). In-sample or out-sample test of predictability?: which one should we use?, *Econometrics Reviews*, 23, 1-32.

Kinnunen H. (1999). Cash Data for Central Government: Time Series Analysis, Bank of Finland, Economics Department Working Papers.

Lahiri K., & Moore G. H. (1993). *Leading economic indicators. New approaches and forecasting records*, Cambridge: Cambridge University Press.

Lawrence K., Anandarajan A., & Kleinman G. (1998). Forecasting State Tax Revenues: A New Approach. *Advances in Business and Management Forecasting*, 2, 157-170.

Moulin L., Salto M., Silvestrini A., & Veredas D. (2004). Using intra annual information to forecast the annual state deficit. The case of France. CORE Discussion Paper 2004/48.

Newey, W. K., & West, K. D. (1987). A simple positive semi-definite, heteroskedasticity and autocorrelation consistent matrix, *Econometrica*, 55, 703-708.

Pesaran M. H., & Timmermann A. (1992). A simple nonparametric test of predictive performance, *Journal of Business and Economic Statistics*, 10, 461-465.

West, K. D. 1996. Asymptotic inference about predictive ability, *Econometrica*, 64, 1067-1087.

West, K. D., & McCracken, M. W. (1998). Regression-based tests of predictive ability, *International Economic Review*, 39, 817-840.

Tables and figures

Table 1: Description and sources: selected indicator series.

Belgium	Indicator: Treasury Budget Receipts minus Treasury Budget Expenditures. Public Accounts. Monthly (January 1970 - December 2003). Source: National Bank of Belgium.
Germany	Indicator: Public Sector Balance. Public Accounts. Quarterly (Q1 1979 - Q4 2003). Sources Bundesbank Monthly Report, Statistical Appendix, Chapter VIII, Table 1.
Spain	Indicator: Central Government Budgetary Balance. Monthly (Public Accounts: January 1984 - December 1998, ESA95 January 1999 - December 2003). Sources: IGAE and National Institute of Statistics.
France	Indicator: Central Government Budgetary Balance. Public Accounts. Monthly. Sources: Ministry of Economics and Finance. Sample: January 1970 - December 2003.
Italy	Indicator: Central Government Borrowing Requirement. Public Accounts. Monthly. Sources: Bank of Italy. Sample: January 1970 - December 2003.
The Netherlands	Indicator: Central Government Budgetary Balance. Public Accounts. Monthly. Sources: Ministry of Finance. Sample: January 1970 - December 2003 (EMU Balance 1999-2003).
Ireland	Indicator: Central Government Exchequer Returns. Public Accounts. Monthly. Sources: IFS/IMF Q1 1970 - Q4 1995; Ministry of Finance January 1996 - December 2003.
Austria	Indicator: Federal Budget. Public Accounts. Monthly. Sources: IFS/IMF Q1 1970 - Q4 1995; Ministry of Finance January 1996 - December 2003.
Finland	Indicator: Central Government Budgetary Balance. Public Accounts. Monthly. Sources: Bank of Finland. Sample: January 1982 - December 2003.

Table 2: Error Correction Models: General Government vs Indicators. Estimated equation: $\Delta \frac{GG_t}{GDP_t} = \alpha_1 \Delta \frac{Indicator_t}{GDP_t} + \alpha_2 \left(\frac{Indicator_{t-1}}{GDP_{t-1}} + \alpha_3 \frac{GG_{t-1}}{GDP_{t-1}} \right) + \sum w_i \ \xi_t^i + u_t$. Annual figures.

