Cyclical sensitivity of fiscal policies based on real-time data

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ABSTRACT

This paper examines the information-related problems associated with the analysis of fiscal policies, an issue recently studied in connection with monetary policies but largely ignored in the literature on budgetary action. We estimate a fiscal policy rule for the EU and OECD countries using real-time data on cyclical conditions; the results indicate that over the last decade fiscal policies reacted strongly and counter-cyclically to adverse macroeconomic conditions. Using ex post data instead, the reaction to adverse cyclical conditions is weaker and not statistically significant. The results indicate that reliance on the information actually available to policy-makers in real-time is important for the assessment of past policies, as *ex post* revised data may provide a misleading basis for such analysis. The results also suggest that part of the problems the Stability and Growth Pact encountered may have come from a misjudgment of cyclical conditions in some European countries in recent years.

Keywords: Real-time information, OECD countries, stabilization policies, fiscal policy rules
JEL classification numbers: E61, E62

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1. Introduction

In recent years increasing attention has been paid to issues related to the real-time information available to policy-makers. The work of Orphanides (Orphanides, 1998, 2001) documented that in the last decade there have been substantial errors in the real-time assessment of cyclical conditions in the US. This has led to a number of studies using real-time data to assess US past monetary and fiscal policies (e.g. Orphanides, 2001, Cohen and Follette, 2003). Another strand of the literature has discussed whether real-time output gap estimates can be considered sufficiently reliable (Orphanides and van Norden, 2002, and Rünstler, 2002).

There is instead little research employing real-time data on cyclical conditions to analyze economic policies outside the US. Concerning fiscal policy, which is the focus of this paper, to our knowledge, all the recent studies that have analyzed the determinants of budgetary policies in EU and OECD countries are based on *ex post* data. While the use of *ex post* data is important as it allows the actual (or *ex post*) counter-cyclicality of fiscal policies to be assessed, often these data have been used to estimate a fiscal rule, as a proxy for the information actually available to policy-makers in real time. Overall, these studies tend to provide evidence of pro-cyclical fiscal policies (e.g. Melitz, 2000, Buti, 2002, European Commission, 2001 and 2002 and IMF, 2004). As pro-cyclicality contrasts with the stabilization function of fiscal policy, a number of explanations are offered for these results, including conflicting objectives of policy-makers, information problems, complexity of decision-making and lags in the implementation of budgetary decisions (e.g. Buti, Franco and Ongena, 1998, Brunila and Martinez-Mongay, 2002). In the literature, however, no systematic work has sought to assess the relative importance of these factors, and particularly of information-related problems.

This paper compares estimates of fiscal rules for a sample of 19 OECD countries, based on real-time assessments of cyclical conditions, with those obtained employing *ex post* data. For the real-time assessment we use the estimates of output gaps published in various December issues of

OECD *Economic Outlook* (*EO*);[1] the *ex post* data refer to the estimates included in the latest *EO* issue.

In principle, the most direct source of the real-time information available to policy-makers is budget documents. However, quantitative assessments of cyclical conditions are not usually reported. Moreover, when presenting macroeconomic projections, policy-makers may take into account their "announcement effects". Therefore, the assessment of economic conditions may not fully correspond to the real expectations of policy-makers. On the other hand, the OECD data on cyclical conditions present a number of advantageous features. They are not affected by the distortion arising from "announcement effects"; they are comparable across countries and they are produced with a significant degree of coordination with national experts, mostly working within government units. As for the time of production, a preliminary version of the December *EO* is discussed with national delegates (usually from the Finance Ministries) at an OECD meeting that takes place between the end of October and the beginning of November. Therefore, even in the unlikely case of the OECD assessment differing significantly from the view expressed by the Ministry of Finance experts, there is enough time for this different view to affect budgetary decisions, which are usually finalized in December.

One of the reasons for the lack of studies based on real-time data is that international organizations have started to produce comparable estimates of output gaps only relatively recently. The longest period for which these estimates are available, the one provided by the OECD, only starts with the *EO* of December 1995. In this paper, however, we extend the information back two years by estimating the values of the output gaps of the OECD countries implicit in the *EO*s published in December 1993 and 1994 (owing to the lack of information we cannot extend the data further). Therefore, we can examine the information on cyclical conditions available in real-time to policy-makers in the years 1993-2003, which bears on their policy actions in 1994-2004.

While for other kinds of empirical investigation this time dimension may appear limited, we think it is adequate for two main reasons. First, the study focuses on cross-country results, with the full

[1] The OECD issues the *EO* twice a year, in June and December. Therefore, every year two estimates of that year's output gap and two forecasts for the following year are available. Since the budget is usually approved at the end of the year, it is natural to use the estimates published in December.

sample comprising about 200 observations. Second, the conduct of fiscal policy may differ considerably between one period and another as, for example, the results of Auerbach (2003) for the US suggest. In other terms, the way fiscal policy was conducted in the 1970s or 1980s may indeed be of little help in understanding fiscal policy in the 1990s. In particular, the whole fiscal policy framework changed for the European countries in 1993, when the Maastricht Treaty entered into force.

The rest of the paper is structured as follows. In section 2 we discuss the specification of the fiscal rule we estimate, pointing out some of the alternatives explored in the literature. In section 3 we describe the data-set used in our analysis. We focus mainly on real-time data (the procedure employed to extend the latter series backwards is described in the Appendix), also comparing them with the *ex post* data now available. In section 4 we analyze the estimates of the fiscal rule, using alternatively real-time and *ex post* data. We also discuss the source of the differences between the two sets of estimates. In section 5 we examine the implications of misjudging cyclical conditions on fiscal policies. Section 6 concludes.

2. Model specification

In this section we describe the model specification we use for examining fiscal policies. Our starting point is the specification adopted in Galì and Perotti (2003) which, in common with a number of studies (e.g. European Commission, 2001 and 2002, Auerbach, 2003, Cohen and Follette, 2003 and Taylor, 2000) has the discretionary component of the budget as dependent variable:

$$\Delta d_{it} = \phi_i + \phi_x E_{t-1} x_{it} + \phi_b b_{it-1} + \phi_d d_{it-1} + u_{it}$$

where the subscript i indicates the country and t the time, d_t is the cyclically adjusted primary budget balance (CAPB; a deficit has a negative sign)[2] as a ratio of potential GDP;[3] $E_{t-1}x_t$ is the output gap of time t expected at time $t-1$; b_t is the debt level as a ratio of GDP and u_t is the error

[2] The estimates of the cyclical component of the budget rely on estimates of the trend (potential) in growth or in the aggregates relevant for the budget. For growth, there are different approaches to estimating the trend, ranging from filtering the series to estimating a production function. The CAPB estimated by the OECD is computed from an assessment of trend growth based on a production function approach.

[3] Galì and Perotti (2003) use as dependent variable the level of the CAPB, instead of its change. Since in our case the lagged level of the CAPB is included among the regressors, the two specifications give the same estimates.

term. The term $E_{t-1}x_t$ reflects the fact that budgetary decisions are usually taken in autumn for the following year. The coefficient ϕ_x captures the reaction of fiscal policy to cyclical conditions. The lagged levels of debt and CAPB allow to control for the impact of initial conditions on policymakers' decisions: a positive value of ϕ_b or a negative value of ϕ_d indicate that the higher the initial levels of debt and deficit, the greater the tightening of fiscal policy.

Regarding the dependent variable in equation (1), we are aware that there is no single definition of fiscal policy in the literature. Some studies analyze the overall changes in the budget balance (primary or total), without distinguishing between discretionary actions and automatic stabilizers (e.g. Melitz, 2000; Hagen, Hallett and Strauch, 2002; Wijkander and Roeger, 2002; Balassone and Francese, 2004). Since we are interested in the budgetary decisions, we focus, instead, on the discretionary component, although we understand that these decisions are not fully independent from the extent of the automatic reaction of the budgets. Even when discretionary policy is the dependent variable, it is not always measured by the CAPB; recent examples are found in Fatàs and Mihov (2001); Larch and Salto (2003); Buti and van den Noord (2004) and Auerbach (2002).

Regarding the cyclical conditions variable, some authors use measures of growth instead of output gaps. While growth does not represent an adequate proxy for cyclical conditions (during the economic cycle, a positive gap, as well as a negative one, is accompanied by growth rates both above and below the trend), it is still an open question as to what exactly conditions policy-makers' budgetary choices, and growth is a potential candidate. Therefore, to address this issue we also substitute in our regressions the real-time and *ex post* output gap estimates with corresponding measures of growth.[4] Overall, the estimated coefficients of these measures of growth are less significant than those of output gaps.

