CYCLICAL SENSITIVITY OF FISCAL POLICIES BASED ON REAL-TIME DATA

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ABSTRACT

This paper examines the informational problems associated with the analysis of fiscal policies, an issue recently analyzed in connection to monetary policies but largely ignored in the literature on budgetary actions. The results indicate that reliance on the information actually available to policy makers in real time is important for the assessment of past policies. We show that estimating fiscal policy rules based on ex-post revised data tend to provide a misleading assessment of the sensitivity of discretionary policies to cyclical conditions. The results also suggest that part of the problems which recently led to putting aside the SGP came from an overoptimistic assessment of the state of the economy in some European countries over the last years.

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JEL classification numbers: E61, E62

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1. Introduction

In recent years an 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 the errors in the real-time assessment of cyclical conditions in US have been substantial over the last decade. 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 which employs real-time data on cyclical conditions to analyze economic policies outside the US. Concerning fiscal policy, which is the focus of this paper, in our knowledge all recent studies which have analyzed the determinants of budgetary policies in EU and OECD countries are based on ex-post data.[1] These studies tend to provide evidence of pro-cyclical fiscal policies (e.g. Melitz, 2000, Buti, 2002, European Commission, 2001 and 2002). As pro-cyclicality contrasts with the stabilization function of fiscal policy, a number of explanations are offered for these results, among which: conflicting objectives of policy makers, informational problems, complexity of decision making, lags in the implementation of budgetary decisions (e.g. Buti, Franco and Ongena, 1998, Brunila and Martinez-Mongay, 2002). However, in the literature no systematic work directed to assess the relative importance of these factors, and in particular of informational problems, can be found.

This paper compares estimates of fiscal rules for OECD countries based on real-time assessments of cyclical conditions with those obtained employing ex-post data. As for the real time assessment, we use the estimates of output gaps published in various issues of December OECD *Economic Outlook* (*EO*);[2] the ex-post data refer to the estimates included in the latest *EO* issue.

In principle, the most direct source of information for the real-time information available to policy makers are the budget documents. However, quantitative assessments of cyclical conditions are usually not 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

[1] There is a short discussion of the issue in Galì and Perotti (2003).
[2] The OECD issues the *EO* twice a year, in June and December. Therefore, every year two estimates are available of that year output gap and two forecasts for the following year. Being the budget usually approved at the end of the year, it is natural to use the estimates published in December.

real expectations of policy makers. On the other hand, the OECD data on cyclical conditions present a number of advantageous features. They do not suffer from the mentioned distortion arising from "announcement effects", are comparable across countries and are produced with a significant degree of coordination with national experts, working mainly within government units. As for the time of production, a preliminary version of the December *EO* is discussed with national delegates (usually from Finance Ministries) in a OECD meeting which takes place between the end of October and the beginning of November. Therefore, even in the unlikely case of the OECD assessment remaining significantly different from the view of 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 the relatively short period of time for which comparable estimates of output gaps are produced by international organizations. The longest spell, provided by the OECD, only starts with the *EO* of December 1995. In this paper, we extend backward by two years this information, as we estimate the values of the output gaps of the OECD countries implicit in the *EO*s published between June 1993 and June 1995. Therefore we can examine the information on cyclical conditions available in real time to fiscal policy makers in the years 1993-2003.

While for other kinds of empirical investigation this time dimension may appear limited, we think that it is adequate for two main reasons. First, the study focuses on cross-country results, with the full sample comprising about 220 observations. Second, the conduct of fiscal policy may differ considerably between one period and another, as, for example, the results for the US of Auerbach (2003) suggest. In other terms, the way fiscal policy was conducted in the seventies or the eighties may indeed be of little use for understanding fiscal policy in the nineties. In particular, for the European countries the whole fiscal policy framework changed in 1993 with the Maastricht Treaty.

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 procedure employed to extend the real time output gap series backwards and we also compare the real time 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, Taylor, 2000) has the discretionary component of the budget as dependent variable:

$$\Delta d_{it} = \phi_i + \phi_1 E_{t-1} x_{it} + \phi_2 b_{it-1} + \phi_3 d_{it-1} + u_{it} \qquad (1)$$

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) [3] as a ratio of potential GDP [4]; $E_{t-1}x_t$ 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 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_1 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_2 or a negative value of ϕ_3 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 not a unique 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). We focus instead on the discretionary component as we are interested in the budgetary decisions, though we understand that these decisions are not fully independent from the extent of the automatic reaction of the budgets. Even when

[3] 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 estimate 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.

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

discretionary policy is the dependent variable, it is not always measured by the CAPB; recent examples are in (Fatàs and Mihov, 2001; Larch and Salto, 2003; Buti and van den Noord, 2004, Auerbach, 2002).