	Short-term $\Delta \frac{Indicator_t}{GDP_t}$	Error Correction $\hat{\alpha_2}(\frac{Indicator_{t-1}}{GDP_{t-1}} + \hat{\alpha_3}\frac{GG_{t-1}}{GDP_{t-1}})$		Dummy variables $(\sum w_i \ \xi_t^i)$	In-sample tests of predictability
Belgium	0.926	0.367	-0.908	Impulse 1990	PT test ($pval$) = 0.01990
1970-2003	(0.133)	(0.227)	(0.059)	Impulse 1981†	F test ($pval$) = 0.00003
	R^2=0.79; σ_u^2=0.78; LM(1)($pval$)=1.000; White Test($pval$)=0.261				
Germany	0.959	0.333	-1.277	Step 1990	PT test ($pval$) = 0.00001
1979-2003	(0.080)	(0.169)	(0.117)		F test ($pval$) = 0.00000
	R^2=0.90; σ_u^2=0.10; LM(1)($pval$)=0.292; White Test($pval$)=0.174				
Spain	1.262	0.668	-0.786		PT test ($pval$) = 0.0004
1984-2003	(0.088)	(0.216)	(0.050)		F test ($pval$) = 0.00000
	R^2=0.86; σ_u^2=0.33; LM(1)($pval$)=0.170; White Test($pval$)=0.492				
France	0.799	0.603	-1.010	Step 1990	PT test ($pval$) = 0.00010
1970-2003	(0.106)	(0.173)	(0.089)	Step 1995	F test ($pval$) = 0.00000
	R^2=0.62; σ_u^2=0.47; LM(1)($pval$)=0.279; White Test($pval$)=0.149				
Italy	0.357	0.252	-1.022	Impulse 1975	PT test ($pval$) = 0.00050
1970-2003	(0.068)	(0.073)	(0.076)	1983†, Step 1993	F test ($pval$) = 0.00001
	R^2=0.77; σ_u^2=0.71; LM(1)($pval$)=0.513; White Test($pval$)=0.299.				
The Netherlands	0.955	0.203	-0.931	Impulse 1983	PT test ($pval$) = 0.00000
	(0.087)	(0.082)	(0.132)		F test ($pval$) = 0.00000
1970-2003	R^2=0.82; σ_u^2=0.37; LM(1)($pval$)=0.390; White Test($pval$)=0.396.				
Ireland	0.695	0.185	-1.179	Impulse 1975	PT test ($pval$) = 0.00043
1970-2003	(0.088)	(0.086)	(0.142)	Impulse 1996	F test ($pval$) = 0.00000
	R^2=0.79; σ_u^2=0.76; LM(1)($pval$)=0.537; White Test($pval$)=0.689				
Austria	0.943	0.469	-1.134		PT test ($pval$) = 0.00008
1980-2003	(0.094)	(0.142)	(0.085)		F test ($pval$) = 0.00000
	R^2=0.79; σ_u^2=0.30; LM(1)($pval$)=1.000; White Test($pval$)=0.235				
Finland	0.866	0.624	-1.067	Constant	PT test ($pval$) = 0.00005
1982-2003	(0.135)	(0.285)	(0.123)		F test ($pval$) = 0.00000
	R^2=0.77; σ_u^2=1.91; LM(1)($pval$)=0.800; White Test($pval$)=0.111				

Notes:

(i) Figures in parenthesis below estimates are standard errors of the estimates (White heteroskedasticity consistent variances estimates).

(ii) Diagnosis measures: (1) R^2: coefficient of determination; (2) σ_u^2: estimated variance of regression residuals. (3) LM(k): Lagrange Multiplier test for serial correlation in the residuals (null hypothesis of no serial correlation up to lag order k. (4) White Test (White, 1980): test for heteroskedasticity in the residuals (null hypothesis of no heteroskedasticity against heteroskedasticity of some unknown general form); (5) PT-test: Pesaran and Timmerman test of predictive performance, for the null hypothesis of independence between $\Delta(GG_t/GDP_t)$ and the estimate for $\Delta(GG_t/GDP_t)$ based on the regression; (6) F-test: standard test for the null hypothesis $\alpha_1 = \alpha_2 = 0$.

(iii) Dummy variables: (1) Impulse: a variable with a 1 at date t, and zero elsewhere; (2) Step: 1 from date t till the end of the sample, and zero elsewhere. (3) Impulse 1981†: variable with four non-zero elements: a 1 in 1981 and 1983, a -1 in 1982 and 1984; (4) Impulse 1983†: variable with three non-zero elements: a 1 in 1983 and 1985, a -1 in 1984.

Table 3: Univariate models for the quarterly indicators: Unobserved components models and ARIMA models. For details see footnote.

