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WHAT THEY WERE DOING?  
REASSESSING FISCAL POLICY  
WITH REAL TIME DATA.**

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***INTERNATIONAL MACROECONOMICS***



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## ABSTRACT

### Did Fiscal Policy Makers Know What They Were Doing? Reassessing Fiscal Policy with Real Time Data.\*

Empirical fiscal policy reaction functions based on ex-post data cannot be said to describe fiscal policymakers intentions because they utilise data which did not exist when their decisions were made. A characterisation of what fiscal policy makers were trying to do requires real time data. This paper compares fiscal policy reaction functions for 14 European countries over the period 1995-2006 using both types of data. We exploit the information contained in real time and ex-post data and develop a new approach to estimating the automatic and discretionary fiscal policy responses to changing economic conditions. This avoids the uncertainties and inaccuracies associated with filtering the data in an attempt to estimate potential output or the structural budget. We find that the often commented on pro-cyclicality of discretionary policy only arises in the ex-post data; the real time data suggests that policymakers have tried to run counter-cyclical discretionary policy, but find it hard to do so due to data constraints. Compared to elsewhere in the literature, our model yields lower estimates of the automatic fiscal responses and stronger estimates of the discretionary responses to the output gap.

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# 1 Introduction

The literature on the behaviour of monetary policymakers recognises the importance of using data available to policymakers *at the time the policy decisions were made*, if the goal is to uncover how the policymaker was seeking to act. Following Orphanides (2001), a number of papers have demonstrated that estimating behavioural rules based on so-called *real time data*, may yield quite different (and empirically better performing) descriptions of monetary policymakers behaviour.

The vast majority of empirical work on fiscal policymakers behaviour uses revised data not available to the decision makers at the time fiscal policy was set, rather than real time data. Whilst empirically estimated fiscal reaction functions based on ex post data may fit the data reasonably well, they cannot be said to be a description of what the policymaker was trying to do at the time. The reason for this, as Orphanides (2001) points out, is that such rules could not have been implemented at the time because they require data which was not available until (often many years) after the decision was made. Only very recently has a literature begun to emerge which uses real time data to estimate fiscal reaction functions.

A common finding of literature based on ex post data is that discretionary fiscal policy is acyclical or even pro-cyclical. From this, it is often concluded that this represents the conscious desire of a policymaker for myopic, electoral or other reasons to run a fiscal policy which does not counteract the cycle. However, this conclusion may be a non-sequitur. It could be that fiscal policymakers are not malintentioned, but simply misinformed-i.e. they are trying to run a countercyclical fiscal policy, but are unable to do so due to the limitations of real time data. A real time dataset enables us to test empirically which of these hypotheses is correct. If the problem is one of *malintention*, then the reaction functions estimated with real time data should look similar to their ex post counterparts. If however, the problem is one of *misinformation*, then the real time reaction functions should reveal a counter-cyclical response to the output gap.

The relative lack of attention to fiscal policy in the real time literature is all the more surprising given that the most significant real-time data problems concern the accuracy of estimates of potential GDP and the output gap, rather than prices or the money supply.<sup>1</sup> Although central banks do take account of output gaps, the primary goal of monetary policy is rarely output stabilisation. However, output stabilisation is usually seen as a more important goal of fiscal policy that it is for monetary policy<sup>2</sup> especially for

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<sup>1</sup>See Orphanides and van Noorden (2002) for a comprehensive account of the problems of real time output gap measurement.

<sup>2</sup>Several papers have made the point that the division of labour between a central bank and a fiscal policymaker should (and indeed does) require the latter attempting to stabilise output. See Demertzis et al (2004), Melitz (1997) and Wyplosz (1999).

countries in a monetary union, where it is the only tool available to deal with country-specific shocks.

Moreover data measurement problems are likely to be bigger in the area of fiscal policy because the instrument used by policymakers, the cyclically adjusted budget deficit, is also subject to substantial measurement errors: both in terms of the real-time estimates of the (unadjusted) fiscal deficit, and the output gap estimate used in the cyclical adjustment process (Hughes Hallett et al, 2007). These errors are not likely to counteract each other, but rather to reinforce one another. Consider the case where the policymaker believes at the time that the current output gap is zero, and consequently the cyclically adjusted balance (CAB) is set at zero. Now suppose that the ex post data reveals a positive output gap. That downward revision means that the CAB has turned out to be in deficit, and it also means that the cycle was such that the policymaker should have been running a surplus. Thus the revised data reveals the policymaker ended up running a pro-cyclical fiscal policy, even though they had never intended to.

In order to assess ‘active’ fiscal policy, it is necessary to separate out automatic fiscal adjustments from discretionary fiscal interventions (whether short term around the cycle, or long term), since it is the latter which are (by construction) the outcome of a conscious decision by policymakers. The conventional methodology is to measure active fiscal policy by calculating the cyclically adjusted budget balance (CAB). That evidently allows us to separate out cyclical from long term movements in fiscal policy. But, again by convention, that is also said to split actual budget balance figures into their automatic and discretionary components (Galí and Perotti, 2003). This methodology has two major drawbacks, however. First, in practice, there may well be short term, cyclical discretionary elements in fiscal policy (see von Kalckreuth and Wolff (2007) for the case of the US). Those elements may be quite large in some economies (HM Treasury, 2003). If the deficit time series is simply smoothed over the cycle, this smoothing will also remove any short term changes in fiscal stance in response to cyclical factors. Second, it is not at all easy to measure potential output levels, and hence the cyclically adjusted budget, with any accuracy or reliability. Indeed attempts to do so usually make the estimates of an economy’s business cycle heavily dependent on the particular detrending techniques used to determine the underlying path of potential output (Canova and Dellas, 1993; Canova, 1998). Evidently it would be desirable to come up with a different way of separating automatic from discretionary policy which does not rely on the cyclically adjusted fiscal balance and which does not automatically assume that short term discretionary fiscal interventions are always zero. This paper provides just such a methodology.

The paper contributes to the existing literature in two key ways. First, the fiscal policy reaction function is derived from a simple model of budget setting, which explicitly incorporates both discretionary and automatic fiscal

policy. In our model, automatic stabilisers operate with respect to a change in the level of output, rather than output gap per se. This model enables to test for the effects of real time measurement error across a broader range of reaction functions, contrasting the accounts given by regressions using ex post data with those generated by real time data.

Second, we come up with an innovative way of separating automatic from discretionary fiscal policy without pre-filtering of the data in an attempt to estimate potential output or the structural (cyclically adjusted) budget directly. Our methodology exploits the information contained in real-time *and* ex post data. The basic idea is that discretionary fiscal policy responds to the real-time output gap, while automatic fiscal policy reacts to the ex post output level. Accordingly, automatic fiscal policy should not respond to the measurement error contained in estimating the output gap. Thus, regressing the ex post primary balance on the ex post output gap and the measurement error in calculating the output gap enables us to identify automatic and discretionary fiscal policy without pre-filtering the data. The coefficient on the measurement error describes the discretionary fiscal reaction, while the coefficient on the output gap measures the sum of discretionary and automatic policy.