Regarding the cyclical conditions explanatory variable, some authors use some measures of growth instead of output gaps. While growth does not represent an adequate proxy for cyclical conditions (as during an economic cycle, a positive gap, as well as a negative one, is accompanied by growth rates both above and below trend), still it is an open question on what exactly policy makers condition their budgetary choices and growth is a potential candidate. Therefore, to address this issue, we have also substituted in our regressions the real time and ex-post output gap estimates with corresponding measures of growth.[5] 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 aspects. First, we take into account the role of the Maastricht convergence criteria (in particular the 3% constraint on the deficit) for the conduct of fiscal policies in the years preceding the Monetary Union, as our sample is composed for over 60% by Euro area countries. In order to do so, we construct a variable, m_t, equal to zero except for the 12 Euro area countries with a deficit level above the 3% threshold in the years between 1993 and 1996; in these cases the variable takes a value equal to the difference between the deficit level and the 3% threshold divided by the number of years remaining to 1997. The idea being that the threshold has been more binding the higher the deficit above the 3% and the closer the year to 1997.[6] 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 has been positive or negative. Taking into account these two aspects, the equation we estimate is the following:

$$\Delta d_{it} = \phi_i + \phi_1 E_{t-1} x_{it}^n + \phi_2 E_{t-1} x_{it}^p + \phi_3 m_{it} + \phi_4 b_{it-1} + \phi_5 d_{it-1} + u_{it} \qquad (2)$$

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

[5] 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.

[6] 1997 is the year in which the Maastricht criteria had to be satisfied in order to adopt the common currency. Furthermore, we tried to add in the regression a variable defined as m_t interacted with the output gap; it is not statistically significant from zero, in accordance with the finding (see Galì and Perotti 2003, and OECD 2003) that the Maastricht rules seem not to have hindered the counter-cyclicality of fiscal policies among EMU countries.

The third aspect in which we improve on equation (1) refers 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 consider also the possibility that the policy makers, when budgeting, simply react to *current conditions*. This alternative has also 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 interpretations, the term regarding the gap, $E_{t-1}x_t$, would be replaced by x_{t-1} estimated in real time. For simplicity, we label the latter alternative as *current condition* case, while the former as *expected conditions* 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 governments and of political cycles have been extensively studied in the literature. The first two factors are less of a concern as in principles they should not be correlated with economic cycles and therefore they should not affect the estimation of the cyclical response of fiscal policy. Moreover, a focus of this paper is the comparison between the estimates of the fiscal policy rule (2) using real time and ex-post data. In this regard, the above aspects should not be relevant, as there is no reason why they should have a different impact on estimates when using data in real-time or ex-post. Concerning the political cycles, in our regressions we have introduced 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 have been of the expected sign but never significant. Since the inclusion of a control for election year had no significant impact on the coefficients of the equation, we decided to exclude it from our benchmark specification.

3. Data concerning the real time cyclical conditions

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 starting from December 1995, when the OECD revised its method for estimating output gaps and structural budget balances (Giorno et al., 1995). We extend this series backwards by two years, estimating the values of the output gap implicit in the data on the cyclical component of the budget published in the *EOs* of December 1993 and 1994 (no such data were

available before 1993). 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.[7] This computation can be expressed in the following way:

$$cc_t = \alpha_1 x_t + \alpha_2 x_{t-1} \tag{3}$$

with cc_t is the cyclical component of the budget as a ratio of GDP, x_t is the output gap at time t, α_1 and α_2 are coefficients. These coefficients are approximately constant over time as the size of the budgetary categories relative to GDP do not change significantly. In the OECD approach, in half of the OECD countries the coefficient α_2 is set to zero (Chouraqui et al., 1990). The values of α_1 are close to 0.5, while the values of α_2 are much smaller. On the basis of expression (3) we are able to derive an expression for the output gap as function of the cyclical component of the budget. For the case in which α_2 is equal to zero, we have:

$$x_t = \frac{cc_t}{\alpha_1} \tag{4}$$

For the case in which α_2 is not zero, we derived the following expression, in which 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 very small:[8]

$$x_t = \frac{cc_t}{\alpha_1} - \frac{\alpha_2}{\alpha_1^2} cc_{t-1} + \frac{\alpha_2^2}{\alpha_1^3} cc_{t-2} - \frac{\alpha_2^3}{\alpha_1^3} x_{t-3} \tag{5}$$

Giorno et al. (1995) published a series of x_t and cc_t (for the years 87-93) using the methodology applied by the OECD before December 1995. In Chouraqui et al. (1990) the list of countries for which α_2 is set equal to zero in the OECD method is reported. From these two sets of information, we are able to estimate α_1 and α_2 for each individual country. Then, using the real time information on the cyclical component of the

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

[8] For 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 do not affect significantly the results, given the very small size of α_2 compared to α_1.