	Unobserved components model		ARIMA model
	Parameters	Diagnosis on ϵ	(y_t: indicator variable)
Belgium	$p_\eta = -1.381(0.157)$	LM(1)($pval$)=0.571	$\Delta\Delta_4\ y_t = (1+\theta B)(1+\Theta B^4)\ \epsilon_t^A$
1970-2003	$p_\omega = -1.204(0.109)$	LMARCH(1)($pval$)=0.141	$\hat\theta = -0.959(0.035)\ \hat\Theta = 0.061(0.096)$
	$p_\epsilon = -7.145(3.6\times 10^5)$	LMARCH(2)($pval$)=0.206	$\sigma^2_{\epsilon^A} = 10^{-0.180(0.053)}$
Germany	$p_\eta = 0.619(0.160)$	LM(1)($pval$)=0.218	$(1+\phi B)\Delta_4\ y_t = \epsilon_t^A$
1979-2003	$p_\omega = 0.176(0.154)$	LMARCH(1)($pval$)=0.191	$\hat\phi = -0.249(0.101)$
	$p_\epsilon = 0.455(0.490)$	LMARCH(2)($pval$)=0.343	$\sigma^2_{\epsilon^A} = 10^{1.501(0.062)}$
Spain	$p_\eta = -0.825(0.312)$	LM(1)($pval$)=0.375	$(1+\Phi B^4)(\ y_t+\mu) = \epsilon_t^A$
1984-2003	$p_\omega = -0.842(0.226)$	LMARCH(1)($pval$)=0.236	$\hat\Phi = -0.575(0.104)\ \hat\mu = -2.341(0.490)$
	$p_\epsilon = 0.434(0.120)$	LMARCH(2)($pval$)=0.299	$\sigma^2_{\epsilon^A} = 10^{0.757(0.070)}$
France	$p_\eta = -0.175(0.187)$	LM(1)($pval$)= 0.408	$(1+\phi B)\Delta_4\ y_t = \epsilon_t^A$
1970-2003	$p_\omega = 0.187(0.112)$	LMARCH(1)($pval$)= 0.028	$\hat\phi = 0.251(0.085)$
	$p_\epsilon = 0.330(0.337)$	LMARCH(2)($pval$)= 0.024	$\sigma^2_{\epsilon^A} = 10^{1.270(0.053)}$
Italy	$p_\eta = 0.158(0.259)$	LM(1)($pval$)= 1.000	$\Delta_4\ y_t = (1+\Theta B^4)\ \epsilon_t^A$
1970-2003	$p_\omega = -6.77(1.0\times 10^5)$	LMARCH(1)($pval$)= 0.046	$\hat\Theta = -0.616(0.071)$
	$p_\epsilon = 1.747(0.063)$	LMARCH(2)($pval$)= 0.000	$\sigma^2_{\epsilon^A} = 10^{1.877(0.053)}$
	$\rho_1 = -0.201(0.107), \rho_2 = -0.132(0.104), \rho_3 = -0.228(0.000),$		
The	$p_\eta = -0.911(0.208)$	LM(1)($pval$)= 0.204	$(1+\phi B)\Delta_4\ y_t = (1+\Theta B^4)\ \epsilon_t^A$
Netherlands	$p_\omega = -1.273(0.152)$	LMARCH(1)($pval$)= 0.291	$\hat\phi = -0.249(0.085)\ \hat\Theta = -0.385(0.085)$
1970-2003	$p_\epsilon = -0.238(0.048)$	LMARCH(2)($pval$)= 0.318	$\sigma^2_{\epsilon^A} = 10^{0.285(0.053)}$
	$\rho_1 = 0.337(0.166), \rho_2 = -0.358(0.169),$		
Ireland	$p_\eta = -1.941(0.196)$	LM(1)($pval$)= 0.770	$\Delta_4\ y_t = (1+\Theta B^4)\ \epsilon_t^A$
1970-2003	$p_\omega = -1.943(0.130)$	LMARCH(1)($pval$)= 0.273	$\hat\Theta = -0.211(0.092)$
	$p_\epsilon = -1.461(0.244)$	LMARCH(2)($pval$)= 0.000	$\sigma^2_{\epsilon^A} = 10^{-0.723(0.053)}$
	$p_\beta = -10.624(0.196)$		
Austria	$p_\eta = -1.822(0.222)$	LM(1)($pval$)= 0.132	$\Delta_4\ y_t = (1+\theta_1 B+\theta_2 B^2)(1+\Theta B^4)\ \epsilon_t^A$
1980-2003	$p_\omega = -1.939(0.137)$	LMARCH(1)($pval$)= 0.009	$\hat{\theta_1} = -0.125(0.080)\ \hat{\theta_2} = 0.351(0.086)$
	$p_\epsilon = -1.146(0.154)$	LMARCH(2)($pval$)= 0.000	$\hat\Theta = -0.138(0.088)$
	$p_\beta = -5.664(3.041)$		$\sigma^2_{\epsilon^A} = 10^{-0.584(0.053)}$
Finland	$p_\eta = -0.977(0.199)$	LM(1)($pval$)= 0.272	$\Delta_4\ y_t = (1+\theta_1 B+\theta_2 B^2)(1+\Theta B^4)\ \epsilon_t^A$
1982-2003	$p_\omega = -2.436(0.334)$	LMARCH(1)($pval$)= 0.077	$\hat\theta = -0.612(0.089)\ \hat\Theta = -0.690(0.090)$
	$p_\epsilon = -0.516(0.126)$	LMARCH(2)($pval$)= 0.008	$\sigma^2_{\epsilon^A} = 10^{-0.143(0.067)}$