We improve on the fiscal policy rule embodied in equation (1) in three respects. First, as over 60 per cent of our sample is composed of euro-area countries, we try to control for the role of European fiscal rules, as laid down by the Maastricht Treaty and the Stability and Growth Pact. In order to do so, we construct a variable, m_t, (from now on referred to as the Maastricht variable)

[4] In particular, with reference to the budget approved in year *t-1* for year *t*, we have used the growth expected in year *t-1* for the following year, the estimated growth for year *t-1* and measures of current and expected growth minus the average of the previous five years.

always equal to zero for all non-euro-area countries. For euro-area countries, the variable is also zero in the years when their government deficit is equal to or below the threshold of 3 per cent of GDP. For the years 1993-1996, when the deficit exceeds the threshold, the variable takes a value equal to the difference between the deficits and the 3 per cent of GDP limit, divided by the number of years remaining to 1997, the assumption being that during the run-up to the Monetary Union, fiscal rules were more binding the higher above the threshold was the deficit and the closer the year to 1997. After 1997, the variable takes a value equal to the difference between the deficit and the 3 per cent of GDP limit, divided by two, as the provisions of the Pact require a country to correct an excessive deficit (above 3 per cent) occurring in year *t* (and usually recorded officially in year *t+1*) by year *t+2*, that is in the year after official recognition of the excessive deficit.[5] Possibly in relation to the difficulties encountered by the Pact in recent years, the results are very similar whether or not we define the Maastricht variable for the years after 1997.

Second, since there is recent evidence that fiscal policies in OECD countries have been counter-cyclical mainly in downturns and not much or not at all in upturns (see, among others, OECD 2003 and Balassone-Francese, 2004), we allow for different coefficients depending on whether the output gap is positive or negative. Taking into account these two aspects, the equation we estimate is the following:

$$\Delta d_{it} = \phi_i + \phi_n E_{t-1} x_{it}^n + \phi_p E_{t-1} x_{it}^p + \phi_m m_{it} + \phi_b b_{it-1} + \phi_d d_{it-1} + u_{it} \qquad (2)$$

where the superscript *n* indicates negative gaps and *p* positive ones.

The third respect in which we improve on equation (1) relates to the term $E_{t-1} x_t$, for which we explore two alternatives throughout our empirical investigation. An obvious candidate to proxy the $E_{t-1} x_t$ term is the forecast for year *t* made in autumn of year *t–1*. However, we also consider the possibility that policy-makers, when budgeting, simply react to *current conditions*. This alternative also has a different interpretation, *i.e.* that policy-makers, when preparing the budget for year *t* in the autumn of year *t–1*, use the estimate for year *t–1* to forecast the output gap of year *t*. In any interpretation the term regarding the gap, $E_{t-1} x_t$, would be replaced by x_{t-1} estimated in real-time.

[5] Since the variable deficit is defined with a negative sign, the Maastricht variable takes always a negative sign (as it is defined as the difference between a deficit above 3 per cent and the 3 per cent deficit threshold).

For simplicity, we label the latter alternative the *current condition* case, and call the former the *expected condition* case.

Finally, we are aware that there are other factors that might affect the conduct of fiscal policy. For example the role of budgetary rules, of the form of government and of political cycles have been studied extensively in the literature. The first two factors are less of a concern, as in principle they should not be correlated with economic cycles and therefore should not affect the estimation of the cyclical response of fiscal policy. Moreover, one focus of this paper is the comparison between the estimates of the fiscal policy rule (2) using real-time and *ex post* data; for this, the above factors should not be relevant, as there is no reason why they should have a different impact on estimates when using real-time or *ex post* data. Concerning the political cycles, in our regressions we introduce a number of alternative variables for elections, as suggested by the recent literature in this field (e.g. Franzese, 2000). The estimates of the corresponding coefficients are of the expected sign but never significant. Since the inclusion of a control variable for election year has no significant impact on the coefficients of the equation, we decided to exclude it from our benchmark specification.

3. The data

Except for real-time information, all data we use are from the June 2004 issue of the OECD *EO*. The information on cyclically adjusted primary balances (Annex Table 30 of the *EO*), our dependent variable, refers to 21 OECD countries. For lack of real-time information on cyclical conditions, we exclude Iceland from the sample and, for the years preceding 1998, New Zealand. Moreover, as the main focus of our study is to assess the cyclical reactions of fiscal policies, we decided to report the results based on a sample which also excludes Ireland.[6] We consider Irish fiscal policy in this respect clearly to be an outlier, as the economy growth rate over the last decade has been extremely high (between 6 and 11 per cent) in almost all years, never dropping below 2 per cent. In this context, cyclical stabilisation has not been a priority for budgetary policy and, in fact, Ireland received an early warning from the European Council in 2001 for running pro-cyclical discretionary policies. Summing up, our sample includes 19 OECD countries for 11 years, with 4

[6] Information on the impact of excluding Ireland from the sample is provided in section 4.1.

observations missing. The euro-area countries included are 10: there is no information on Luxemburg and, as already mentioned, we exclude Ireland.

As discussed in the introduction, we use the estimates of output gaps published by the OECD in the December *Economic Outlook* (*EO*) of each year as a proxy for the information on cyclical conditions available to policy-makers in that year. These data are published for 21 OECD countries since December 1995, when the OECD revised its method of estimating output gaps and structural budget balances (Giorno *et al.,* 1995).

We extend this series back by two years, computing for each country[7] the values of the output gap implicit in the data on the cyclical component of government budget published in the *EOs* of December 1993 and 1994 (no such data were available before 1993). This reconstruction is particularly important as it allows the analysis to cover the whole period in which European fiscal policies have been conducted within the new framework established by the Maastricht Treaty, which entered into force in 1993. Even more important, it enables the study to encompass a second period of generalised downturn of economic activity, approximately centred in 1993, in addition to the most recent one.

To estimate the relation between the output gap and the cyclical component of government budget we rely on Giorno *et al.* (1995). This study, reviewing the methodology employed by the OECD to cyclically adjust government budgets before December 1995, presents mutually consistent data for both variables for the years 1987-96. In the Appendix there is a full description of the procedure we use to extend the data.

In the first 11 columns of the first half of Table 1 we report the differences between the output gap estimated in the December issue of the *Economic Outlook* of year *t* for the same year and the *ex post* estimate (published in the latest issue of the *Economic Outlook,* that of June 2004). In the

[7] As the December 1993 *EO* explicitly reports estimates of the real time output gap in 1993 for the seven largest countries, we do not need to reconstruct them.

Table 1 – Errors, measured by *ex post* data, in the real-time output gap by country and years

(percentage point of potential GDP)

a) [$x_t^{real\ time} - x_t^{ex-post}$]

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**Average error by country**	Average effect on CAPB (*)
US	0.9	1.4	1.7	0.3	0.1	0.5	0.1	0.6	0.7	0.6	0.5	0.7	0.1 (3)
Japan	–4.1	–1.4	–3.0	–3.8	–4.5	–3.6	–1.0	–2.2	–0.3	0.6	–0.1	–2.1	–0.4 (11)
Germany	1.2	0.4	–0.3	0.4	0.2	–0.1	–0.9	–1.4	–1.1	–0.6	–0.4	–0.2	–0.0 (11)
France	–3.2	–1.8	–0.7	0.1	1.1	0.9	0.4	–0.4	–0.3	–0.5	–0.6	–0.5	–0.1 (9)
Italy	–0.9	0.9	–2.1	0.0	–1.0	–2.3	–2.3	–2.1	–2.4	–0.8	0.2	–1.2	–0.2 (11)
UK	–1.3	–1.3	–0.6	–0.1	0.9	1.1	0.7	–0.5	–0.7	–0.4	–0.4	–0.2	–0.1 (7)
Canada	–2.1	–1.7	–1.1	–0.7	–0.1	0.5	–0.6	–1.4	–0.5	–0.7	–0.2	–0.8	–0.2 (7)
Australia	0.7	–0.2	0.5	0.3	–0.7	–1.4	–1.0	–0.3	–1.8	–1.5	–1.6	–0.6	–0.1 (6)
Austria	–2.4	–1.7	1.3	–0.8	–1.0	–2.2	–1.4	–2.2	–0.9	–1.4	0.2	–1.1	–0.3 (8)
Belgium	1.3	–0.7	–1.5	–0.5	–1.2	–0.7	–1.9	–2.9	–1.0	–1.0	–0.5	–1.0	–0.2 (11)
Denmark	–0.6	–1.2	–0.8	–2.4	–1.2	–0.5	–1.6	–1.9	–1.8	–1.1	0.1	–1.2	–0.2 (8)
Finland	–0.1	4.3	3.9	3.5	3.1	2.9	1.6	–1.1	0.1	–0.8	–1.2	1.5	0.3 (8)
Greece	3.6	1.7	2.1	1.7	1.2	1.6	2.2	1.3	1.3	0.5	–0.1	1.6	0.3 (8)
Ireland	5.1	4.5	1.6	2.4	–1.1	1.5	1.3	–1.3	–2.1	–3.8	1.0	0.8	0.3 (3)
Netherlands	1.6	–2.3	–0.9	–0.6	–1.1	–0.6	–1.7	–2.1	–2.0	–2.2	0.5	–1.0	–0.2 (6)
New Zealand	n.a.	n.a.	n.a.	n.a.	–1.6	0.5	–0.6	–0.6	–0.2	–1.0	–0.3	–0.5	–0.1 (3)
Norway	–2.1	1.5	0.7	0.2	–0.5	–0.6	–1.0	–0.7	–1.1	0.7	0.8	–0.2	–0.1 (4)
Portugal	–0.8	0.0	–1.4	–1.8	–1.6	–1.9	–2.7	–2.7	–1.8	–0.7	0.2	–1.4	–0.2 (9)
Spain	–0.2	–0.3	1.8	1.9	1.2	0.8	0.7	–1.0	–0.5	–0.4	–0.3	0.3	0.1 (10)
Sweden	–0.7	0.8	0.9	2.1	0.9	0.1	–0.9	–1.3	–1.4	–0.5	–0.1	0.0	0.0 (10)
Av.age error by year	–0.2	0.2	0.1	0.1	–0.3	–0.2	–0.5	–1.2	–0.9	–0.8	–0.1	–0.4	