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 implicit estimates of the output gaps in year *t* and *t+1*.

In the first 11 columns of the upper part 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)[9]. In the lower part, the reported differences are between the estimates made in year *t* for year *t+1* and the ex-post ones for year *t+1*. The data in the upper part of the table refer to the *current conditions* case (discussed in section 2), those in the lower part to the *expected conditions* one; they convey approximately the same message. For most countries, the differences between real time and ex-post data are substantial, persistent over time and tend to be systematic, i.e. their mean across years departs significantly from zero. The averages by country of the differences are reported in the last but one column of the table.

Focusing on the upper part of table 1, in the majority of the countries the value of the output gap has been, on average over the decade, overestimated: in Japan by approximately 2% of GDP; in Italy, Canada, Austria, Belgium, Denmark, Netherlands and Portugal by around 1%. There was instead an underestimation of the output gap in Finland and Greece and by a lesser extent in Ireland, Unites States and Spain.

4. Results of estimations

In this section we report the estimates of the fiscal rule embodied in equation (2) using real time and ex-post data, in both the *current* and *expected conditions* cases.

We first focus on the results of the two cases (*current* and *expected conditions*) with real time data for the whole sample of countries (respectively reported in columns 1 and 3 of the upper part 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

[9] We use the preliminary data of the OECD Economic Outlook n.75, available on the OECD website since May 2004. The full report is going to be published in June. While the final set of data may be slightly different, leading to some minor changes in our results, we think that it is still preferable to use the preliminary data of the EO n.75 than those of the EO n.74, as significant revisions of public finance data for 2003 have occurred between the two reports. The use of the EO n.75 also allowed us to extend the period of analysis from 10 to 11 years. The results confirm those based on EO n.74. A preliminary version of the paper, based entirely on EO n.74 data is available on request.

conditions. The reaction is sizeable, as the estimated coefficient implies that a 1% negative output gap induces a worsening of the CAPB by 0.22% of GDP. The coefficient for the positive output gap is negative (indicating a pro-cyclical reaction) but smaller and not significant. The estimated impact of the Maastricht variable is of the expected sign and significant. Also the coefficients of the other initial conditions 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 conditions* 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.[10] The results (column 3 of the upper part of table 2) are almost identical to those of the *current conditions* case. The only exception concerns the coefficient of the positive output gaps, which is larger and significant in the *expected conditions* case. However, this result depends entirely on the inclusion of Ireland in the sample (see results reported in the bottom part of table 2 and also section 4.1 below). More generally, estimates for the coefficient of the positive output gaps should be taken with caution, as they are based on a number of observations relatively small. This is particularly true for the real time data, for which there are only 62 observations (61 in the *expected conditions* case) of positive output gaps, less than 30% of the total (for ex post data, positive gaps are slightly less than 40% of the total).

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 we use instead 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.[11] The general fit of the ex-post data regressions is worse than that obtained using ex ante information. 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 use as instruments the December estimate of the gap of the same year and the (GDP weighted) average of gap of all the other countries in the sample estimated in December for the same year. We get very similar estimates if instead of this latter instrument we use the (GDP weighted) average lagged December forecast for the output gap of the following year of all the other countries.

[11] 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 Restricting the sample

Given our sample size, we cannot run country-by-country regressions and therefore we cannot estimate the country specific response to the cyclical conditions. Given the well known sensibility of cross-country regressions on the sample of countries considered, we run the four regressions of table 2 eliminating a single country at a time. Overall the results are robust, but there are exceptions. In particular, when dropping Ireland, generally the coefficient on the positive output gap switches sign, from pro-cyclical to counter-cyclical, although it remains not statistically significant. Only in the real time *expected conditions* case, as already mentioned, the coefficient for the full sample is significant; excluding Ireland, the value of the coefficient remains negative, but it becomes very small and it is no longer statistically significant.

Ireland is really a special case as its growth rate over the last decade has been extremely high (between 6 and 11 per cent) in almost all years and never dropped below 2 per cent. In this context, cyclical stabilization has not represented 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. We decided therefore to report, in the bottom part of the table, the results excluding Ireland.

Of some interest is to restrict the sample to the Euro area countries (see table 3). The coefficient estimates are broadly in line with the ones of the complete sample. The estimated counter-cyclical fiscal response to adverse cyclical conditions reduces somewhat (when real time data are used, from the 0.20-0.24 range to the 0.17-0.19 range) while the coefficient on the lagged value of the CAPB increases (when real time data are used, from 0.35-0.36 to 0.44-0.45).