Notes: (i) Figures in parenthesis are standard errors of the estimates.

(ii) Unobserved components models for a given indicator variable y_t are of the form:

$$y_t = \mu_t + S_t + \phi_t,$$

$$\mu_t = \mu_{t-1} + \beta_t + \eta_t, \quad \eta_t \sim iid\ N(0,\sigma^2_\eta), \quad \sigma^2_\eta = 10^{p_\eta}$$

$$\beta_t = \beta_{t-1} + \eta^\beta_t, \quad \eta^\beta_t \sim iid\ N(0,\sigma^2_\beta), \quad \sigma^2_\beta = 10^{p_\beta}$$

$$S_t = \sum_{j=1}^{R_s} S_{t,j},\ S_{t+1,j} = cos(\lambda_j)S_{t,j} + sin(\lambda_j)S^*_{t,j} + \omega_{t,j},\ S^*_{t+1,j} = -sin(\lambda_j)S_{t,j} + cos(\lambda_j)S^*_{t,j} + \omega^*_{t,j}, \lambda_k = 2\pi k/s,$$

$k = 1,2,...,R_s; R_s = s/2$ for s even and $(s-1)/2$ if s is odd. $\omega^*_{t,j}, \omega_{t,j} \sim iid\ N(0,\sigma^2_\omega),\ \sigma^2_\omega = 10^{p_\omega}$

$$\phi_t = \rho_1\phi_{t-1} + \rho_2\phi_{t-2} + \rho_3\phi_{t-3} + \epsilon_t, \quad \epsilon_t \sim iid\ N(0,\sigma^2_\epsilon), \quad \sigma^2_\epsilon = 10^{p_\epsilon}$$

(iii) All parameters were estimated by Exact Maximum Likelihood with the `MATLAB` toolbox of D. Pedregal (2004) "SSPACE: a flexible toolbox for State Space Modeling", University of Castilla-la-Mancha, Spain, available at http://www.uclm.es/area/organizacionempresas_etsii/Personal/Diego/SSpace.zip.

(iv) LM(k) test: test for the null hypothesis of no serial correlation up to order k in ϵ_t.

(v) LMARCH(k) test: test for the null hypothesis of no ARCH effect up to order k in ϵ_t.

Table 4: Forecasting performance statistics I. Ratio of Root Mean Squared Errors (RMSE) of forecast alternatives to annual random walk RMSE. Alternatives: Indicator-based regression ("Regression"), European Commission ("EU Com") and forecast combination ("Combination"), for years t to T (1994 to 2003), and quarters j to J.

		Current year: ratio $RMSE^{m,1}/RMSE^{RW,1}$			Year ahead: ratio $RMSE^{m,2}/RMSE^{RW,2}$		
		$j=1, J=4$	$j=1, J=2$	$j=3, J=4$	$j=1, J=4$	$j=1, J=2$	$j=3, J=4$
Belgium	Regression	0.547	0.589	0.506	0.346	0.410	0.282
	EU Com	0.333	0.445	0.222	0.254	0.274	0.233
	Combination	0.345	0.454	0.237	0.264	0.299	0.229
Germany	Regression	0.546	0.729	0.364	0.807	0.944	0.670
	EU Com	0.838	1.119	0.557	1.109	1.293	0.925
	Combination	0.548	0.797	0.299	0.894	1.044	0.743
Spain	Regression	0.398	0.492	0.304	0.477	0.676	0.279
	EU Com	0.228	0.217	0.239	0.103	0.117	0.090
	Combination	0.181	0.173	0.189	0.166	0.220	0.112
France	Regression	0.405	0.463	0.348	0.285	0.339	0.230
	EU Com	0.466	0.646	0.286	0.457	0.522	0.392
	Combination	0.351	0.481	0.220	0.358	0.418	0.298
Italy	Regression	0.359	0.484	0.234	0.292	0.283	0.301
	EU Com	0.247	0.299	0.196	0.290	0.333	0.246
	Combination	0.217	0.271	0.163	0.257	0.292	0.222
The Netherlands	Regression	0.715	1.010	0.421	0.510	0.570	0.449
	EU Com	0.790	0.951	0.629	0.663	0.735	0.591
	Combination	0.690	0.898	0.481	0.585	0.655	0.515
Ireland	Regression	0.585	0.704	0.466	0.499	0.527	0.472
	EU Com	0.946	1.199	0.693	0.887	0.976	0.798
	Combination	0.753	0.958	0.548	0.695	0.758	0.633
Austria	Regression	0.454	0.524	0.383	0.513	0.657	0.369
	EU Com	0.355	0.401	0.309	0.244	0.265	0.222
	Combination	0.321	0.381	0.261	0.286	0.337	0.236
Finland	Regression	0.688	0.700	0.677	0.450	0.630	0.269
	EU Com	0.309	0.326	0.292	0.292	0.336	0.249
	Combination	0.288	0.300	0.276	0.269	0.336	0.202