In line with the earlier literature, we confirm an acyclical fiscal policy reaction, when solely ex post data are used. However, when we use real-time data instead, the estimation results suggest that fiscal policy makers' *intention* is to pursue a counter-cyclical fiscal policy. Moreover, our innovative reaction function based on primary balances shows a stronger discretionary and a weaker automatic fiscal policy reaction compared to the estimated reaction functions based on cyclically adjusted data. This can be explained by the fact that our new methodology allows for short-term discretionary fiscal intervention, while the approach based on cyclically adjusted data assumes that all short-term cyclical movements are always automatic fiscal policy responses. The latter approach obviously leads to an underestimation of discretionary intervention.

The paper is organised as follows. Related literature is summarised in section 2. Section 3 develops a simple model of fiscal policy setting that demonstrates the role of real time measurement error and its effect on fiscal policymaking. Section 4 formally analyses the econometric problem of estimating regression equations where the variable is measured with error, and considers explicitly how the measurement error problem varies across successive vintages. Section 5 discusses the compilation of our real time dataset. Section 6 discusses econometric issues and reports the results of our empirical estimations. Lastly, section 7 concludes.

## 2 Related Literature

On the monetary policy front, there has been considerable attention given to the different results emerging from the use of real time (as opposed to ex post) data for monetary policy reaction functions.<sup>3</sup> In particular, there are several instances of papers which demonstrate that what appeared to be malintentioned behaviour, in fact can be explained by authorities responding “correctly” to real time (mis)information.

For example, Gerberding et al. (2004) are able to overturn the puzzling finding that money growth does not appear to be a significant variable in estimates of the Bundesbank’s reaction function by re-estimating the function with real time rather than ex post data. Using real time data to re-estimate the Fed’s reaction function, Orphanides (2003) uncovers the striking finding that the Fed’s policy rule did not change substantially during the Great Inflation. Rather it was persistent misestimations of the natural rate of unemployment which led to an expansionary policy.

On the fiscal policy front, a large body of empirical studies has estimated fiscal reaction functions in order to assess the stabilizing function of fiscal policy across the business cycle. In the majority of these studies the estimations are based on published ex post data. In this vein, focussing on a sample of Euro area countries, a number of papers find that discretionary fiscal policy is either a-cyclical or pro-cyclical.<sup>4</sup> See for example, Wyplosz (2006), CEPII (2005), IMF (2004) and Galí and Perotti (2003) using data published by the OECD; Or Balassone and Francese (2004) and Ballabriga and Martinez Mongay (2002) who found similar results using the AMECO data set. Taken together, these studies based on ex post data suggest that the lack of counter-cyclical discretionary policy appears to be robust to changes in additional control variables and the data source used.

The small but growing number of papers estimating fiscal policy reaction functions using real time data suggest that estimation results can differ substantially from those generated from ex post data. Forni and Momigliano (2004) and Cimadomo (2007) estimate a reaction function for the OECD countries and compare regression results based on ex post data with those based on real-time data. They show that the use of ex post data will typically lead to an underestimate of the cyclical sensitivity coefficient, indicating a more pro-cyclical fiscal stance, while regressions based on real-time data will contain less of an underestimate and may therefore imply a countercyclical fiscal policy reaction. Thus, in a comprehensive piece surveying (and replicating) a broad variety of work on fiscal policy reaction functions, Golinelli

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<sup>3</sup>See for example, Boivin (2006), Croushore & Stark (2001), Ehrman & Smets (2003), Gianone et al (2006) Gruen et al, (2002), Ironside & Tetlow (2007), Nelson & Nikolov (2003), Rudebusch (2002).

<sup>4</sup>For a formal political economy model which generates a rationale for such a pro or acyclical policy see Alesina and Tabellini (2005) or Talvi and Vegh (2007).

and Momigliano (2007) also report that in general there is greater evidence of counter-cyclical policy when real time data is utilised. This provides prima facie evidence, that difficulties in measuring the output gap in real time may have a role to play in explaining the apparently weak counter-cyclical (or even acyclical) response of fiscal policy to the cycle in conventional studies.

In an analysis of fiscal policy co-ordination, Beetsma and Giuliadori (2007) find that EMU governments do respond to the budgetary positions of others when setting their fiscal policy. A later paper by the same authors (Beetsma and Giuliadori, 2008), suggests that policymakers do depart systematically from their fiscal plans in the light of new information about the output gap. In a similar vein, papers which control for forecasting errors when assessing the cyclicity of fiscal policy also find that these errors have a significant effect on fiscal outcomes. Jonung and Larch (2006), Buti and van den Noord (2004) and Pina and Venes (2007) all find evidence that official output forecasts may be biased to present an overly optimistic picture of the state of public finances. This suggests that aside from extra information about the output gap, fiscal plans may depart from fiscal output gaps due to manipulation of forecasts by governments.

That in turn suggests that careful attention needs to be paid to the role of data revisions (and to the vintage of data used) when evaluating the behaviour of policymakers.

### **3 A Model of Fiscal Policymaking**

In this section we outline a relatively more detailed model of the fiscal policy making process, based on Hughes Hallett et al (2007). As Orphanides (2001) noted, a necessary condition for any rule which claims to characterise policymakers intentions is that the rule must be implementable given the information they had at the time.

Aside from the issue of real time output gaps an additional point is that policymakers cannot simply set the budget balance (or the cyclically adjusted budget balance) for any particular year in the way that the central bank can set their policy rate. Rather they can pass a budget containing a mixture of discretionary actions, automatic spending/revenue items and spending measures fixed in cash terms. If the actual outturn of GDP and/or potential output depart from their projected values, the budgetary variables will also depart from their forecast value. Accordingly, we develop here a simple model of setting fiscal framework, which yields a fiscal policy rule that would meet Orphanides requirement of “implementability” in real time.

### 3.1 Notation

Actual output,  $Y$  can be decomposed into potential output,  $Y^*$ , plus the output gap,  $\tilde{Y}$  :

$$Y_t = Y_t^* + \tilde{Y}_t. \quad (1)$$

A key feature of the model is that different vintages of data exist. To differentiate between them we introduce a second subscript denoting the vintage. In this section, for ease of exposition, the latest available vintage of data will be referred to as the “final” vintage, and is denoted with the subscript  $f$ .<sup>5</sup> For other vintages, we find it convenient to express the vintage relative to the year to which the observation refers. Thus, the information about time  $t$  output, available at time  $t$  is denoted with  $t|t$ , and last year’s estimate of this years output is denoted  $t|t - 1$ .

More generally, the data year  $t$  available at time  $t + s$  is denoted  $t|t + s$ . If  $s < 0$ , then the published data is a forecast, if  $s = 0$  this is a “first release” observation, and if  $s > 0$  then it is a revision of a previously released figure.