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

In both *current* and *expected conditions* 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 seem not 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 the *current* and the *expected conditions* cases. Second, using ex-post data, the estimated fiscal policy stabilizing response to adverse cyclical conditions is, in absolute terms, sizably lower: in the *current conditions* case, the coefficient of negative output gaps in the regression with ex-post data is 50% lower than that with real time data; in the *expected conditions* case, the difference is 33%. Excluding Ireland (lower part of table 2), the two coefficients are approximately 60% lower than the corresponding ones using real time data. The coefficients of the positive output gap are usually also lower, in absolute value, when ex-post are used.

These differences can be better understood 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 thought as the real time ones plus an error η_t, which not necessarily has a zero mean. That is: $\eta_t = \mu + \varepsilon_t$ where μ is a non zero constant and ε_t is a zero mean residual. Therefore, the regression using ex-post data can be rewritten as follows:

$$\Delta d_{it} = (\phi_i + \phi_1 \mu_i^n + \phi_2 \mu_i^p) + \phi_1 x_{it}^{rt,n} + \phi_2 x_{it}^{rt,p} + \phi_3 m_{it} + \phi_4 b_{it-1} + \phi_5 d_{it-1} + (u_{it} + \phi_1 \varepsilon_{it}^n + \phi_2 \varepsilon_{it}^p) \qquad (6)$$

where x^{rt} is the real-time output gap and superscripts *n* and *p* refer, as before, respectively to negative and positive gaps.

Two implications follow from equation (6). The first is a variant of the standard downward bias in the estimate of ϕ_1 and ϕ_2 due to measurement error. The expression for this bias assuming $E(\eta_t, x_t^{rt}) = 0$ is the following:

$$\hat{\phi} = \phi \left(\frac{\sigma_{x^{rt}}^2}{\sigma_{x^{rt}}^2 + \sigma_\eta^2} \right) \qquad (7)$$

If $E(\eta_t, x_t^{rt}) \neq 0$, which is our case, there is also a problem of omitted variable. Then, assuming that the measurement error η_t is not correlated with the other explanatory variables, the formula for the bias in the OLS regressions can be written in the following way:[12]

[12] The term $\left(\sigma_{x^{ep},\eta} / \sigma_{x^{ep}}^2 \right)$ corresponds to the coefficient of the regression of η on x_t^{ep}, where the superscript *ep* indicates *ex-post* data.

$$\hat{\phi} = \phi\left(1 - \frac{\sigma_{x^{ep},\eta}}{\sigma^2_{x^{ep}}}\right) \tag{8}$$

where x^{ep} is the ex-post output gap. On the basis of this formula we computed the bias for the coefficients ϕ_1 and ϕ_2 (respectively, of the negative and positive output gaps) on the basis as the differences between ex-post and real time data both in the *current* and *expected conditions* cases (these differences are reported in table 1). The bias is always downward, ranging between 20% and 40% of the true coefficients. In the *current* and the *expected conditions* cases the bias we computed on ϕ_1 (the coefficient of the negative output gap) is in both cases approximately 40%. This value is close to the differences we observe between real time and ex-post estimates. When we consider ϕ_2 (the coefficient of the positive output gap), the correspondence is less close, probably due to the fact that the estimate is less precise (allowing for a greater role of the correlation of the measurement error η_t with other explicatory variables) and, in the *expected conditions* case, that we use instrumental variables.

On the basis of formula (8), we should expect to find a negative bias for the countries with a positive value of the term $\left(\sigma_{x^{ep},\eta} / \sigma^2_{x^{ep}}\right)$ and a positive bias otherwise. In fact, if we focus on the countries with a positive value of the term (which are the majority[13]), we find that the coefficients on the negative and positive output gaps using ex-post data are lower (in absolute value) than those computed using real time data by approximately 60% and 80%.

The second implication of equation (6) is 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 $\left(\phi_1 \mu_i^n + \phi_2 \mu_i^p\right)$. In fact the correlation between this term and the difference of the fixed effects obtained using ex-post and real time data is respectively 0.83 in the *expected conditions* case and 0.88 in the *current conditions* one.