Table 5: Forecasting performance statistics II. Diebold-Mariano test for the null hypothesis of equal forecast accuracy of two alternative methods: Indicator-based regression (“Regres”), European Commission (“EU Com”) and forecast combination (“Comb”). Absolute loss function. The number in each cell represents the loss differential of the method in its horizontal column and the method in the vertical column.

		Current year						Year ahead					
		$j=1, J=4$		$j=1, J=2$		$j=3, J=4$		$j=1, J=4$		$j=1, J=2$		$j=3, J=4$	
		Comb	Regres	Comb	Regres	Comb	Regres	Comb	Regres	Comb	Regres	Comb	Regres
Belgium	Regres	2.05	—	1.06	—	1.78	—	1.70	—	1.81	—	0.66	—
	EU Com	0.27	-1.34	0.34	-0.61	0.07	-1.23	-0.58	-1.34	-1.31	-1.65	0.63	-0.26
Germany	Regres	-0.46	—	-0.79	—	0.14	—	-0.91	—	-0.68	—	-0.63	—
	EU Com	4.12	2.08	2.52	1.59	3.36	1.35	1.46	1.11	1.08	0.83	1.01	0.78
Spain	Regres	2.37	—	2.30	—	0.90	—	2.93	—	2.04	—	2.36	—
	EU Com	2.16	-1.06	1.56	-1.68	1.50	0.13	-1.38	-2.43	-1.48	-1.86	-0.30	-1.72
France	Regres	1.31	—	0.36	—	1.48	—	0.31	—	0.58	—	-0.14	—
	EU Com	0.55	-0.64	1.17	0.24	-0.47	-1.16	2.10	0.40	1.74	0.09	1.27	0.47
Italy	Regres	0.64	—	0.57	—	0.31	—	-1.19	—	-1.74	—	-0.19	—
	EU Com	0.59	-0.22	0.62	-0.16	0.15	-0.16	3.72	2.00	4.00	2.47	1.86	0.72
The	Regres	-0.30	—	0.39	—	-1.06	—	-1.06	—	-0.74	—	-0.76	—
Nether.	EU Com	2.39	1.13	0.54	-0.09	3.16	2.02	2.30	1.58	1.81	1.21	1.45	1.04
Ireland	Regres	-1.65	—	-2.26	—	-0.25	—	-1.55	—	-1.07	—	-1.08	—
	EU Com	4.27	2.75	3.80	2.96	2.35	1.05	2.68	1.96	1.62	1.27	2.13	1.46
Austria	Regres	2.72	—	2.09	—	1.79	—	3.49	—	2.79	—	2.09	—
	EU Com	-0.07	-2.08	-0.07	-1.66	-0.02	-1.33	-1.11	-2.77	-1.46	-2.36	0.06	-1.48
Finland	Regres	3.34	—	1.54	—	3.35	—	3.33	—	3.00	—	1.81	—
	EU Com	0.04	-2.39	0.07	-1.01	-0.03	-2.65	1.49	-1.80	0.63	-2.09	1.68	-0.51

Note: Critical values for the test: 2.33 at 1%, 1.65 at 5% (normal distribution).

Table 6: Percentage of correctly predicted changes in the General Government deficit in ESA79/ESA95 with forecasts generated with the alternatives: Indicator-based regression ("Regression"), European Commission ("EU Com") and forecast combination ("Combination"), for years t to T (1994 to 2003), and quarters j to J.