Final output data,  $Y_{t|f}$ , is not available in real time, and so the authorities must use preliminary output data. The preliminary estimate,  $Y_{t|t+s}$ , based on the information known at  $t + s$  is subject to an error term  $U_{t|t+s}$ :

$$Y_{t|t+s} = Y_{t|f} + U_{t|t+s}. \quad (2)$$

The level of potential output is not directly observable in real time either. It is estimated using data available at time  $t + s$ , subject to an error term  $V_{t|t+s}$ .<sup>6</sup>

$$Y_{t|t+s}^* = Y_{t|f}^* + V_{t|t+s}. \quad (3)$$

Combining (1), (2) and (3) yields an expression for the error with which the output gap is estimated in real time:

$$\tilde{Y}_{t|t+s} = Y_{t|t+s} - Y_{t|t+s}^* \quad (4)$$

$$\Rightarrow \tilde{Y}_{t|t+s} = \tilde{Y}_{t|f} + U_{t|t+s} - V_{t|t+s}. \quad (5)$$

### 3.2 Setting Fiscal Policy

A key feature of any model based with real time data is that decisions are taken using preliminary data. We adopt a general notation and denote the data vintage used when setting policy as  $t + s$ . The value of  $s$  (the timing of policymaking decisions) is discussed in the following section. Projected expenditures and revenues are thus given by:

<sup>5</sup>In this context, we mean “final” in the sense that it is the latest vintage that we have in our dataset. Of course in reality, today’s data vintage will be revised in the future, but for ease of exposition, we use the term “final” to refer to the last available data vintage that we currently have.

<sup>6</sup>Note that the terms  $U_{t|t+s}$  and  $V_{t|t+s}$  simply represent the real time measurement error and thus we do not assign particular statistical properties to this term up front.

$$R_{t|t+s} = \beta Y_{t|t+s} + \tau Y_{t|t+s}^* + \alpha(Y_{t|t+s} - Y_{t|t+s}^*) \quad (6)$$

$$E_{t|t+s} = \phi Y_{t|t+s} + \gamma Y_{t|t+s}^* + \theta(Y_{t|t+s} - Y_{t|t+s}^*) \quad (7)$$

The model assumes that spending (and revenues) can be split up into three categories.

The first category of expenditures,  $\beta$  and  $\phi$ , respond to the actual level of output. These represent the automatic response of fiscal policy to changes in the level of economic activity- for example through channels such as unemployment benefits. In this model we assume they respond to the level of GDP rather than the output gap per se.<sup>7</sup> This is because the tax and benefit system responds to the actual level of economic activity, rather than deviations from the trend level of activity.<sup>8</sup> It therefore follows that, if the level of GDP in year  $t$  is higher (lower) than expected, then these expenditures (revenues) will be lower (higher) than expected.

A second category is revenues and expenditure are entirely independent of the level of output and of the output gap. For example, the US governments 2008 proposed Federal Budget allots the department of defense a fixed base budget of \$481.4bn.<sup>9</sup> For ease of algebraic manipulation these expenditures and revenues are expressed as a fractions  $\tau$  and  $\gamma$  of potential output as measured at time  $t + s$ . Because these expenditures are fixed in cash terms subsequent revisions to estimates of potential output, or the level of GDP will not affect their cash value.<sup>10</sup>

The last category of expenditures and revenues,  $\alpha$  and  $\theta$ , represent the governments discretionary changes to revenues and expenditures in response to what they perceive the output gap to be at time  $t + s$ . An example of this would be the recently mooted one-off tax rebate to households in the US (Congressional Budget Office, 2008).<sup>11</sup>

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<sup>7</sup>This assumption has been seen elsewhere in the literature, particularly where a separation is made between spending and revenue in fiscal plans or where the goal is to analyse the fiscal windfall arising from above trend growth. Von Hagen (2003), Buti and van den Noord (2004) and Hughes Hallett et al (2004) all assume that expenditures are fixed in nominal terms, and all taxes are proportional to GDP.

<sup>8</sup>This assumption is consistent with the approach followed in the sensitivity analysis of the US President's Budget plans. As in our model, these sensitivity analysis consider the budgetary effect of an *extra* percentage point of GDP growth, and assume that this effect is constant regardless of what happens to potential output. For more information see Budget of the United States Government, Fiscal Year 2008 chapter 12; <http://www.gpoaccess.gov/usbudget/fy08/browse.html> .

<sup>9</sup>For full details of the budget see <http://www.gpoaccess.gov/usbudget/fy08/pdf/budget/defense.pdf> .

<sup>10</sup>These budgetary items could, in principle be amended over the fiscal year. However, in the context of this model and the subsequent estimations the crucial property is that any revisions to this category is independent of the level of GDP and the output gap.

<sup>11</sup>For other examples of this type of discretionary fiscal intervention, see Congressional Budget Office (2008).

In this paper, the first category represents automatic fiscal policy, and the other two categories represents what we term “discretionary fiscal policy”. The actual outturn of revenues and expenditures is thus given by:<sup>12</sup>

$$R_{t|f} = \beta Y_{t|f} + \tau Y_{t|t+s}^* + \alpha(Y_{t|t+s} - Y_{t|t+s}^*) \quad (8)$$

$$E_{t|f} = \phi Y_{t|f} + \gamma Y_{t|t+s}^* + \theta(Y_{t|t+s} - Y_{t|t+s}^*) \quad (9)$$

Substituting the measurement error equations (2) and (3) in (8) and (9) and dividing by  $Y_{t|f}^*$ , we obtain after some re-arrangements:

$$r_{t|f} = \tau + \beta + \tau v_{t|t+s} + (\alpha + \beta)\tilde{y}_{t|f} + \alpha(u_{t|t+s} - v_{t|t+s}) \quad (10)$$

$$e_{t|f} = \gamma + \phi + \gamma v_{t|t+s} + (\gamma + \phi)\tilde{y}_{t|f} + \theta(u_{t|t+s} - v_{t|t+s}), \quad (11)$$

where small letters denote the previous variables rescaled with respect to final potential GDP:  $Y_{t|f}^*$ . This implies the following equation for the budget balances (expressed as a percentage of potential GDP):

$$pb_{t|f} = \tau + \beta - \gamma - \phi + (\tau - \gamma)v_{t|t+s} + (\alpha + \beta - \theta - \phi)\tilde{y}_{t|f} + (\alpha - \theta)(u_{t|t+s} - v_{t|t+s}) \quad (12)$$

Each of the four terms has an economic interpretation. The first term, a constant, gives the governments desired fiscal stance over the cycle. A  $\tau + \beta - \gamma - \phi$  equal to zero implies that the government seeks to balance its budget over the cycle, a negative value implies a deficit bias.