b) $E_{t-1}x_t^{real\ time} - x_t^{ex-post}$

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	**Average error by country**	Average effect on CAPB (*)
US	0.5	2.3	0.6	–0.7	–0.4	–1.6	0.3	2.9	–0.6	0.3	0.0	0.3	0.0 (3)
Japan	–6.1	–2.0	–5.3	–5.2	–2.2	–3.1	–2.4	–0.2	–0.4	–1.1	–1.5	–2.7	–0.5 (11)
Germany	–0.5	0.0	0.4	0.8	0.3	–0.6	–2.0	0.1	–0.7	1.1	–0.2	–0.1	–0.0 (10)
France	–4.8	–0.8	0.5	0.8	0.5	0.2	–0.7	0.3	–0.3	1.0	–0.7	–0.4	–0.1 (9)
Italy	–2.0	–0.1	–1.2	–1.0	–0.8	–2.3	–3.3	–1.7	–1.9	0.2	1.0	–1.2	–0.2 (11)
UK	–3.0	–0.9	–0.7	–0.1	0.2	–0.4	–0.2	0.3	–0.3	–0.1	–0.8	–0.5	–0.2 (8)
Canada	–3.7	–0.6	0.4	–0.8	0.2	–1.5	–2.1	0.2	–2.2	0.5	–0.2	–0.9	–0.2 (8)
Australia	–0.8	0.3	0.3	0.0	–2.3	–2.4	–1.0	0.1	–1.9	–1.0	–1.7	–1.0	–0.3 (7)
Austria	–3.2	–0.7	–0.8	–1.3	–1.7	–2.4	–1.7	–0.2	–0.8	0.0	0.2	–1.1	–0.2 (9)
Belgium	–0.1	–0.1	–0.4	–2.1	–0.6	–1.7	–3.0	–1.1	–0.6	–0.2	–0.6	–1.0	–0.2 (11)
Denmark	–2.5	–0.6	–0.5	–2.4	–0.9	–1.5	–2.8	–1.0	–1.6	0.5	0.4	–1.2	–0.2 (8)
Finland	–1.8	5.1	3.3	1.8	2.5	2.0	–0.4	1.6	–1.5	–0.4	–0.4	1.1	0.2 (7)
Greece	3.1	1.8	2.7	0.9	1.8	2.0	1.9	1.3	0.8	–0.2	0.0	1.5	0.4 (7)
Ireland	5.1	2.9	1.3	0.2	–0.2	–2.7	–1.3	–0.8	–6.4	–2.5	0.6	–0.3	–0.1 (2)
Netherlands	0.5	–1.8	–1.4	–1.0	–1.6	–2.1	–2.5	–0.3	–1.1	–0.5	0.1	–1.1	–0.2 (5)
New Zealand	n.a.	n.a.	n.a.	n.a.	1.9	–1.7	–1.5	–0.3	–1.9	–0.9	–0.2	–0.7	–0.2 (4)
Norway	–1.2	1.0	0.4	–0.8	–1.2	–1.5	–2.4	–0.1	–0.7	1.7	0.0	–0.4	–0.2 (4)
Portugal	–1.2	–2.0	–1.9	–2.4	–2.4	–2.4	–2.6	–1.5	–0.9	1.2	0.7	–1.4	–0.2 (8)
Spain	–1.7	0.0	2.4	1.0	0.5	–0.3	0.1	–0.2	–0.5	–0.5	–0.5	0.0	0.0 (9)
Sweden	–2.2	–0.1	2.3	1.9	0.2	–1.7	–1.6	1.4	–2.0	0.2	–0.1	–0.2	–0.0 (9)
Av.age error by year	–1.3	0.2	0.1	–0.5	–0.3	–1.3	–1.5	0.0	–1.3	0.0	–0.2	–0.6	

$x_t^{ex-post}$ = OECD output gap for year *t* estimated in the June 2004 issue of the OECD *EO*.

$x_t^{real\ time}$ = OECD output gap for year *t* estimated in the December issue of the OECD *EO* of year *t*.

$E_{t-1}x_t^{real\ time}$ = OECD output gap for year *t* estimated in the December issue of the OECD *EO* of year *t–1*.

* See Chapter 5.

second half, the reported differences are between the estimates made in year *t* for year *t+1* and the ex post ones for year *t+1*.[8]

4. Results of estimations

In this section we report the estimates of the fiscal rule embodied in equation (2) for our sample of 19 OECD countries and for the euro-area countries (respectively, first and second half of Table 2). We present the estimates for the *current* and *expected condition* cases (respectively, columns 1-2 and 3-4 of Table 2) using real-time and *ex post* data.

We first focus on the results with real-time data for our full sample (reported in columns 1 and 3 of the first half of Table 2). In the *current conditions* case (column 1), where we use OLS, the coefficient for the negative output gap is positive and highly significant, pointing to a counter-cyclical reaction of fiscal policy to adverse economic conditions. The reaction is sizeable, as the estimated coefficient implies that a 1 per cent negative output gap induces a worsening of the CAPB by 0.19 per cent of GDP. The coefficient for the positive output gap is also positive (again signaling a counter-cyclical reaction), but slightly smaller (0.16) and not significant. The estimated impact of the Maastricht variable is of the expected sign and significant. Moreover, the coefficients of the other initial-condition variables (lagged levels of debt and deficit) have the expected sign and are statistically significant: high debt and deficit levels induce, *ceteris paribus*, a tightening of fiscal policies.

In the expected condition case we use instrumental variables, as the December forecast of the gap for the following year is finalized late in the year and it is therefore possible that it incorporates the effects of the planned fiscal policy.[9] The results (column 3 of the first half of Table 2) are almost identical to those of the current conditions case. The only two exceptions concern the loss of statistical significance of the coefficient of the debt and the coefficient of the positive output gap**,** which is reduced to zero. It should be noted that, in general, estimates for the coefficient of the

[8] For the years 1993 and 1994, in both parts of the table we use (when necessary; see previous footnote) the reconstructed values of the real-time estimates. We also include the year 2004 in the second half of Table 1, taking as *ex post* measure the assessment made for that year in June 2004 *EO*.

[9] We use as instruments the estimate made in December of the gap of the same year and the (GDP weighted) average gap of the other countries in the sample estimated in December for the same year. We get very similar estimates if instead of the latter instrument we use the (GDP weighted) average gap for the following year of all the other countries.