		Current year			Year ahead		
		$j=1, J=4$	$j=1, J=2$	$j=3, J=4$	$j=1, J=4$	$j=1, J=2$	$j=3, J=4$
Belgium	Regression	75 %	70 %	80 %	40 %	25 %	55 %
	EU Com	70 %	65 %	75 %	45 %	40 %	50 %
	Combination	75 %	70 %	80 %	38 %	30 %	45 %
Germany	Regression	83 %	75 %	90 %	43 %	40 %	45 %
	EU Com	73 %	60 %	85 %	50 %	50 %	50 %
	Combination	83 %	70 %	95 %	33 %	30 %	35 %
Spain	Regression	83 %	80 %	85 %	83 %	85 %	80 %
	EU Com	83 %	80 %	85 %	88 %	90 %	85 %
	Combination	85 %	85 %	85 %	83 %	85 %	80 %
France	Regression	93 %	90 %	95 %	65 %	65 %	65 %
	EU Com	90 %	85 %	95 %	65 %	60 %	70 %
	Combination	88 %	80 %	95 %	53 %	50 %	55 %
Italy	Regression	78 %	80 %	75 %	63 %	65 %	60 %
	EU Com	65 %	65 %	65 %	70 %	70 %	70 %
	Combination	65 %	70 %	60 %	70 %	70 %	70 %
The Netherlands	Regression	63 %	45 %	80 %	35 %	30 %	40 %
	EU Com	45 %	35 %	55 %	30 %	30 %	30 %
	Combination	58 %	40 %	75 %	30 %	30 %	30 %
Ireland	Regression	70 %	70 %	70 %	38 %	35 %	40 %
	EU Com	65 %	55 %	75 %	43 %	40 %	45 %
	Combination	68 %	60 %	75 %	38 %	35 %	40 %
Austria	Regression	78 %	70 %	85 %	58 %	45 %	70 %
	EU Com	90 %	85 %	95 %	65 %	60 %	70 %
	Combination	90 %	85 %	95 %	63 %	55 %	70 %
Finland	Regression	80 %	80 %	80 %	53 %	45 %	60 %
	EU Com	100 %	100 %	100 %	85 %	80 %	90 %
	Combination	95 %	90 %	100 %	83 %	80 %	85 %

Table 7: EMU Indicator: in-sample and out-sample tests of predictive performance.

PANEL A: Error Correction Models: General Government Net Borrowing/Net Lending vs Indicator. Estimated equation:

$$\Delta \frac{GG_t}{GDP_t} = \alpha_1 \Delta \frac{Indicator_t}{GDP_t} + \alpha_2 \frac{Indicator_{t-1}}{GDP_{t-1}} + \alpha_3 \frac{GG_{t-1}}{GDP_{t-1}} + \sum w_i \ \xi_t^i + noise.$$

	Short-term $\Delta \frac{Indicator_t}{GDP_t}$	Error Correction $\hat{\alpha_2}(\frac{Indicator_{t-1}}{GDP_{t-1}} + \hat{\alpha_3}\frac{GG_{t-1}}{GDP_{t-1}})$		Dummy variables $(\sum w_i \ \xi_t^i)$	In-sample tests of predictability
Indicator	1.286	0.211	0.931	Impulse 1990	PT test ($pval$) = 0.00014
1980-2003	(0.110)	(0.074)	(0.056)		F test ($pval$) = 0.00000
	R^2=0.91; σ_u^2=0.07; LM(1)($pval$)=0.272; White Test($pval$)=0.087				

PANEL B: Forecast performance measures: percentage of correctly predicted changes, RMSE ratio and Diebold-Mariano.

	Current year			Year ahead		
	$j=1, J=4$	$j=1, J=2$	$j=3, J=4$	$j=1, J=4$	$j=1, J=2$	$j=3, J=4$
Method: GG estimates based on indicator-based regressions						
$RMSE/RMSE^{RW}$	0.294	0.428	0.160	0.601	0.700	0.501
Diebold-Mariano (vs EU Com)	-1.676	-1.340	-1.016	1.096	0.908	0.641
% predicted changes	95 %	100 %	90 %	28 %	20 %	35 %
Method: EU Commission provided estimates for GG						
$RMSE/RMSE^{RW}$	0.430	0.575	0.285	0.448	0.514	0.381
Diebold-Mariano (vs Comb)	3.330	2.262	2.622	-0.181	-0.394	0.205
% predicted changes	68 %	55 %	80 %	48 %	50 %	45 %
Method: combination						
$RMSE/RMSE^{RW}$	0.291	0.409	0.173	0.429	0.504	0.354
Diebold-Mariano (vs Reg)	0.696	0.736	0.185	-1.434	-1.115	-0.927
% predicted changes	83 %	75 %	90 %	43%	40 %	45 %

Figure 1: Evolution of the selected Indicators. Billions of euro. Quarterly figures. Sample: see Table 1.