The second term captures the effect of having different estimates for the potential output in the real time and final data vintages. To see the intuition behind this, consider the case where output is always at its potential level, thus,  $\tilde{y}_{t|f} = 0$  in Equation (12). In this case, if  $\tau = 0$  and  $\phi = 0$ , all tax revenue fluctuates with output, and all spending commitments are fixed in cash terms so that the government’s task is to select the average tax rate which generates enough revenue to cover their spending commitments. If they are too optimistic in their assessment of potential GDP, a shortfall will result, because revenues are insufficient to meet spending commitments. In reality, empirical evidence on the magnitude of automatic stabilisers suggests that revenues tend to fluctuate more with actual output, and a greater proportion of expenditures tends to be fixed with respect to income.<sup>13</sup>

The third term of (12) captures the response of fiscal policy to the ex post output gap- combining both discretionary (given by  $\alpha$  and  $\theta$ ) and automatic (given by  $\beta$  and  $\phi$ ) responses. The fourth term captures the error made by

<sup>12</sup>Note that those for those expenditures and revenues which are fixed in cash terms,  $\tau$  and  $\gamma$ , the terms are still expressed with respect to  $Y_{t|t+s}^*$ . This is because they are fixed in cash terms at the outset, and hence the actual outturn of actual and potential output has no effect on their value.

<sup>13</sup>See Bouthevillain et al. (2001) and van den Noord (2000).

fiscal policymakers in responding to the real time (as opposed to the ex post) output gap. Since automatic stabilisers do not react to measurement errors, the coefficient,  $\alpha - \theta$ , is the policymakers desired discretionary response.

## 4 Measuring discretionary and automatic fiscal policy

### 4.1 A generalised form of reaction function

We propose using equation (12) to estimate a fiscal policy reaction function, which uses the primary balances as its dependent variable instead of cyclically adjusted primary balances. Thus, this approach does not rely on pre-filtering the data to remove cyclical influences. That has the advantage that we can come up with a new method of distinguishing between automatic and discretionary policy:

$$\begin{aligned} pb_{t|f} &= \tau + \beta - \gamma - \phi + (\tau - \gamma)v_{t|t+s} + (\alpha + \beta - \theta - \phi)\tilde{y}_{t|f} + (\alpha - \theta)z_{t|t+s} \\ &= \mu_0 + \mu_1 v_{t|t+s} + \mu_2 \tilde{y}_{t|f} + \mu_3 z_{t|t+s} \end{aligned} \quad (13)$$

where  $pb$  denotes primary balances. Since the dependent variable is the unfiltered primary balance, the coefficient on the output gap in this regression,  $\mu_2$ , measures the automatic and discretionary fiscal policy reactions jointly. The coefficient  $\mu_3$  estimates the discretionary fiscal policy. The intuition behind this is that  $z'_{t|t+s}$  is the error made by fiscal policymakers in estimating the output gap. Automatic fiscal policy, which responds to the actual level of GDP is not affected by errors in estimating the output gap. Discretionary fiscal policy- which operates in response to the perceived output gap in real time- is affected by errors in measuring the output gap. Thus, the automatic component of fiscal policy is given by  $\mu_3 - \mu_2 = \beta - \phi$ .

A potentially advantageous feature of this reaction function is that the left hand side variable is the ex post rather than the real time deficit ratio. If (like in much of the emergent literature on real time fiscal policy) the left hand side variable is a real time one, then this variable may not be a true reflection of policymakers intentions. It could be that this real time figure is the subject creative accounting, and hence does not give a fair representation of what the policymaker “thought they were doing”. Expressing a reaction function with ex post fiscal variable on the left hand side insulates our results against creative accounting on the deficit side.

### 4.2 Reaction functions based on ex-post CAPB

It is common in the literature to use the cyclically adjusted (primary) balance as the dependent variable, since this is seen to represent the discretionary reaction of the fiscal policy maker. To express this in the context of

our model, we subtract the cyclical component,  $(\beta - \phi)\tilde{y}_{t|f}$ , to obtain the cyclically adjusted form of (13):

$$\begin{aligned} capb_{t|f} &= \tau + \beta - \gamma - \phi + (\tau - \gamma)v_{t|t+s} + (\alpha - \theta)\tilde{y}_{t|f} + (\alpha - \theta)(u_{t|t+s} - v_{t|t+s}) \\ &= \lambda_0 + \lambda_1 v_{t|t+s} + \lambda_2 \tilde{y}_{t|f} + \lambda_3 z_{t|t+s}, \end{aligned} \quad (14)$$

where the coefficient  $\lambda_2$  and  $\lambda_3$  both measure the discretionary fiscal policy response. However, the traditional literature has usually assumed a fiscal reaction function based on cyclically adjusted budget balances of the following form:<sup>14</sup>

$$capb_{t|f} = \tilde{\lambda}_0 + \tilde{\lambda}_2 \tilde{y}_{t|f} \quad (15)$$

Comparing this with our model-based equation (14), we see that two variables are omitted in (15),  $v_{t|t+s}$  (the error in estimating potential output) and  $z_{t|t+s}$  (the error in estimating the output gap). If at least one of these variables  $v_{t|t+s}$  and  $z_{t|t+s}$  is a significant determinant of the cyclical adjusted primary balance, the regression results will suffer from an omitted variable bias, if the goal is to use  $\tilde{\lambda}_2$  to estimate the policymakers intentions.<sup>15</sup> By the same token, testing for the significance of the coefficients on  $v_{t|t+s}$  and  $z_{t|t+s}$  gives a clear cut econometric means of discerning whether ex post regressions based on ex post data are in fact valid.

### 4.3 Reaction functions based on real time CAPB

A more recent approach to resolving the problem posed by ex post data is to estimate the same reaction function using real time data.<sup>16</sup> Within our framework this can be derived by taking equation (14) and conditioning on information available at time  $t + s$ .<sup>17</sup>

<sup>14</sup>See for example, Galí and Perotti (2003), Wyplosz (2006), Fonseca Marinheiro (2005). Jonung and Larch (2006) formulate a similar reaction function which uses *ex post* data, but which also includes a term capturing the difference between the real time and ex post estimates of *potential output growth*. However, this doesn't include any other real time measurement errors.

<sup>15</sup>If however, the goal of the reaction function is to estimate what the policymaker ended up doing, then there is no omitted variable bias. The disconnect between the two arises from the fact that the policymakers intended response is different from the eventual response. An estimation based on ex post data measures the latter correctly and the former incorrectly.

<sup>16</sup>For example Giuliodori and Beetsma (2007), Forni and Momigliano (2004), Cimadomo (2007). All variables are expressed as ratios to  $y_{t|f}^*$ , whereas in the other papers, variables may be expressed as ratios to  $y_{t|t}^*$  or  $y_{t|t}$ .

<sup>17</sup>At time  $t + s$ , the conditional expectations of the final output gap and final capb are their real time counterparts :  $\tilde{y}_{t|t+s}$  and  $capb_{t|t+s}$  respectively. Similarly, at time  $t|t + s$  the conditional expectations of  $u$  and  $v$  are zero.

$$\begin{aligned}
capb_{t|t+s} &= \tau + \beta - \gamma - \phi + (\alpha - \theta)\tilde{y}_{t|t+s} \\
&= \pi_0 + \pi_1\tilde{y}_{t|t+s},
\end{aligned}
\tag{16}$$

with  $\pi_1$  describing the discretionary fiscal policy response. This is the form of fiscal reaction function commonly found in the real-time fiscal literature - e.g. Cimadomo (2007), Forni and Momigliano (2004) and Beetsma and Giuliadori (2008). In our framework regressions which have real time data on both sides do not suffer from the kind of omitted variable bias of (15). But like the reaction functions described in equations (14) and (15), it does rely on filtering the data to remove the automatic component of fiscal policy and may therefore be sensitive to the detrending technique used.