Overall, we interpret the reported evidence as supporting the view that coefficient estimates obtained using ex-post data are subject to a relevant bias. When pooling the countries together, we have shown the bias of

[13] In fact, this implies excluding from our sample 4 (US, UK, Norway and Sweden) and 6 (US, UK, Canada, Australia, Netherlands and Sweden) countries when analyzing the coefficient on the negative output gap in the *current* and *expected conditions* cases respectively, and excluding 4 (US, UK, Australia and New Zealand) and 1 (Japan) respectively when analyzing the coefficient on the positive output gap.

the coefficient gauging the response to the cycle being significant and downward. Our results suggests that for individual countries this bias can be very large and of any sign. When using ex-post data to run country-by-country regression 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 proprieties of the consistent estimators that have been proposed in the literature are not well understood (our sample is small, eleven years for each country). That 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 4 reports results based on the Arellano-Bond two step estimator, assuming one lag of the dependent variable to be included in the model and assuming 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 reports also the Sargan test of 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 2nd 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 OLS and IV ones. In particular, the coefficients on the negative output gap are positive and, generally, highly statistically significant; those of the positive gap are usually not significant.[14] 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 range of coefficient is 0.18-0.26 (in the four alternative estimates presented in table 4); with the latter is in the range 0.08-0.25.

[14] Note that, in order to implement the Arellano-Bond estimate in Stata, we specified 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.

The Arellano-Bond estimation procedure, however, leads to some problematic results, which suggest the need for caution. For instance, when we exclude Ireland from the sample the coefficient of the negative output gap in the *expected condition* case with real time data drops from 0.25 to 0.08 and it is no longer statistically significant. This is a large impact, taking into account that in the case of Ireland we have only 2 observations of negative output gaps (out of a total of 139 observations in the sample).

5. The impact on fiscal policies of misjudging cyclical conditions

In this section we examine the differences (termed η in the discussion in the previous section) between the real time estimates of the output gaps and the currently available data (published in May 2004[15]) and make a tentative assessment of their possible impact on budgetary trajectories. These differences, reported in table 1, can be thought as the misjudgment of cyclical conditions made at the time when fiscal policies have been decided, measured on the basis of the information now available (they correspond, with a switched sign, to the overall revisions occurred in the period between the two different estimates).

To get a sense of the implications of these errors on fiscal policies we multiplied them by our estimates of their effects on fiscal policy. In particular, for the differences in the *current conditions* case (reported in the upper part of table 1) we use the OLS estimate (0.22) obtained with real time data of the coefficient for the effects of the negative output gap on the deficit (we disregard the coefficient on the positive gap since it is usually not significant). For the differences reported in the lower part of the table we use instead the estimate of the corresponding coefficient in the *expected conditions* case (0.24). These are our best proxies for the effects on individual country fiscal policies, which we cannot estimate given the very short sample. Then we calculate the average over time (reported in the last column of table 1) for each country of these products.

These results show that the budgetary effects of the misjudgment of cyclical conditions are significant in many countries and may have induced a systematic bias in fiscal policies for several years. About 60% of the countries have an average yearly impact in absolute terms equal to or above 0.2% of GDP; the highest average impact, relative to Japan, is respectively equal to 0.5% and 0.6% in the two cases we examine.

[15] See footnote n.9.

If we focus on the European countries, which should have had the same long-term fiscal target over the last years, we find a certain correspondence between our estimates of induced fiscal bias and the current fiscal positions of the member states. In six out of the seven European countries which in 2003 have recorded deficits close or above 3% of GDP (Germany, Italy, France, Portugal, Netherlands, Greece and UK) the bias in the real time gap estimates is negative, i.e. it has induced more expansive fiscal policies in the last decade. The exception is Greece. The impact on Germany fiscal policies is, on the decade average, negative but small. On the other hand, among those showing surpluses in 2003 (Belgium, Denmark, Spain, Ireland, Finland and Sweden) the bias in the real time gap estimates is negative in, respectively, only two and four countries out of six, depending on which case - *current* or *expected conditions* - we focus on. 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 has left 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 right hand side of the equation would imply that the impact of misjudging cyclical conditions is rather transitory, as about 90% of any additional deficit in year t is offset by year $t+4$. This implies that, for explaining the budgetary positions in 2003, we can restrict the attention to the previous 4 years (moreover, for the years preceding 1998, for the European countries there was 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 (upper part of table 1). The results are significant but, because of the above mentioned dynamics, not conspicuous. Focusing on the seven European countries, which in 2003 have recorded deficits close, or above 3% of GDP[16], 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 countries except Greece. The impact on the 2003 level of the deficit range from a positive one (reducing the deficit) of 0.1% of GDP in the case of Greece to negative effects (increasing the deficit) of 0.1% of GDP (in the case of UK and France) and of 0.2-0.5% (Portugal, Germany, Netherlands and Italy).

[16] We use the coefficients of the negative output gap and of the lagged dependent variable, obtained with a regression restricted to the Euro area excluding Ireland in the *current conditions* case (we do not consider the coefficient on the positive gap as it is not significant).