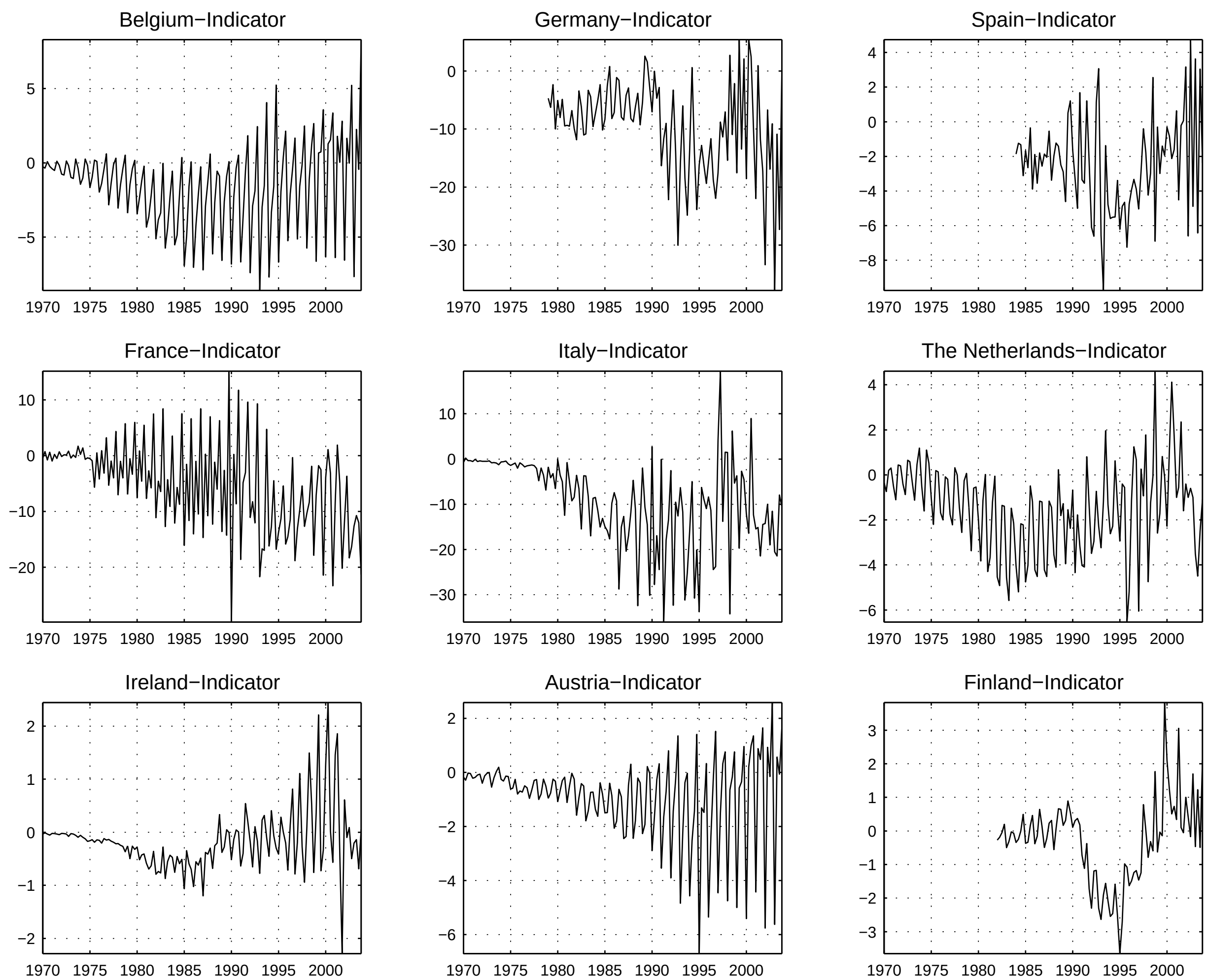

Figure 2: Evolution of the General Government Net Borrowing (-)/Net Lending (+) in ESA79-ESA95 (solid-dot line) and Public Accounts Deficit(-)/Surplus(+) Indicator (solid line). Variables as a percentage of GDP. Annual figures.