## 5 Dataset

We utilise an augmented version of the dataset originally compiled for Hughes Hallett et al (2007), using successive editions of the OECD's *Economic Outlook*(EO). At the time of writing there is no publicly available OECD dataset containing all the relevant variables for estimating equations outlined in the previous section. The OECD's has published real time dataset<sup>18</sup> but this does not include data for fiscal variables. Therefore our dataset had to be compiled by taking successive issues of EO and collating them into a single file. The dataset consists of the published values of GDP, output gap and cyclically adjusted budget deficit series in each issue from December 1994 (Issue 56) to December 2005 (Issue 78).<sup>19</sup> We include all EU countries over the period 1994-2006. The raw data contained a small number of missing observations, which were replaced by using the next available vintage (for full details of the replacements made see the table in the appendix). This dataset is similar to that used by Cimadomo (2007) and Beetsma and Giuliadori (2007), who also also compiled (independently) data from old issues of EO.

Using this dataset has a number of attractive features. First, it allows us to do empirical work which could not have been done with publicly available real time datasets. Only a handful of national statistical offices have published real time GDP data, and even fewer have published budget deficit data.

Second, given real time GDP data, the issue arises as to how to calculate the output gap. Simply applying a mechanistic procedure such as an HP filter to detrend the data, suffers from the shortcoming that, in reality, a policymaker would have had more information (outside of the real time

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<sup>18</sup>For an explanation of the dataset, and the data itself see <http://stats.oecd.org/mei/default.asp?rev=1> .

<sup>19</sup>Some of the data was taken from a data set kindly supplied by Beetsma and Giuliadori.

Table 1: Mean Absolute Revision of Real Time Values

	Output Gap t-1 to 2006	Output Gap t to 2006	CAB t-1 to 2006	CAB t to 2006
Austria	1.16	1.19	0.66	0.74
Belgium	0.74	0.71	0.59	0.49
Denmark	0.65	0.68	1.50	1.42
Finland	2.02	2.16	1.36	1.29
France	0.50	0.38	0.64	0.46
Germany	1.07	1.21	0.97	0.72
Greece	0.87	0.48	2.83	2.22
Ireland	1.78	1.10	2.58	1.53
Italy	1.96	1.79	1.68	1.21
Netherlands	0.49	1.08	1.40	1.08
Portugal	1.36	1.27	1.51	1.07
Spain	0.42	0.91	0.55	0.60
Sweden	1.46	1.12	2.41	1.47
United Kingdom	0.70	0.72	1.41	0.72
<b>Average</b>	<b>1.17</b>	<b>1.09</b>	<b>1.45</b>	<b>1.09</b>

dataset) and could have used a more sophisticated approach. Taking the figures reported by the OECD in *Economic Outlook* circumvents this problem and gives a figure which corresponds to the “best guess” of the output gap at the time, given all the information available.

Third, since the data is compiled by an independent body, it helps to insulate against “political” bias in provisional figures and forecasts compiled by national governments.<sup>20</sup> For example, empirical work by Jonung and Larch (2006) suggests that in some countries estimates of potential output produced by national statistical agencies may have been biased systematically upwards, in order to present a more favourable picture of cyclically adjusted public finances. In addition to providing a potentially more accurate picture of information available at the time decisions were made, our dataset permits the possibility of testing for such a bias.

The potential importance of data revisions can be seen from a simple examination of the magnitude of the revisions. Table 1 shows the mean absolute revision from December of year  $t - 1$  to the last available vintage (December 2006); and from December of year  $t$  to the last available vintage.

Table 1 makes it clear that data revisions are substantial for virtually

<sup>20</sup>This problem is not entirely eliminated by using OECD data, since OECD figures are typically generated following consultation with national governments. But the OECD does not police the budget data for excessive deficits as the European Commission or a parliamentary opposition does.

all EU countries. The largest revisions to the output gap occur in countries who appeared to have experienced a structural break in their GDP over the 1990s- Finland and Ireland; but the revisions in other countries are far from trivial, averaging more than a full percentage point in both the  $t - 1$  to final year and the  $t$  to final year cases. The CAB is prone to even greater revisions, because of the additional uncertainty surrounding the actual deficit figure.

## 6 Estimations

The following four regression equations are based on the fiscal reaction functions described by equations (15), (14), (16) and (13) respectively:

$$capb_{t|f} = \tilde{\lambda}_0 + \tilde{\lambda}_1 capb_{t-1|f} + \tilde{\lambda}_2 \tilde{y}_{t|f} + \tilde{\lambda}_3 \mathbf{x}_{t|f} + \epsilon_t \quad (\text{A})$$

$$capb_{t|f} = \lambda_0 + \lambda_1 capb_{t-1|f} + \lambda_2 \tilde{y}_{t|f} + \lambda_3 v_{t|t+s} + \lambda_4 z_{t|t+s} + \lambda_5 \mathbf{x}_{t|f} + \epsilon_t \quad (\text{B})$$

$$capb_{t|t+s} = \pi_0 + \pi_1 capb_{t-1|t+s-1} + \pi_2 \tilde{y}_{t|t+s} + \pi_3 \mathbf{x}_{t|t+s} + \epsilon_t \quad (\text{C})$$

$$pb_{t|f} = \mu_0 + \mu_1 pb_{t-1|f} + \mu_2 \tilde{y}_{t|f} + \mu_3 v_{t|t+s} + \mu_4 z_{t|t+s} + \mu_5 \mathbf{x}_{t|f} + \epsilon_t, \quad (\text{D})$$

where  $\epsilon_t$  denotes a random error term and  $\mathbf{x}_{t|t-j}$  is a vector consisting of three additional explanatory variables that are commonly found to be significant in the related literature: *debt*, is the debt to GDP ratio and explains the initial state of public finances; *eyear* is a dummy variable taking the value of 1 in the year of parliamentary elections and zero otherwise and measures the relevance of the electoral cycle (see Golinelli and Momigliano (2006, 2007)); *Maastricht* is a ‘‘Maastricht variable’’ similar in spirit to that developed by Momigliano and Forni (2004) and subsequently utilised by Cimadomo (2007) to capture the effect of fiscal consolidations in the run-up to EMU. For countries with a deficit of more than 3% prior to 1998 ( $b < -3$ ), the variable is defined as:<sup>21</sup>

$$maastricht = \frac{d - 3}{1998 - t} \quad (17)$$

The variable is set to zero for countries with deficits of less than 3%, countries who chose not to participate in EMU; and for all countries after 1998. This variable provides a simple way of capturing the fiscal consolidations seen in many EU countries in order to meet the Maastricht criteria, which uses up only one degree of freedom.