Table 2 – Real-time versus *ex post* data: OECD countries and euro-area countries

	Current conditions (gap in the year of budgeting) OLS				**Expected condition (gap expected for the following year) IV**			
	Real-time data		*Ex post data*		*Real-time data*		*Ex post data*	
	(1)		(2)		(3)		(4)	
	Full sample of 19 OECD countries (*)							
	Coeff.	t stat	coeff.	t stat	coeff.	t stat	coeff.	t stat
Negative Output gap (ϕ_n)	0.19	*3.15*	0.09	*1.38*	0.22	*3.38*	0.14	*1.60*
Positive Output gap (ϕ_p)	0.16	*0.83*	0.10	*0.87*	0.00	*0.01*	0.13	*0.84*
Maastricht (ϕ_m)	–0.51	*–4.06*	–0.49	*–3.69*	–0.56	*–4.33*	–0.52	*–3.86*
Debt (ϕ_b)	0.01	*2.03*	0.02	*2.48*	0.01	*1.22*	0.02	*2.12*
Deficit (ϕ_d)	–0.39	*–8.06*	–0.34	*–7.21*	–0.38	*–8.10*	–0.36	*–7.09*
R-squared								
within	0.372		0.343		0.373		0.345	
between	0.048		0.094		0.045		0.090	
overall	0.120		0.102		0.117		0.101	
No. of obs.	205		205		205		205	
	Euro-area countries (*)							
	Coeff.	t stat	coeff.	t stat	coeff.	t stat	coeff.	t stat
Negative Output gap (ϕ_n)	0.19	*2.71*	0.03	*0.37*	0.20	*2.74*	0.06	*0.78*
Positive Output gap (ϕ_p)	–0.38	*–1.17*	0.07	*0.52*	–0.40	*–0.98*	0.10	*0.60*
Maastricht (ϕ_m)	–0.46	*–3.57*	–0.39	*–2.93*	–0.46	*–3.53*	–0.42	*–3.11*
Debt (ϕ_b)	0.02	*1.60*	0.02	*1.68*	0.01	*0.87*	0.02	*1.58*
Deficit (ϕ_d)	–0.42	*–5.64*	–0.38	*–4.83*	–0.43	*–5.70*	–0.39	*–4.91*
R-squared								
within	0.411		0.368		0.412		0.372	
between	0.005		0.003		0.010		0.004	
overall	0.248		0.225		0.238		0.218	
No. of obs.	110		110		110		110	

Note: *Ex post* data are taken from the June 2004 issue of the OECD *EO*. *Real-time* data from the December issue of the OECD *EO* at time *t–1*. (*) Ireland and Luxemburg are not included.

positive output gaps should be taken with caution, as they are based on a relatively small number of observations. This is particularly true for the real-time data, for which there are only 53 observations (52 in the expected condition case) of positive output gaps, less than 26 per cent of the total (for *ex post* data, positive gaps are slightly less than 38 per cent of the total).

When we focus only on the euro-area countries (as already pointed out, Ireland and Luxemburg have been excluded from the full sample), the coefficient estimates are broadly in line with the ones for the complete sample, while the general fit improves (see second half of Table 2). The estimated counter-cyclical fiscal response to adverse cyclical conditions remains about 0.2, while the coefficient on the positive output gap (favorable conditions) is still not significant but changes sign, signaling the existence of pro-cyclical reactions on average, but with a large dispersion of policies. Compared with the full sample results, there is also a slight rebalancing of the respective impact of the Maastricht and lagged deficit variables. The debt variable is not significant in either the *current* and the *expected condition* cases.

The results of the regressions which use *ex post* data are reported in columns 2 and 4 of Table 2. As before, in the *current conditions* case (column 2) we employ OLS. In the *expected condition* case, instead, we use instrumental variables: the endogeneity problem is probably more severe than that of the corresponding case with real-time data, as the GDP realized in year *t* is certainly affected by the fiscal policy actually adopted in that year.[10] The general fit of the *ex post* data regressions is worse than that obtained using *ex ante* information, for both the full sample and for the euro-area countries. In particular, coefficients of the output gaps are never significant and differ sizably from those estimated with real-time data. These differences are analyzed in section 4.2 below. As for the estimated coefficients of the Maastricht and the lagged debt and deficit variables, they are very close to those obtained with real-time data and are significant.

[10] We instrument the output gap of each country with both its lagged value and the (GDP weighted) average lagged output gap of all the other countries in the sample. Galì and Perotti (2003) suggest a similar instrument: they use the EU15 lagged output gap for the US and the US lagged gap for all other countries; we obtain very similar results when using this other instrument.

4.1 Sensitivity analysis

Given our sample size, we cannot run country-by-country regressions and, therefore, we cannot estimate the country-specific responses to cyclical conditions. To assess the sensitivity of cross-country regressions in the sample of countries considered, we run the four regressions of Table 2 for the 19 OECD countries in our sample, eliminating a single country at a time. Overall, the results are very robust to the exclusion of a single country, both in terms of value and significance of coefficients and of differences between real-time and *ex post* data.[11] Focusing on the coefficient of the negative output gap with real-time data, the range of the estimates we obtain in the 19 alternative regressions is between 0.16 and 0.22 (corresponding, respectively, to the sub-sample which excludes Denmark and to that which excludes Japan) in the *current condition* case and between 0.18 and 0.27 (corresponding to the same countries) in the *expected condition* case.

We also compared our full sample results with those obtained including Ireland. The two sets of results and the statistical properties of estimates are very similar for all coefficients except for that of the positive output gap. While in the benchmark analysis (full sample of 19 countries) this coefficient is either positive or zero, and always not significant, when we include Ireland it is always negative (indicating pro-cyclicality of policies) and, in the real-time *expected condition* case, relatively large (–0.41) and significant. The inclusion of Ireland has a stronger impact on the evidence of pro-cyclicality in good times when we restrict the sample to the euro-area countries. With real-time data, in the restricted sample the coefficient is negative but not significant. With the inclusion of Ireland the estimated coefficient remains approximately the same but is significant in both the *current* and *expected condition* cases.

Since real-time output gap data for the first two years of the sample are partly estimated, we also run our standard regressions using data for 1994 and 1995 based on alternative estimation methods. The results, reported in the Appendix, are not significantly different from those of Table 2.

[11] We also run a regression with *ex post* data, using the initial 4 observations for New Zealand. The results are not significantly different from those of the benchmark regression, in which we drop those observations for comparison with the analysis based on real-time data.

Furthermore, in a number of experiments we tried to assess the sensitivity of our results to the sample period we selected. In particular, we run our standard regressions with real-time data excluding the initial two years, when fiscal policies had to react to the generalized downturn approximately centered in 1993. This restriction leads to the loss of statistical significance of the coefficient of the negative gap for both the *current* and *expected condition* cases (the coefficient of positive output gaps is also not significant, as in the full historical sample). This suggests that there has been no systematic response of fiscal policies to cyclical conditions over the years 1996-2004.

However, the loss of statistical significance of the coefficient of the negative gap when we drop the first two years may be due to the limited number of observations available more than to a change in the actual policy responses to adverse cyclical conditions. To better understand our results, we dropped not the first two years but the years 2003-2004, during which sizeable negative output gaps emerge again in most countries. Interestingly, the results show stronger and more significant coefficients of the negative output gaps with respect to the full historical sample, both with *real-time* and *ex post* data.[12]

Overall, these experiments would suggest that the policies followed in 1994 and 1995 were more counter-cyclical than those conducted during the recent downturn, controlling for the other variables included in the regression. This does not mean that the fiscal stance (as measured by the change in the cyclically-adjusted primary deficit) was more expansionary at the beginning of the 1990s than during the more recent downturn (indeed, the contrary is true), as in the initial years the deficit levels were, on average, much higher and required larger correction.

Finally, the historical sample we examine includes the fiscal policies for 2004. For this year, the values of our dependent variable are those estimated by the OECD in June 2004. As these estimates are subject to significant errors, we also restricted our sample to the period 1994-2003. The results are not substantially different from those reported.

[12] Result do not change if we drop 2002-2003 instead of 2003-2004.

4.2 Comparing estimates of cyclical responses with real-time and ex post data

As already mentioned, in both *current* and *expected condition* cases, using real-time data we obtain a better fit than with *ex post* data. As for the estimated coefficients, those of the Maastricht and the lagged debt and deficit variables do not seem to depend on the timing of the information on cyclical conditions. Noticeable differences emerge instead for the coefficients of the output gaps. First, while with *ex post* data both the coefficients (of negative and positive output gaps) are not statistically significant, with real-time data that of the negative output gap is highly significant. This is true for both the *current* and the *expected condition* cases. Second, using *ex post* data, the estimated fiscal-policy-stabilizing response to adverse cyclical conditions is sizeably lower: in the *current conditions* case, the coefficient of negative output gaps in the regression with *ex post* data is 50 per cent lower than that with real-time data; in the *expected condition* case, the coefficient is approximately 35 per cent lower. When restricting the sample to euro-area countries, these differences are larger.