5. 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 OECD countries, 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 conditions* case (they are concerned instead with the output gap which is expected to prevail in the following year, when the budget will be implemented). In both cases, we allow for different effects of negative and positive output gaps.

Overall, the choice between *current* and *expected conditions* as explicatory 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 sizable differences in the estimated impact 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 implies that a 1% negative output gap induces a worsening of the CAPB by respectively 0.22% and 0.24% of GDP in the *current* and the *expected condition*s cases (0.20% and 0.23%, respectively, if Ireland is excluded). The value of the coefficient reduces slightly when only Euro area countries are included in the sample.
- The coefficient of the positive output gap is usually negative (indicating a pro-cyclical reaction) and not significant.
- Among the estimated coefficients of the control variables, that meant to capture the role of the Maastricht criteria and 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 explicatory factors different from the output gap (Maastricht and the lagged debt and deficit variables) are very similar. 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 *current conditions* case, the coefficient is 50% smaller; in the *expected conditions* case, the difference is 33%.

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 negative 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 make cross-country comparisons.

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 significant role in determining the dispersion in budgetary situations we observe now in Europe.

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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	1.0	1.5	1.7	0.3	0.1	0.5	0.1	0.6	0.7	0.6	0.5	0.7	0.2
Japan	-4.0	-1.4	-3.0	-3.8	-4.5	-3.6	-1.0	-2.2	-0.3	0.6	-0.1	-2.1	-0.5
Germany	1.4	0.4	-0.3	0.4	0.2	-0.1	-0.9	-1.4	-1.1	-0.6	-0.4	-0.2	-0.0
France	-2.8	-1.5	-0.7	0.1	1.1	0.9	0.4	-0.4	-0.3	-0.5	-0.6	-0.4	-0.1
Italy	-0.6	0.9	-2.1	0.0	-1.0	-2.3	-2.3	-2.1	-2.4	-0.8	0.2	-1.1	-0.2
UK	-2.1	-1.7	-0.6	-0.1	0.9	1.1	0.7	-0.5	-0.7	-0.4	-0.4	-0.3	-0.1
Canada	-2.2	-1.7	-1.1	-0.7	-0.1	0.5	-0.6	-1.4	-0.5	-0.7	-0.2	-0.8	-0.2
Australia	1.2	0.3	0.5	0.3	-0.7	-1.4	-1.0	-0.3	-1.8	-1.5	-1.6	-0.5	-0.1
Austria	-2.2	-1.5	1.3	-0.8	-1.0	-2.2	-1.4	-2.2	-0.9	-1.4	0.2	-1.1	-0.2
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
Denmark	-0.7	-1.2	-0.8	-2.4	-1.2	-0.5	-1.6	-1.9	-1.8	-1.1	0.1	-1.2	-0.3
Finland	0.2	4.5	3.9	3.5	3.1	2.9	1.6	-1.1	0.1	-0.8	-1.2	1.5	0.3
Greece	3.5	1.6	2.1	1.7	1.2	1.6	2.2	1.3	1.3	0.5	-0.1	1.5	0.3
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	0.2
Netherlands	1.7	-2.2	-0.9	-0.6	-1.1	-0.6	-1.7	-2.1	-2.0	-2.2	0.5	-1.0	-0.2
New Zealand	2.6	-0.5	-1.2	-1.5	-1.6	0.5	-0.6	-0.6	-0.2	-1.0	-0.3	-0.4	-0.1
Norway	-2.2	1.4	0.7	0.2	-0.5	-0.6	-1.0	-0.7	-1.1	0.7	0.8	-0.2	-0.0
Portugal	-1.0	-0.1	-1.4	-1.8	-1.6	-1.9	-2.7	-2.7	-1.8	-0.7	0.2	-1.4	-0.3
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
Sweden	-1.1	1.0	0.9	2.1	0.9	0.1	-0.9	-1.3	-1.4	-0.5	-0.4	0.0	0.0
Av.age error by year	0.0	0.2	0.0	0.0	-0.3	-0.2	-0.5	-1.2	-0.9	-0.8	-0.1	-0.3	-0.1