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<sup>21</sup>For the final data case,  $b_{t-1|f}$  is used; for the  $s = 0$  case,  $b_{t-1|t}$  is used; for the  $s = -1$  case,  $b_{t-1|t-1}$  is used. In the case of Greece (whose convergence report was written in 2001), the formula was  $maastricht = \frac{b_{t-1}+3}{2002-t}$ .

Since budgetary figures are often characterized by a high degree of persistence, we have included a lagged dependent variable in all four regressions to remove serial correlation from the error terms. Stability in equations (A)-(D) requires that the coefficient on the lagged dependent variable must be smaller than 1.

Regression (A) describes the standard reaction function based on ex-post cyclical adjusted primary balances. Regression (B) shows a modified fiscal reaction function also based on cyclical adjusted primary balances which includes terms capturing the effect of real time errors in measuring the output gap and potential output. Regression (B) differs from (A) in that it incorporates two additional variables capturing the errors in estimating potential output and in the output gap ( $v$  and  $z$ ). If one or both of these variables is significant, then (A) suffers from omitted variable bias.

Regression (C) describes the fiscal reaction function based entirely on real time data, as estimated by Forni and Momigliano (2004) and Cimadomo (2007). In this regression, the coefficient on the output gap measures the discretionary fiscal policy reaction. Finally, regression (D) is our new proposed reaction function using unfiltered primary deficits as dependent variable. It is this regression which allows a direct estimation of both automatic and discretionary fiscal policy responses. The coefficient on the error in measuring the output gap,  $\mu_4$ , measures the discretionary and the difference,  $\mu_2 - \mu_4$ , measures the automatic fiscal policy response.

## 6.1 What is the relevant data vintage for “real time” data?

There is some debate over the “correct” data vintage for our real time estimations. In other words, for setting policy for year  $t$ , do policymakers use the data available at the start of the year-  $t - 1$  vintage data- or do they use information which becomes available to them during the course of the year- vintage  $t$  data?

The fact that budgetary plans are typically drawn up and presented to national parliaments before the start of the fiscal year suggests that the appropriate information set is that which is available at time  $t - 1$  ( $s = -1$ ). On the other hand, there are considerations which may mitigate in favour of using data vintage  $t$  for our real time case ( $s = 0$ ). Beetsma and Giuliadori (2008) find that governments do systematically depart from  $t - 1$  budget plans in the face of new information. Von Kalckreuth and Wolff (2007) find evidence of “real time” fiscal responses to GDP revisions at the quarterly frequency. In other words fiscal policy is not set in stone at the start of the year- and governments are able to make additional discretionary fiscal adjustments during course of year  $t$ .

We take the  $s = 0$  case as our benchmark, to allow for the possibility of intra year adjustments to fiscal policy chronicled elsewhere in the literature. In fact, our estimation results are largely similar regardless of whether  $s$  is

zero or  $-1$ . The only significant difference in results is that for regression (C), the output gap is significant in the  $s = 0$  case, but not in the  $s = -1$  case. But comparing the  $R^2$  values, it is evident that for regression (C) the  $s = 0$  specification fits the data considerably better, suggesting that  $s = 0$  is the appropriate choice.<sup>22</sup>

## 6.2 Estimation Methodology

Since the time dimension of our data set is relatively short, we estimate the each fiscal reaction function as a panel.<sup>23</sup> A necessary condition for poolability is that countries follow the same, or relatively similar, fiscal reaction functions. Therefore, we have tested up front for the four regressions models (A)-(D), whether the estimated slope coefficients, excluding the constant terms to allow for country fixed effects, differ between the 14 countries contained in our data set. We find that the null hypothesis of equality of slope coefficients for all countries cannot be rejected in any regression at the 5% significance level. The results of the poolability test are shown in Table (4) in the Appendix.<sup>24</sup>

To capture unobserved country fixed effects, we have included in all regressions country dummies and, similar to previous studies, an  $F$ -test cannot reject their joint significance. The presence of country fixed effects and lagged dependent variables among the regressors means that ordinary least squares (OLS) and within estimations are severely biased and inconsistent unless the time dimension  $T$  is large (see Nickell, 1981; and Kiviet, 1995). Therefore, estimating the dynamic fiscal reaction function with a standard fixed-effect panel estimator- as some other studies<sup>25</sup> do- may not be appropriate.

One common approach to resolving this difficulty is to remove the panel-level effects by first-differencing the estimation equation and then to apply a linear generalized method of moments (GMM) estimator.<sup>26</sup> A common choice in the literature<sup>27</sup> is the Arellano-Bond estimator (Arellano and Bond,

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<sup>22</sup>The  $R^2$  value increases substantially from 0.44 to 0.73, when we switch from  $s = -1$  to  $s = 0$ .

<sup>23</sup>For simplicity reasons we drop the country index  $i$  from the variable notation.

<sup>24</sup>Bun (2004) shows that in a dynamic panel model the classical asymptotic test procedures reject poolability too often. In other words, the p-values are too low. Thus, our estimated p-values are biased downwards and should be regarded as the lower bound.

<sup>25</sup>Annett (2006), Galí et al. (2003), Forni et al. (2004), Cimadomo (2007) and Wyplosz (2006) all followed this approach.

<sup>26</sup>An alternative way to handle dynamic panel bias is to perform a least squares dummy variable estimator (LSDV) and then to correct the results for the bias (Kiviet (1995)). However this approach does not address the potential endogeneity of other regressors, which is the case in our regressions.

<sup>27</sup>See for example. Debrun and Kumar (2007), Balassone and Francese (2004), Forni and Momigliano (2004).

1991) which uses the lags of the dependent variable to instrument the differenced dependent variable, which turns endogenous after first-differencing.

However, Alonso-Borrego and Arellano (1996) and Blundell and Bond (1998), show that when the autoregressive parameter is moderately large, lagged levels of the dependent variable provide weak instruments for first differences.<sup>28</sup> Given the high degree of autoregressivity in our dataset<sup>29</sup>, the Arellano Bond estimator would thus provide weak instruments. Furthermore, the first-difference GMM estimator only yields unbiased and consistent results if the cross section dimension  $N$  is large.<sup>30</sup> This is not the case in our data set.

We therefore follow Golinelli and Momigliano (2006) in using the Blundell Bond estimator (1998), which extends the first-difference GMM estimator proposed by Arellano and Bond (1991) by using lagged differences of the dependent variable as instruments for equations in levels, in addition to lagged levels of the dependent variable as instruments for equations in first differences (compare Arellano and Bover (1995)). Blundell and Bond (1998) show that this ‘system GMM’ estimation approach significantly improves the performance of the usual first-differences GMM estimator, when the autoregressive parameter is moderately high.