These differences can be better understood by examining the theoretical implications of using *ex post* data when the true fiscal rule is based on real-time information. *Ex post* data on the output gap can be written as:

$$x_t^{ep,j} = x_t^{rt,j} + \eta_t^j = x_t^{rt,j} + \mu^j + \varepsilon_t^j \qquad \text{for } j = n, p$$

where the superscripts *n* and *p* identify respectively the sets of negative and positive output gaps, x^{ep} is the *ex post* output gap, x^{rt} is the real-time gap and η_t, the difference between the *ex post* and real-time estimates, is split into μ, a non-zero constant, and ε_t, a zero-mean residual. Therefore equation (2), if estimated using *ex post* data, can be rewritten as follows:

$$\Delta d_{it} = (\phi_i + \phi_n \mu_i^n + \phi_p \mu_i^p) + \phi_n x_{it}^{rt,n} + \phi_p x_{it}^{rt,p} + \phi_m m_{it} + \phi_b b_{it-1} + \phi_d d_{it-1} + (u_{it} + \phi_n \varepsilon_{it}^n + \phi_p \varepsilon_{it}^p) \qquad (3)$$

Under the assumption that ε_t^n and ε_t^p are not correlated to the real-time estimates of, respectively, the negative and positive output gaps, we are in the standard measurement error case and the estimates of ϕ_n and ϕ_p, in absolute value, are subject to a downward bias. In our case, however,

data do not justify the above assumption.[13] Therefore, the regression with *ex post* data has also an omitted variable problem. Under the assumptions that $\varepsilon_t^{\,n}$ and $\varepsilon_t^{\,p}$ are not correlated with all the other regressors and that the two sets of real-time output gap estimates are not correlated, the expression for the bias in the OLS regressions (*current condition* case)[14] can be simplified to the following:

$$\hat{\phi}_j = \phi_j \left(1 - \frac{\sigma_{x^{ep,j},\eta^j}}{\sigma^2_{x^{ep,j}}} \right) \qquad for\ j = n, p \tag{4}$$

where $\sigma_{x^{ep,j},\eta^j}$ is the covariance between the *ex post* gap and the error, and $\sigma^2_{x^{ep,j}}$ is the variance of the *ex post* gap. The expression indicates that, under the above assumptions, the bias is proportional (but with the opposite sign) to the correlation between the measurement error in the real-time estimation of the output gap and the value of the gap assessed *ex post*.

To understand how important is this factor in explaining our results, we computed the values of $\hat{\phi}_n$ and $\hat{\phi}_p$ on the basis of expression (4).[15] They have the same sign as the differences between the actual estimates of equation (2) with real-time and *ex post* data and are also broadly similar, but not close: for $\hat{\phi}_n$ we obtain a downward bias of 24 per cent, against an actual result of 50, while for $\hat{\phi}_p$ the value is 67, against a result of 40. Clearly, these discrepancies reflect the failure to satisfy all the simplifying assumptions behind expression (4).

On the basis of expression (4), we expect to find a more negative bias for the countries for which the correlation between the measurement error in the real-time estimation of the output gap and the value of the gap assessed *ex post* is higher. In fact, if we split the sample of countries in two, depending on the value of this correlation, the bias computed on the set of countries with higher values is equal to about 80 per cent and 260 per cent for ϕ_n and ϕ_p respectively.

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[13] In our data set the correlation between ε_t and x^{rt} for the sets of positive and negative output gaps is equal, respectively, to –0.45 and –0.28 in the *current condition* case, and to –0.62 and –0.58 in the *expected condition* case.

[14] We focus on the OLS estimates (*current condition* cases), as in the *expected condition* case the analysis of the bias would be very complicated by the use of instrumental variables.

[15] Based on expression (4) the bias of $\hat{\phi}_n$ corresponds to the coefficient of the regression of η_t^n on $x^{ep,n}$, and similarly the bias of $\hat{\phi}_p$ corresponds to the coefficient of the regression of η_t^p on $x^{ep,p}$.

Equation (3) also implies that the estimated country-fixed effects when using *ex post* data should be approximately equal to the ones estimated using real-time data plus the term $\left(\phi_{1n}\mu_i^n + \phi_p\mu_i^p\right)$. In fact the correlation between this term and the difference of the fixed effects obtained using *ex post* and real-time data in the *current conditions* case is approximately 80 per cent.

Summing up, in this section we analyze the distortion in the estimates of the response of fiscal policies to cyclical conditions when using *ex post* data when the true fiscal rule is based on real-time information. Our analysis suggests that the correlation between the measurement error η_t and the *ex post* measure of the output gap is the main factor affecting the distortion. In our sample, that correlation is positive for most countries, leading to a significant downward bias of the estimates.

The analysis also suggests that for individual countries the bias can be very large and of any sign. When using *ex post* data to run country-by-country regressions and make comparisons of the results, particular caution is therefore required.

4.3 Controlling for the lagged dependent variable

The fiscal policy rule sketched in (2) contains the lagged dependent variable on the right-hand side; therefore, the standard fixed effect estimator is inconsistent. However, in comparing the estimates using real-time and *ex post* data there is no reason to assume that the inconsistency would be different between the two cases. Moreover, the small sample properties of the consistent estimators that have been proposed in the literature are not well understood (our sample is small, only eleven years for each country). This is why we prefer to use fixed-effect OLS and IV estimators in our benchmark analysis.

As a robustness check, however, we now assess whether consistent estimates would provide substantially different results. Table 3 reports results based on the Arellano-Bond estimator, assuming one lag of the dependent variable to be included in the model and right-hand-side variables as strictly exogenous. Moreover, we set to 1 the maximum number of lags of the dependent variable that are used as instruments. The table also reports the Sargan test of

Table 3 - Consistent estimates (Arellano-Bond estimator)

	Current conditions (gap in the year of budgeting)				Expected condition (gap expected for the following year)			
	Real-time data		*Ex post data*		*Real-time data*		*Ex post data*	
	(1)		(2)		(3)		(4)	
	Full sample of 19 OECD countries (*)							
	coeff.	z stat	coeff.	z stat	coeff.	z stat	coeff.	z stat
Negative output gap (ϕ_n)	0.25	*3.17*	0.22	*2.36*	0.26	*3.19*	0.19	*1.53*
Positive output gap (ϕ_p)	0.11	*0.52*	0.22	*1.59*	0.25	*0.77*	0.34	*1.95*
Maastricht (ϕ_m)	–0.44	*–2.66*	–0.50	*–2.88*	–0.50	*–3.02*	–0.54	*–3.11*
Debt (ϕ_b)	0.04	*3.27*	0.06	*4.11*	0.04	*2.86*	0.05	*3.77*
Deficit (ϕ_d) (1)	0.64	*5.68*	0.67	*6.10*	0.63	*5.78*	0.66	*5.77*
Sargan test	Pr > chi2 = 0.138		Pr > chi2 = 0.080		Pr > chi2 = 0.116		Pr > chi2 = 0.090	
Arellano-Bond test								
1st order	Pr > z = 0.000		Pr > z = 0.000		Pr > z = 0.000		Pr > z = 0.000	
2nd order	Pr > z = 0.273		Pr > z = 0.210		Pr > z = 0.301		Pr > z = 0.234	
No. of obs.	186		186		186		186	
	Euro-area countries (*)							
	coeff.	z stat	coeff.	z stat	coeff.	z stat	coeff.	z stat
Negative output gap (ϕ_n)	0.21	*2.02*	0.09	*0.76*	0.18	*1.69*	0.01	*0.09*
Positive output gap (ϕ_p)	–0.15	*–0.37*	0.15	*0.77*	0.20	*0.38*	0.34	*1.66*
Maastricht (ϕ_m)	–0.33	*–1.77*	–0.33	*–1.70*	–0.37	*–1.94*	–0.37	*–1.91*
Debt (ϕ_b)	0.06	*2.26*	0.07	*2.65*	0.06	*2.03*	0.07	*2.62*
Deficit (ϕ_d) (1)	0.65	*4.10*	0.66	*4.12*	0.63	*3.95*	0.64	*3.93*
Sargan test	Pr > chi2 = 0.016		Pr > chi2 = 0.011		Pr > chi2 = 0.019		Pr > chi2 = 0.017	
Arellano-Bond test								
1st order	Pr > z = 0.000		Pr > z = 0.000		Pr > z = 0.000		Pr > z = 0.000	
2nd order	Pr > z = 0.183		Pr > z = 0.115		Pr > z = 0.130		Pr > z = 0.145	
No. of obs.	100		100		100		100	

Note: *Ex post* data are taken from the June 2004 issue of the OECD *EO*. *Real-time* data from the December issue of the OECD *EO* at time *t–1*. (*) Ireland and Luxembourg are not included.
(1) In order to implement the Arellano-Bond estimate in STATA, the dependent variable is the level of the CAPB and not its difference. This implies that the value of the coefficient of the lagged dependent variable presented in this table is not immediately comparable with those of the preceding tables.

over-identifying restrictions and the Arellano-Bond test for autocorrelation of the residuals. The former suggests that the instruments are appropriate, the latter indicates no second order autocorrelation of the residuals.