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

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	**Average gap by country**	Average effect on CAPB
US	0.6	2.3	0.6	-0.7	-0.4	-1.6	0.3	2.9	-0.6	0.3	0.0	0.3	0.1
Japan	-6.0	-2.0	-5.3	-5.2	-2.2	-3.1	-2.4	-0.2	-0.4	-1.1	-1.5	-2.7	-0.6
Germany	-0.6	-0.1	0.4	0.8	0.3	-0.6	-2.0	0.1	-0.7	1.1	-0.2	-0.1	-0.0
France	-4.5	-0.8	0.5	0.8	0.5	0.2	-0.7	0.3	-0.3	1.0	-0.7	-0.3	-0.1
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	-0.3
UK	-3.4	-0.9	-0.7	-0.1	0.2	-0.4	-0.2	0.3	-0.3	-0.1	-0.8	-0.6	-0.1
Canada	-3.6	-0.6	0.4	-0.8	0.2	-1.5	-2.1	0.2	-2.2	0.5	-0.2	-0.9	-0.2
Australia	-0.3	0.3	0.3	0.0	-2.3	-2.4	-1.0	0.1	-1.9	-1.0	-1.7	-0.9	-0.2
Austria	-3.0	-0.7	-0.8	-1.3	-1.7	-2.4	-1.7	-0.2	-0.8	0.0	0.2	-1.1	-0.3
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
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	-0.3
Finland	-1.6	5.1	3.3	1.8	2.5	2.0	-0.4	1.6	-1.5	-0.4	-0.4	1.1	0.3
Greece	3.0	1.8	2.7	0.9	1.8	2.0	1.9	1.3	0.8	-0.2	0.0	1.5	0.3
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
Netherlands	0.6	-1.8	-1.4	-1.0	-1.6	-2.1	-2.5	-0.3	-1.1	-0.5	0.1	-1.1	-0.3
New Zealand	-0.5	-1.2	-1.5	-0.3	1.9	-1.7	-1.5	-0.3	-1.9	-0.9	-0.2	-0.7	-0.2
Norway	-1.3	1.0	0.4	-0.8	-1.2	-1.5	-2.4	-0.1	-0.7	1.7	0.0	-0.4	-0.1
Portugal	-1.3	-1.9	-1.9	-2.4	-2.4	-2.4	-2.6	-1.5	-0.9	1.2	0.7	-1.4	-0.3
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
Sweden	-2.1	0.0	2.3	1.9	0.2	-1.7	-1.6	1.4	-2.0	0.2	-0.1	-0.1	-0.0
Av.age error by year	-1.3	0.1	0.0	-0.5	-0.3	-1.3	-1.5	0.0	-1.3	0.0	-0.2	-0.6	-0.1

$x_t^{ex-post}$ = 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*.

Table 2 - Real time vs. ex-post data: OECD countries

	Current conditions (gap in the year of budgeting) OLS				**Expected conditions (gap expected for the following year) IV**			
	real-time data		*ex-post data*		*real-time data*		*ex-post data*	
	(1)		(2)		(3)		(4)	
	OECD Countries							
	coeff.	t stat	coeff.	t stat	coeff.	t stat	coeff.	t stat
Negative output gap	0.22	*3.51*	0.11	*1.70*	0.24	*3.69*	0.16	*1.85*
Positive output gap	-0.15	*-1.18*	-0.05	*-0.51*	-0.42	*-2.23*	-0.07	*-0.59*
Maastricht	0.45	*3.68*	0.40	*3.15*	0.46	*3.69*	0.41	*3.19*
Debt	0.02	*2.75*	0.02	*3.20*	0.01	*1.96*	0.02	*3.17*
Deficit	-0.35	*-7.50*	-0.31	*-6.86*	-0.35	*-7.62*	-0.32	*-6.86*
R-squared								
within	0.361		0.330		0.371		0.332	
between	0.010		0.025		0.008		0.025	
overall	0.149		0.113		0.146		0.112	
N. of obs.	216		220		216		220	
	OECD Countries less Ireland							
	coeff.	t stat	coeff.	t stat	coeff.	t stat	coeff.	t stat
Negative output gap	0.20	*3.23*	0.08	*1.32*	0.23	*3.43*	0.13	*1.49*
Positive output gap	0.13	*0.67*	0.08	*0.70*	-0.07	*-0.24*	0.10	*0.66*
Maastricht	0.45	*3.73*	0.41	*3.27*	0.49	*3.99*	0.43	*3.41*
Debt	0.02	*2.30*	0.02	*2.85*	0.01	*1.51*	0.02	*2.52*
Deficit	-0.36	*-7.18*	-0.31	*-6.44*	-0.35	*-7.16*	-0.32	*-6.34*
R-squared								
within	0.367		0.335		0.367		0.337	
between	0.042		0.081		0.040		0.077	
overall	0.133		0.108		0.130		0.108	
N. of obs.	205		209		205		209	

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*.