Bun and Kiviet (2006) have analysed the finite sample behaviour of various least squares (LS) and a range of GMM estimators (including the system GMM) in dynamic panel models with individual effects and weakly exogenous explanatory variables. They conclude that if  $T$  and  $N$  are small, standard first-order asymptotic theory is of little use in ranking the qualities of the different estimators and that system GMM estimators are a “relatively safe choice”, except when the autoregressive process of the dependent variable is small, which is not the case in our data set. Furthermore, Hayakawa (2007) shows that system GMM estimators like the Blundell Bond estimator suffer less from a small sample bias than alternative first-difference GMM or level GMM estimators. The reason is that the bias of the system GMM estimator is a weighted sum of the small sample biases in opposite directions of the first differencing and the level GMM estimator. Hayakawa (2007) finds that the two elements of the bias of the system GMM estimator partly cancel each other out, and this is the reason why the small sample bias is almost zero when the autoregressive coefficient on the lagged dependent variable is around 0.4, which is roughly the size of the coefficient on the

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<sup>28</sup>To see why this is the case, consider for simplicity the autoregressive process  $y_{i,t} = \alpha y_{i,t-1} + \epsilon_{i,t}$ . Subtracting  $y_{i,t-1}$  from both sides yields  $\Delta y_{i,t} = (\alpha - 1)y_{i,t-1} + \epsilon_{i,t}$ . Thus we see that for sufficiently high autoregressive parameters, the slope coefficient on  $y_{i,t-1}$  can be made arbitrarily close to zero. This is why  $y_{i,t-1}$  will be a weak instrument for  $y_{i,t}$  in highly autoregressive models.

<sup>29</sup>Regressing the real time (ex post) cyclically adjusted budget balance on its own lag yields an autoregressive parameter of 0.89 (0.90).

<sup>30</sup>See Anderson and Hsiao (1982), Arellano and Bond (1991), Blundell and Bond (1998).

lagged dependent variable in our estimations.

Given our choice of Blundell Bond as an estimation technique, this leaves three key issues to resolve concerning lag length, endogeneity of the output gap and the validity of the GMM technique.

Our choice of lag length is influenced by Bun and Kiviet (2006), who showed that increasing the number of moment conditions used in dynamic panel estimations increases the bias in finite samples considerably. Further, too many instruments can significantly reduce the power of the Hansen test for overidentification. Therefore, we limit the number of available instruments by using no more than three lags of the dependent variables (in levels as well in differences) as instruments.<sup>31</sup>

To address the possible endogeneity of the output gap, we explicitly allow the ex-post and real-time output gaps to be endogenous variables. We instrument these endogenous variables with their first three lags and as suggested by Forni and Momigliano (2004), with a GDP-weighted average of the output gap of all other European countries.

The validity of the GMM estimations is based on the condition of no second-order autocorrelation. Thus in the lower part of the table, we report the p-values of the Arellano-Bond test that the average autocovariance of the in residuals of order two is zero. The null-hypothesis of no second-order autocorrelation cannot be rejected in all four regressions. To check for misspecification of our instruments we have performed a Hansen test; the relevant p-values are reported in the bottom line of the table.

Finally, the test results of the Im, Peseran and Shin panel unit root test (2003) are listed in Table 5 in the Appendix. For all variables used in our regressions, null hypothesis of a unit root is rejected at the 5% significance level.

### 6.3 Results

Table 2 shows the baseline estimation result. Our baseline specification is a simple fiscal “taylor rule” containing only the output gap, a lagged dependent variable and lagged debt as explanatory variables.

Column A shows the the canonical ex post reaction function. The coefficient on the output gap is negative but insignificant, in line with much of the literature. However, that literature may be wrong. According to our model this regression will be misspecified as a description of the policymakers desired reaction, if one of the error terms  $v$  or  $z$  is significant. Including these two terms (column B) shows that  $z$ , the error made when measuring the output gap in real time, is indeed highly significant, which means that the estimation results of regression (A) suffer from an omitted variable bias.

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<sup>31</sup>The estimation results turned out to be quite robust to the choice of the lag length of the instruments.

Table 2: Blundell-Bond estimation results

	(A)	(B)	(C)	(D)
Dep variable	$capb_{t f}$	$capb_{t f}$	$capb_{t t}$	$pb_{t f}$
Output gap	$\tilde{y}_{t f}$	$\tilde{y}_{t f}$	$\tilde{y}_{t t}$	$\tilde{y}_{t f}$
<i>Gap</i>	-0.085 (0.48)	0.242 (0.12)	<b>0.209**</b> (0.05)	<b>0.803***</b> (0.00)
$v_{t t}$		<b>-0.043*</b> (0.06)		-0.043 (0.12)
$z_{t t}$		<b>0.414***</b> (0.00)		<b>0.560***</b> (0.00)
<i>debt</i>	<b>0.020*</b> (0.07)	<b>0.031**</b> (0.03)	<b>0.032**</b> (0.02)	<b>0.038**</b> (0.02)
Lagged dep. variable	<b>0.432***</b> (0.00)	<b>0.334***</b> (0.00)	<b>0.418***</b> (0.00)	0.210 (0.12)
constant	-0.347 (0.61)	-0.622 (0.47)	-0.712 (0.31)	0.756 (0.46)
$R^2$	0.72	0.59	0.65	0.32
N	168	168	166	168
AR(2)	0.841	0.931	0.048	0.80
Hansen	0.217	0.348	0.356	0.404

p-values in parentheses. \*, \*\*, \*\*\* indicate significance at the 1,5, and 10% significance levels respectively; figures for the Arellano-Bond test for second order autocorrelation and the Hansen test for misspecification are reported in p-values. (A) canonical, ex-post (B) modified, ex-post (C) canonical, real time (D) real time, automatic+discretionary.

Estimating the simplest form of real time reaction function (C), results in a significant positive coefficient on the output gap, implying countercyclical discretionary fiscal policy response. Specifically, the coefficient of 0.21 implies that for every euro below (above) potential output that GDP is, 21 cents of counteracting discretionary fiscal policy measures are undertaken.

Lastly, the real time reaction function derived from our own model (D) also presents a similar picture of policymakers intentions. The discretionary

response (given by the coefficient on  $z$ ) is somewhat stronger at 0.56. The magnitude of automatic stabilisers given by the difference between the coefficient on  $gap$  and  $z$ , is around 0.24. This is markedly lower than estimates derived from other approaches.<sup>32</sup> The stronger discretionary fiscal intervention in (D) than (C) could be explained by the fact that we allow in (D) for short-term discretionary fiscal intervention, while the approach represented in (C) assumes that all short-term cyclical movements are always automatic fiscal policy responses- and hence (C) wrongly attributes some of the discretionary actions to automatic stabilisers<sup>33</sup> and that it is wrong to attribute all cyclical elements in fiscal variables to automatic stabilizers. Thus, discretionary fiscal policy seems to be underestimated and automatic fiscal policy overestimated in regression approaches based on cyclically adjusted data. Across all four specifications, the debt variable is positive and significant, implying that governments do tighten fiscal policy in response to rising debt ratios.