Notwithstanding the differences in the estimators (for example, the Arellano-Bond estimator assumes random effects), the estimates are generally in line with those of the OLS and IV. In particular, the coefficients on the negative output gap are positive and, generally, statistically significant; those of the positive gap are usually not significant.[16] Similar but less uniform results are also obtained concerning the difference between the estimated response to adverse cyclical conditions with real-time and *ex post* data: with the former, the coefficient range is 0.18-0.26 (in the four alternative estimates presented in Table 3); with the latter the range is 0.01-0.22.

The Arellano-Bond estimation procedure, however, leads to some problematic results, which suggest the need for caution. For instance, when we include Ireland in the sample the coefficient of the negative output gap in the *expected condition* case with *ex post* data increases from 0.19 to 0.32 and becomes statistically significant. This is a large impact, taking into account that in the case of Ireland we have only 4 observations of negative output gaps (out of a total of 149 observations in the sample).

5. The impact on fiscal policies of misjudging cyclical conditions

In this section we examine the differences (corresponding to $-\eta$ in the analysis of the previous section) between the real-time estimates of the output gaps and the currently available data, and make a tentative assessment of their possible impact on budgetary trajectories. These differences, reported in Table 1, can be thought of as the misjudgment of cyclical conditions made at the time fiscal policies were decided, measured on the basis of the information now available (they correspond, with a switched sign, to the overall revisions occurring in the period between the two different estimates).

[16] Note that, in order to implement the Arellano-Bond estimate in Stata, we specify the model using as dependent variable the level of the CAPB and not its first difference; the estimated coefficient on the lagged dependent variable is therefore different from our previous estimates.

To get a sense of the implications of these errors for fiscal policies we compute, only for the years in which output gaps are negative, their effects on fiscal policy, using a coefficient of 0.2, which is approximately the value we obtain with our regressions using real-time data.[17] This is our best assessment for the effects on the fiscal policies of each individual country, which we cannot estimate given the very short sample. We then calculate for each country (over the years with negative output gaps) the per-year average of these products (reported in the last column of Table 1 together with, in brackets, the number of relevant years).

These results suggest that the misjudgments of cyclical conditions have been significant in many countries and may have induced a systematic bias in fiscal policies for several years. About 60 per cent of the countries have an average yearly impact in absolute value equal to or above 0.2 per cent of GDP; the highest average impact, relative to Japan, is respectively equal to 0.4 per cent and 0.5 per cent in the two cases we examine.

If we focus on the European countries, which should have had the same long-term fiscal targets over the last years, we find a certain correspondence between our estimates of induced fiscal bias over the last decade and the current fiscal positions of the member states. In six out of the seven European countries which in 2003 recorded deficits close or above 3 per cent of GDP (Germany, Italy, France, Portugal, Netherlands, Greece and UK) the bias is negative, *i.e.* the misjudgment of cyclical conditions has induced more expansionary fiscal policies. The exception is Greece; the impact on Germany's fiscal policies is negative but very small. On the other hand, among those showing surpluses in 2003 (Belgium, Denmark, Spain, Ireland, Finland and Sweden) the induced bias is negative in, respectively, only two and four countries out of six, depending on which case – *current* or *expected condition* – we focus. Overall, these findings suggest that the differences in the misjudgment of cyclical conditions across countries in the last decade may have had a role in determining the dispersion in budgetary situations we observe now in Europe.

The above discussion leaves aside the dynamics implicit in the fiscal rule embodied in equation (2). The sign and the value (generally close to 0.4) of the coefficient of the lagged deficit on the

[17] We disregard the years when positive output gaps appear, as the corresponding coefficient is always not significant in our regressions. Excluding positive output gaps from our regressions, the results for the negative output gaps remain close to 0.2 in both the *current* and *expected condition* cases.

right-hand side of the equation would imply that the impact of misjudging cyclical conditions is rather transitory, as about 90 per cent of any additional deficit in year *t* is offset by year *t+4*. This implies that, to explain the budgetary positions in 2003, we can restrict attention to the previous 4 years (moreover, for the years preceding 1998, the European countries were under the Maastricht constraint). On the basis of equation (2), we recursively computed the impact of the misjudgments of current cyclical conditions for the years starting in 1999. The results are significant but, because of the dynamics mentioned above, not conspicuous. Focusing on the seven European countries which in 2003 have recorded deficits close to or above 3 per cent of GDP,[18] the results indicate that the misjudgment of the size of the negative output gaps for the years 1999-2002 led to higher deficits in 2003 in all the countries except Greece. The impact on the 2003 level of the deficit range from a positive effect (reduction of the deficit) of 0.2 per cent of GDP in the case of Greece to negative effects (increase in the deficit) of 0.1-0.2 per cent of GDP (in the case of France, Portugal and UK) and of 0.3-0.6 per cent (in the case of Germany, Italy and the Netherlands).

6. Conclusions

This paper compares real-time estimates of output gaps from the 1993-2003 December issues of the OECD *Economic Outlook* with the OECD estimates now available for the same years. For most of the OECD countries examined, the differences between real-time and *ex post* data are substantial and tend to be systematic across time.

The two sets of data on output gaps are used in estimating different specifications of a fiscal policy rule for the OECD countries. In particular, two alternatives with respect to cyclical conditions relevant for budgetary decisions are explored for both real-time and *ex post* data: the *current conditions* case (policy-makers are concerned with the output gap of the year when the budgeting process takes place) and the *expected condition* case (they are concerned instead with the output gap that is expected to prevail in the following year, when the budget is implemented). In both cases, we allow for different effects of negative and positive output gaps.

[18] We use values of 0.2 and 0.4, respectively, for the coefficients of the negative output gap and of the lagged dependent variable.

Overall, the choice between *current* and *expected condition* as explanatory variable does not have an important impact on the results, while that concerning the use of real-time versus *ex post* data has significant effects. In particular, with real-time data we obtain a noticeable improvement of the overall fit compared with *ex post* data and sizeable differences in the estimated impact on fiscal policy of adverse cyclical conditions.

Using real-time data, our main empirical results are the following:

- The coefficient for the negative output gap is always positive and highly significant, pointing to a sizeable counter-cyclical reaction of fiscal policy to adverse economic conditions. The estimated coefficient for the full sample of countries (19 OECD countries, excluding Ireland) implies that a 1 per cent negative output gap induces a worsening of the CAPB by respectively 0.19 per cent and 0.22 per cent of GDP in the *current* and in the *expected condition* cases. The value of the coefficient does not change significantly when the sample is restricted to euro-area countries.
- The results for the coefficient for the negative output gap depend crucially on the fiscal policies for the years 1994-1995: excluding those years from the sample the coefficient becomes non significant. On the contrary, the exclusion of recent years, during which sizeable negative output gaps have emerged again in most countries, leads to stronger and more significant coefficients of the negative output gaps. Overall, these experiments would suggest that the policies followed in 1994 and 1995, on the basis of the information available at that time, were more counter cyclical than during the recent downturn, controlling for the other variables included in the regression (in particular, for the initial level of the deficit).
- The coefficient of the positive output gap is always not significant.
- Among the estimated coefficients of the control variables, that meant to capture the role of the Maastricht criteria and that of the lagged level of the deficit have the expected sign and are always significant. The coefficient of the lagged level of the debt has the expected sign but it is not always statistically significant.

Comparing the estimates obtained with real-time data to those based on *ex post* data, the following results emerge:

- The results for the coefficients of the explanatory factors other from the output gap (Maastricht and the lagged debt and deficit variables) are very similar across the different specifications. We also obtain not conclusive indications for the impact of positive output gaps with both sets of data.
- Noticeable differences emerge instead for the coefficient of the negative output gap. While with *ex post* data the coefficient is not statistically significant, with real-time data it is, as already mentioned, always highly significant. Moreover, the value of the coefficient estimated with *ex post* data is, in absolute terms, sizably lower than that estimated on the basis of real-time data.

In the paper we show that the main source of the differences in these estimates (which are obtained pooling together all countries) is the existence (for most countries) of a positive correlation between the measurement error in the real-time estimation of the output gap (positive and negative) and the value of the output gap assessed *ex post*. An important implication of our analysis is that for individual countries the bias using *ex post* data can be very large and of any sign.

The results therefore indicate that reliance on the information actually available to policy-makers in real-time is essential for the correct assessment of past policies and that particular caution is required when using *ex post* data in regressions for individual countries and making cross-country comparisons. They also suggest that, on average, the misjudgment of cyclical conditions which occurred when budgetary decisions were taken has greatly dampened the capacity of discretionary policies to stabilize output in adverse cyclical conditions, compared with the original intentions.