Table 3 - Real time vs. ex-post data: Euro area countries

	Current conditions (gap in the year of budgeting) OLS				**Expected conditions (gap expected for the following year) IV**			
	real-time data		*ex-post data*		*real-time data*		*ex-post data*	
	(1)		(2)		(3)		(4)	
	Euro area countries							
	coeff.	t stat	coeff.	t stat	coeff.	t stat	coeff.	t stat
Negative output gap	0.17	*2.62*	0.07	*0.95*	0.17	*2.39*	0.12	*1.45*
Positive output gap	-0.36	*-2.27*	-0.10	*-0.86*	-0.41	*-2.11*	-0.12	*-0.91*
Maastricht	0.41	*3.15*	0.32	*2.40*	0.36	*2.81*	0.34	*2.53*
Debt	0.02	*1.86*	0.03	*2.49*	0.02	*2.21*	0.3	*2.84*
Deficit	-0.45	*6.38*	-0.44	*-5.80*	-0.44	*-5.96*	-0.45	*5.86*
R-squared								
within	0.409		0.360		0.403		0.366	
between	0.169		0.081		0.071		0.057	
overall	0.263		0.212		0.262		0.202	
N. of obs.	121		121		121		121	
	Euro area countries less Ireland							
	coeff.	t stat	coeff.	t stat	coeff.	t stat	coeff.	t stat
Negative output gap	0.18	*2.59*	0.02	*0.35*	0.19	*2.68*	0.06	*0.79*
Positive output gap	-0.39	*-1.18*	0.08	*0.53*	-0.47	*-1.15*	0.09	*0.51*
Maastricht	0.41	*3.25*	0.35	*2.65*	0.41	*3.17*	0.38	*2.83*
Debt	0.02	*1.72*	0.03	*1.78*	0.01	*0.99*	*0.02*	*1.68*
Deficit	-0.44	*-5.78*	-0.39	*-4.98*	-0.45	*-5.86*	-0.41	*-5.08*
R-squared								
within	0.398		0.358		0.401		0.362	
between	0.003		0.005		0.008		0.005	
overall	0.232		0.209		0.226		0.202	
N. 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*.

Table 4 - Consistent estimates for OECD countries (Arellano-Bond estimator)

	Current conditions (gap in the year of budgeting)				**Expected conditions (gap expected for the following year)**			
	real-time data		*ex-post data*		*real-time data*		*ex-post data*	
	(1)		(2)		(3)		(4)	
	OECD Countries							
	coeff.	z stat	coeff.	z stat	coeff.	z stat	coeff.	z stat
Negative output gap	0.26	*7.23*	0.25	*3.71*	0.18	*2.77*	0.25	*2.71*
Positive output gap	-0.14	*-0.89*	0.13	*1.74*	-0.07	*-0.45*	0.12	*1.17*
Maastricht	0.41	*5.39*	0.50	*5.01*	0.50	*5.29*	0.55	*5.29*
Debt	0.05	*5.92*	0.08	*7.40*	0.05	*6.15*	0.08	*6.73*
Deficit (1)	0.65	*9.02*	0.63	*7.19*	0.69	*9.21*	0.66	*6.72*
Sargan test	Pr > chi2 = 0.0772		Pr > chi2 = 0.1240		Pr > chi2 = 0.1277		Pr > chi2 = 0.1650	
Arellano-Bond test								
1st order	Pr > z = 0.0063		Pr > z = 0.0227		Pr > z = 0.0056		Pr > z = 0.0174	
2nd order	Pr > z = 0.2623		Pr > z = 0.2700		Pr > z = 0.3051		Pr > z = 0.2882	
N. of obs.	196		200		196		200	
	OECD Countries less Ireland							
	coeff.	z stat	coeff.	z stat	coeff.	z stat	coeff.	z stat
Negative output gap	0.25	*7.71*	0.13	*2.67*	0.22	*3.97*	0.08	*1.09*
Positive output gap	-0.07	*-0.34*	0.17	*1.52*	0.04	*0.18*	0.32	*2.25*
Maastricht	0.42	*5.65*	0.47	*4.92*	0.50	*6.21*	0.54	*5.02*
Debt	0.05	*5.22*	0.07	*5.78*	0.05	*5.25*	0.07	*6.55*
Deficit (1)	0.69	*11.68*	0.75	*9.75*	0.71	*11.84*	0.75	*8.53*
Sargan test	Pr > chi2 = 0.0836		Pr > chi2 = 0.1181		Pr > chi2 = 0.1273		Pr > chi2 = 0.1694	
Arellano-Bond test								
1st order	Pr > z = 0.0099		Pr > z = 0.0196		Pr > z = 0.0088		Pr > z = 0.0270	
2nd order	Pr > z = 0.3496		Pr > z = 0.3030		Pr > z = 0.3919		Pr > z = 0.3091	
N. of obs.	186		190		186		190	

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*.

(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.