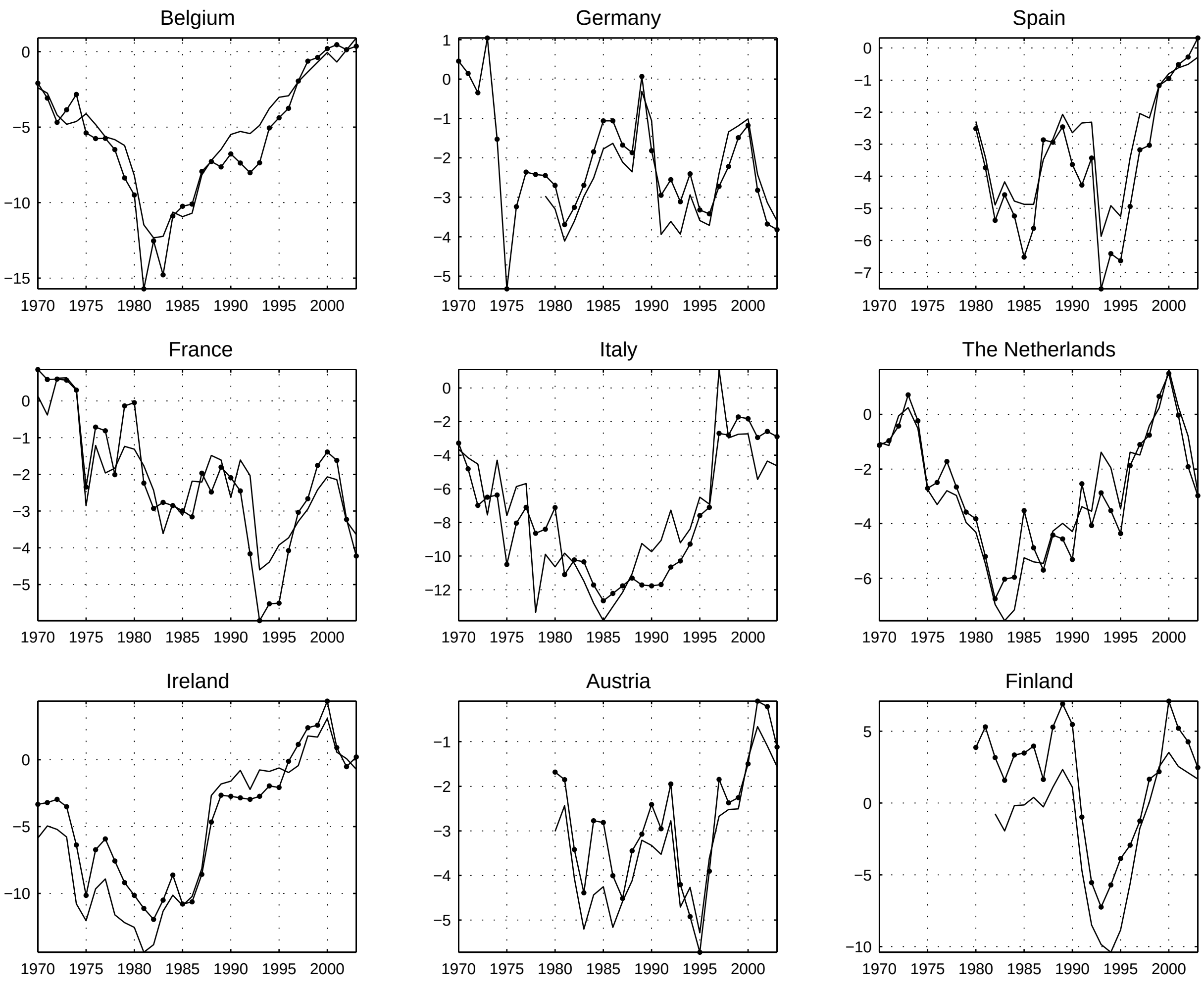

Figure 3: Net lending for EMU: anticipation of the fiscal loosening that started in 2001. Actual figures (thick solid line), indicator-based forecasts (left panels), and EU Commission forecasts (right panels).