Finally, a tentative assessment of the effects of the differences between real-time and *ex post* estimates of cyclical conditions in the last years suggests that they may have had a role in determining the dispersion of budgetary situations we now observe in Europe.

Appendix

Reconstruction of real-time estimates of output gaps in 1993 and in 1994

Estimates of output gaps for 20 countries (encompassing the same year of publication, several preceding ones and the following two) are published by the OECD in the December *Economic Outlook* (*EO*) starting from 1995 (in the case of new Zealand, from 1997). In addition, the December 1993 *EO* reports estimates of output gaps in the same year, but only for the seven largest countries.

In order to extend our sample for all countries to 1993 and 1994, we calculate the values of the output gap for each country (in this reconstruction we exclude New Zealand, for lack of information) implicit in the data on the cyclical component of national government budget published in the *EOs* of December 1993 and 1994 (no such data were available before 1993).

To estimate the relation between the output gap and the cyclical component of government budget implicit in those *EOs,* we rely principally on Giorno *et al.* (1995). This study, reviewing the methodology employed by the OECD to cyclically adjust government budgets before December 1995, presents mutually consistent data for both variables for the years 1987-1996 (see Table 7 of the study).

Under the OECD methodology, the cyclical component of the budget is computed by multiplying the output gap by five budgetary categories (tax revenue, broken down into four categories, and overall expenditure), each weighted according to its specific elasticity, taking into account the existence of lags.[19] As the size of the budgetary categories relative to GDP do not change significantly over time and the elasticities are kept constant in the OECD method, this computation can be expressed in the following way:

$$cc_t = \alpha_1 x_t + \alpha_2 x_{t-1} \qquad \text{(A1)}$$

where cc_t is the cyclical component of the budget as a ratio of GDP at time t, x_t is the output gap at time *t*, α_1 and α_2 are coefficients which, for the reasons given above, are approximately constant over time. In the OECD approach, in half of the OECD countries the coefficient α_2 is set to zero (Chouraqui *et al.*, 1990). On the basis of expression (A1), we are able to derive an expression for

[19] This general description applies to the approach used before 1995 and also to the one adopted afterwards.

the output gap as a function of the cyclical component of the budget. For the case in which α_2 is equal to zero we have:

$$x_t = \frac{cc_t}{\alpha_1} \tag{A2}$$

For the case in which α_2 is not zero, we derive from (1) the following expression:

$$x_t = \frac{cc_t}{\alpha_1} - \frac{\alpha_2}{\alpha_1^2} cc_{t-1} + \frac{\alpha_2^2}{\alpha_1^3} cc_{t-2} - \frac{\alpha_2^3}{\alpha_1^3} x_{t-3} \tag{A3}$$

In (A3), the output gap depends on current and lagged values of the cyclical adjusted deficit and also on an additional term which can be assumed to be almost negligible, given the very small size of α_2 compared to α_1.[20]

On the basis of the data published in Giorno *et al.* (1995), we obtain estimates of α_1 and α_2 for each individual country. We estimate only α_1 for the countries for which, according to Chouraqui *et al.* (1990), α_2 is set equal to zero in the OECD method. In this case, the estimated α_1 is equal to the average (for the years 1993 and 1994) of the ratio between the values of the cyclical component and the output gap presented in Table 7 by Giorno *et al.* (1995). When we estimate both α_1 and α_2, we jointly identify the two values of the parameters which minimise the differences in 1993 and in 1994 between the output gap we compute (on the basis of the cyclical component of the budget reported in Table 7 by Giorno *et al.*,1995) and the value of the gap indicated in the same table.

The very small differences between the output gaps we compute and that indicated in Giorno *et al.* (1995), even for years distant from those of interest, give us a strong assurance that the approximation of our reconstruction is very small. The estimated values of α_1 range between 0.77 in the case of Sweden, and 0.32 in the case of the US, while the values of α_2 do not exceed 0.09 (Table A1). These results broadly correspond to the estimates of the sensitivities of the budget balances in 1999 reported in van den Noord (2000).

[20] Owing to the lack of data, we set equal to zero the fourth term (in *t–3*) on the right-hand side of equation (5) and, in the case of computations concerning 1993, the third term (in *t–2*); these approximations should not significantly affect the results.

Table A1 – Estimated parameters

Country	α_1	α_2	Country	α_1	α_2
US	0.32	0.04	Denmark	0.60	0.09
Japan	0.43	0.00	Finland	0.64	0.00
Germany	0.67	0.00	Greece	0.54	0.00
France	0.53	0.00	Ireland	0.53	0.00
Italy	0.56	0.00	Netherlands	0.56	0.04
UK	0.50	0.06	Norway	0.66	0.07
Canada	0.56	0.00	Portugal	0.52	0.00
Australia	0.38	0.09	Spain	0.53	0.00
Austria	0.58	0.00	Sweden	0.77	0.00
Belgium	0.66	0.00			

Finally, using the real-time information on the cyclical component of the budget reported in the December 1993 and 1994 *EOs* (for the years from *t–2* to *t+1*, with *t* corresponding to the year of issue of the *EO*) we recover the estimates of the output gaps in year *t* and *t+1* implicit in those publications. The complete set of real-time output gap is reported in Table A2.

As robustness tests and to gauge the relevance of our approximation,[21] we have reconstructed individual output gaps using alternative sources for the values of α_1. In particular, we employed the estimates for the sensitivities of budget balances in 1999 published by the OECD (van den Noord, 2000) for α_1 and assumed all α_2 to be equal to 0. The results remained virtually unchanged, as shown in Table A3, which replicates Table 2 of the main text using those sensitivities to estimate real-time output gaps in 1993 and in 1994. We also used an uniform value of 0.5 for α_1 and of 0 for α_2, which correspond to a well known "rule of thumb" for the effects of output gaps on deficits, applicable to most countries. This is really a crude approximation, but still it does not significantly modify the results, as shown in Table A4, which replicates Table 2 using such "rule of thumb" to reconstruct the first two years of real-time output gaps.

[21] For the seven largest countries, we can compare, for 1993, the values of the output gaps we reconstructed and the ones published in the December 1993 *EO*. The difference between the two set of values ranges between 4 and 11 per cent of the published value in 5 cases. The percentage difference is relatively large (25 per cent) in the sixth case, but only because the two estimates are close to zero (0.45 per cent of GDP in our reconstruction and 0.6 in the published one). Overall, the size of these differences seems unlikely to affect results, taking into account the variance of the series of the output gap.

Table A2 – Real-time data

OECD output gap for year *t* estimated in the December issue of the OECD *EO* of year *t*

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
US	–0.7	1.0	0.9	0.1	0.9	2.0	2.5	2.5	–0.5	–1.4	–1.5
Japan	–4.4	–2.3	–3.8	–2.8	–3.0	–4.7	–3.5	–3.2	–2.3	–2.9	–1.9
Germany	–0.6	–0.9	–1.2	–1.2	–1.5	–1.4	–1.7	–0.7	–1.1	–1.9	–3.3
France	–5.5	–3.8	–2.7	–3.0	–2.3	–1.2	–0.7	0.3	0.4	–0.6	–2.4
Italy	–4.1	–1.4	–3.1	–1.5	–2.1	–3.2	–3.2	–1.6	–1.9	–1.6	–1.8
UK	–5.5	–3.7	–2.5	–1.8	0.1	0.9	0.7	0.8	–0.1	–0.8	–1.1
Canada	–5.9	–3.1	–2.3	–3.1	–1.7	–0.7	0.1	0.9	0.2	0.2	–0.4
Australia	–2.6	–1.5	0.0	0.3	–0.6	0.4	1.2	1.4	–0.8	–0.5	–1.0
Austria	–2.4	–1.5	1.1	–1.0	–1.1	–0.8	0.3	0.3	–0.1	–1.6	–1.4
Belgium	–1.0	–2.2	–2.7	–2.9	–1.9	–1.2	–1.2	–0.6	–0.1	–1.5	–1.9
Denmark	–4.2	–1.5	–0.8	–2.0	–0.1	0.8	0.1	0.3	–0.4	–0.7	–1.2
Finland	–11.0	–4.5	–3.4	–2.5	–0.1	1.3	0.4	0.1	–0.5	–1.8	–2.6
Greece	–0.6	–2.4	–1.9	–2.3	–1.7	–1.3	–0.6	–0.8	0.3	0.4	0.8
Ireland	0.7	–0.2	–0.7	0.6	–0.1	2.0	5.0	5.5	4.0	2.6	2.9
Netherlands	1.0	–2.5	–0.7	–0.1	–0.1	1.4	1.4	1.6	0.3	–1.9	–1.6
New Zealand	n.a.	n.a.	n.a.	n.a.	–1.3	–2.0	–1.6	0.0	0.3	0.3	0.6
Norway	–4.3	0.2	0.1	0.5	1.3	2.2	1.4	1.0	–0.2	0.6	–0.7
Portugal	–2.9	–3.7	–3.3	–2.5	–1.2	0.1	–0.1	0.1	–0.3	–1.3	–3.4
Spain	–3.7	–4.0	–2.1	–2.5	–2.1	–1.0	0.2	–0.4	–0.1	–0.7	–0.8
Sweden	–6.9	–3.5	–1.6	–1.0	–1.7	–1.2	–0.2	1.0	–1.0	–0.3	–0.5

OECD output gap for year *t* estimated in the December issue of the OECD *EO* of year *t–1*

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
US	0.1	1.5	0.4	0.1	1.1	0.8	2.2	1.7	–2.6	–1.7	–0.3
Japan	–7.0	–2.8	–4.3	–3.7	–3.3	–5.6	–3.4	–2.2	–3.9	–2.9	–1.5
Germany	–1.8	–0.9	–1.2	–0.9	–1.0	–1.4	–1.3	0.1	–2.0	–1.8	–3.5
France	–6.8	–2.8	–2.6	–2.6	–1.6	–0.9	0.0	1.0	–0.4	–0.8	–2.8
Italy	–4.3	–1.1	–2.7	–2.1	–1.7	–3.2	–2.8	–1.2	–2.7	–1.8	–1.7
UK	–5.4	–2.8	–2.4	–0.9	0.0	–0.4	1.1	0.9	–0.7	–0.8	–0.9
Canada	–5.1	–1.8	–2.0	–2.4	–1.0	–0.8	0.2	0.9	–1.3	0.3	–0.5
Australia	–2.1	–0.2	0.3	0.1	–0.5	–0.2	0.7	1.1	–0.9	–0.4	–1.1
Austria	–3.0	–0.9	–1.0	–1.4	–0.3	–0.7	0.8	0.6	–1.0	–1.6	–1.9
Belgium	–1.6	–1.3	–2.8	–2.8	–1.1	–1.0	–0.7	–0.2	–1.1	–1.6	–2.1
Denmark	–2.8	–0.6	–0.1	–1.3	0.4	0.2	–0.6	0.4	–1.2	–0.8	–1.0
Finland	–10.6	–2.2	–2.7	–1.4	0.9	0.8	0.8	1.0	–2.5	–1.8	–1.5
Greece	–1.0	–2.2	–1.3	–2.0	–1.1	–0.8	–0.2	0.3	0.7	0.7	1.3
Ireland	0.4	0.6	–0.5	1.2	0.3	1.0	5.5	5.3	0.0	–0.6	1.2
Netherlands	0.3	–1.6	–0.9	0.0	0.4	1.0	1.2	2.0	–0.8	–2.6	–2.8
New Zealand	n.a.	n.a.	n.a.	n.a.	–0.6	–2.7	–0.9	0.2	–0.6	0.0	0.4
Norway	–2.5	0.4	0.7	1.0	1.6	0.9	–0.7	0.8	–0.8	0.2	–0.1
Portugal	–4.8	–3.9	–2.6	–2.0	–0.4	0.2	0.2	0.0	–1.5	–2.4	–3.5
Spain	–5.4	–3.9	–2.0	–2.3	–1.3	–0.8	0.7	0.2	–0.8	–1.0	–0.6
Sweden	–6.5	–2.6	–0.8	–0.7	–1.1	–1.0	0.7	1.8	–1.8	–0.2	–0.4

Table A3 – Real-time data partly computed using sensitivities in van den Noord(2000)

	Current conditions (gap in the year of budgeting) OLS				**Expected condition (gap expected for the following year) IV**			
	Real-time data		*Ex post data*		*Real-time data*		*Ex post data*	
	(1)		(2)		(3)		(4)	
	Full sample of 19 OECD countries (*)							
	coeff.	t stat	coeff.	t stat	Coeff.	T stat	coeff.	t stat
Negative output gap (ϕ_n)	0.17	*3.02*	0.09	*1.38*	0.21	*3.69*	0.14	*1.60*
Positive output gap (ϕ_p)	0.16	*0.87*	0.10	*0.87*	-0.20	*-0.80*	0.13	*0.84*
Maastricht (ϕ_m)	–0.51	*–4.04*	–0.49	*–3.69*	–0.54	*–4.21*	–0.52	*–3.86*
Debt (ϕ_b)	0.01	*1.87*	0.02	*2.48*	0.01	*1.08*	0.02	*2.12*
Deficit (ϕ_d)	–0.39	*–7.98*	–0.34	*–7.21*	–0.39	*–8.19*	–0.36	*–7.09*
R-squared								
within	0.370		0.343		0.378		0.345	
between	0.049		0.094		0.043		0.090	
overall	0.118		0.102		0.118		0.101	
No. of obs.	205		205		205		205	
	Euro-area countries (*)							
	coeff.	t stat	coeff.	t stat	coeff.	T stat	coeff.	t stat
Negative output gap (ϕ_n)	0.20	*3.07*	0.03	*0.37*	0.20	*3.29*	0.06	*0.78*
Positive output gap (ϕ_p)	–0.40	*–1.21*	0.07	*0.52*	-0.44	*-1.25*	0.10	*0.60*
Maastricht (ϕ_m)	–0.47	*–3.73*	–0.39	*–2.93*	–0.47	*–3.63*	–0.42	*–3.11*
Debt (ϕ_b)	0.02	*1.46*	0.02	*1.68*	0.01	*0.61*	0.02	*1.58*
Deficit (ϕ_d)	–0.43	*–5.82*	–0.38	*–4.83*	–0.45	*–5.99*	–0.39	*–4.91*
R-squared								
within	0.423		0.368		0.431		0.373	
between	0.006		0.003		0.012		0.004	
overall	0.255		0.225		0.236		0.218	
No. of obs.	110		110		110		110	

Note: *Ex post* data are taken from the June 2004 issue of the OECD *EO*. Real-time data from the December issue of the OECD *EO* at time *t–1*. (*) Ireland and Luxembourg are not included.

Table A4 – Real-time data partly computed with "rule of thumb"

	Current conditions (gap in the year of budgeting) OLS				**Expected condition (gap expected for the following year) IV**			
	Real-time data		*Ex post data*		*Real-time data*		*Ex post data*	
	(1)		(2)		(3)		(4)	
	Full sample of 19 OECD countries (*)							
	coeff.	t stat	coeff.	t stat	Coeff.	T stat	coeff.	t stat
Negative output gap (ϕ_n)	0.17	*3.44*	0.09	*1.38*	0.20	*3.63*	0.14	*1.60*
Positive output gap (ϕ_p)	0.15	*0.81*	0.10	*0.87*	0.02	*0.06*	0.13	*0.84*
Maastricht (ϕ_m)	–0.50	*–4.06*	–0.49	*–3.69*	–0.55	*–4.32*	–0.52	*–3.86*
Debt (ϕ_b)	0.02	*2.08*	0.02	*2.48*	0.01	*1.38*	0.02	*2.12*
Deficit (ϕ_d)	–0.40	*–8.17*	–0.34	*–7.21*	–0.40	*–8.21*	–0.36	*–7.09*
R-squared								
within	0.377		0.343		0.378		0.345	
between	0.054		0.094		0.050		0.090	
overall	0.115		0.102		0.113		0.101	
No. of obs.	205		205		205		205	
	Euro-area countries (*)							
	coeff.	t stat	coeff.	t stat	coeff.	T stat	coeff.	t stat
Negative output gap (ϕ_n)	0.16	*2.71*	0.03	*0.37*	0.17	*2.74*	0.06	*0.78*
Positive output gap (ϕ_p)	–0.39	*–1.23*	0.07	*0.52*	-0.33	*-0.87*	0.10	*0.60*
Maastricht (ϕ_m)	–0.44	*–3.50*	–0.39	*–2.93*	–0.45	*–3.47*	–0.42	*–3.11*
Debt (ϕ_b)	0.02	*1.65*	0.02	*1.68*	0.01	*0.93*	0.02	*1.58*
Deficit (ϕ_d)	–0.43	*–5.68*	–0.38	*–4.83*	–0.44	*–5.72*	–0.39	*–4.91*
R-squared								
within	0.412		0.368		0.412		0.373	
between	0.004		0.003		0.008		0.004	
overall	0.242		0.225		0.234		0.218	
No. of obs.	110		110		110		110	

Note: *Ex post* data are taken from the June 2004 issue of the OECD *EO*. Real-time data from the December issue of the OECD *EO* at time *t–1*. (*) Ireland and Luxembourg are not included.

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