Table 3 shows the results from estimating the four equations including two additional control variables *eyear* and *maastricht*. The coefficients which determine the discretionary and automatic fiscal policy responses seem to be highly robust to the specification of control variables and do not differ substantially to the results in the baseline regressions presented in table 2. Based on ex post data, fiscal policy remains acyclical- i.e. the coefficient on the output gap in (A) remains insignificant. In (B), where we control for the omitted variables, we see a positive significant coefficient on the  $gap$  and  $z$  variables. A similar picture emerges in (C), when real time data are used- a significant positive coefficient on the output gap is present. The strongest evidence of countercyclicality emerges as in the baseline regressions in regression (D), with the result that automatic stabilisers are markedly lower than estimates from other approaches.

The *maastricht* variable is significant across all four regressions. In all four regressions the value is not significantly different from one- the value consistent with a smooth linear adjustment of budget deficits towards the benchmark. This confirms the finding elsewhere in the literature (for example, Hughes Hallett et al. (2003), Hughes Hallett and Lewis (2007)) that many governments did make an additional effort to tighten fiscal policy in the run-up to EMU in order to meet the fiscal criteria for entry. The election dummy, *eyear*, has a significant negative coefficient, implying that fiscal policy is around 0.35 percentage points looser in an election year.

The debt variable is no longer significant once these additional control variables are included. This could reflect the fact that, in the run-up to

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<sup>32</sup>Estimates of automatic stabilisers are usually in the range of 0.3 to 0.5. See, for example, Barrell and Pina (2004), van den Noord (2000), Kiander and Viren (2000) Giorno et al (1995), and Bouthevillain et al (2001).

<sup>33</sup>von Kalckreuth and Wolff (2007) find evidence of discretionary fiscal policy actions at the quarterly frequency for the US.

EMU, governments wishing to consolidate their public finances were focussed primarily on meeting the deficit criterion, and hence the *maastricht* variable picks up the actions of high debt countries seeking to improve their fiscal position.

Despite the fact that the poolability test does not reject the null-hypothesis of equal slope co-efficients, as a further robustness check we assess the sensitivity of cross-country regressions by running regressions (A)-(D) for the 14 EU countries in our sample, eliminating a single country at a time. If the results of the regression change substantially after the exclusion of a particular country, this suggests the results are driven by the incorrect inclusion of one particular country. The relevant coefficients are tabulated in the appendix (see Table 6). This shows that the key findings of acyclicity are robust to the exclusion of individual countries from the sample.

A range of other potential control variables were experimented with. Following Beetsma and Giuliadori (2008) we included a variable capturing the fiscal stance of other nations<sup>34</sup>, but this yielded either an insignificant or an implausibly high coefficient depending on the precise specification used. To test for the effect of the Excessive Deficit Procedure, we constructed a variable EDP, which was equal to zero if a country's budget balance was less than -3% of GDP the previous year or if they were not in the Euro at the time; and equal to the gap between the previous years budget deficit and 3% otherwise.<sup>35</sup> However, this variable was not found to be significant in any of the regression specifications. In other words, breaching the 3% reference value in one year, appeared induce no extra consolidation the following year.

Lagged election years were also included alongside the existing electoral year dummy, with a view to capturing more sophisticated electoral budget cycle dynamics. However, when included alongside *eyear*, the lag of *eyear* was never found to be significant. We experimented with the inclusion of different political variables such as a variable giving the political orientation of the government, but they all turned out to be insignificant.

As a further robustness check, all regressions were re-estimated with time fixed effects. However, the sign and size of coefficients are similar in this case, with the exception that the output gap variable in regression (C) turns insignificant. A possible explanation is that the business cycles of European economies are correlated with each other and that the inclusion of year dummies therefore reduces the explanatory power of the output gap variable.

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<sup>34</sup>Two specifications were tried: The first was the GDP weighted average of all other countries CABs; the second was the GDP weighted average of other Eurozone CABs for Euro members and zero for non-eurozone countries.

<sup>35</sup>The variable was constructed both for real time and for final budget data.

Table 3: Blundell-Bond estimation results

	(A)	(B)	(C)	(D)
Dep variable	$capb_{t f}$	$capb_{t f}$	$capb_{t t}$	$pb_{t f}$
Output gap	$\tilde{y}_{t f}$	$\tilde{y}_{t f}$	$\tilde{y}_{t t}$	$\tilde{y}_{t f}$
<i>Gap</i>	0.047 (0.77)	<b>0.387*</b> (0.06)	<b>0.264***</b> (0.01)	<b>0.901***</b> (0.00)
$v_{t t}$		-0.019 (0.48)		-0.017 (0.58)
$z_{t t}$		<b>0.506***</b> (0.00)		<b>0.675***</b> (0.00)
<i>debt</i>	0.013 (0.37)	0.021 (0.18)	0.21 (0.15)	0.028 (0.12)
<i>maastricht</i>	<b>-1.320*</b> (0.10)	<b>-1.674*</b> (0.06)	<b>-1.228*</b> (0.08)	<b>-1.743*</b> (0.09)
<i>eyear</i>	<b>-0.332**</b> (0.03)	<b>-0.309*</b> (0.06)	<b>-0.381**</b> (0.04)	-0.341 (0.98)
Lagged dep. variable	<b>0.471***</b> (0.00)	<b>0.430***</b> (0.00)	<b>0.551***</b> (0.00)	<b>0.333**</b> (0.03)
constant	-0.347 (0.61)	-0.622 (0.47)	-0.712 (0.31)	0.756 (0.46)
$R^2$	0.72	0.59	0.65	0.32
N	168	168	166	168
AR(2)	0.841	0.931	0.048	0.80
Hansen	0.217	0.348	0.356	0.404

p-values in parentheses. \*, \*\*, \*\*\* indicate significance at the 1, 5, and 10% significance levels respectively; figures for the Arellano-Bond test for second order autocorrelation and the Hansen test for misspecification are reported in p-values. (A) canonical, ex-post (B) modified, ex-post (C) canonical, real time (D) real time, automatic+discretionary.

## 7 Conclusions

A crucial assumption required to view characterisations of fiscal policy based on ex post as representing the intentions of policymakers is that these results tally closely with those provided by real time data. If this is not the case, then there must be a substantial disconnect between what fiscal policymakers ended up doing and what they were intending to do when they set policy.

A key result of our paper is that such a disconnect exists and is significant. Specifically, the weak pro-cyclicality of fiscal policy evident from ex post data does not carry over to real time data. Thus, data revisions play an important role in explaining the apparent pro-cyclical pattern to fiscal policy in previous studies. We found that fiscal policymakers wish to run a counter-cyclical policy, but errors in the output gap render the actual outturn to be either acyclical or mildly pro-cyclical- the problem is one of misinformation rather than malintention. On the other hand, finding that fiscal policy is looser in election years holds across both real time and ex post reaction functions, indicating that this loosening is intentional.

When we specifically estimate both automatic and discretionary responses in the same equation we find that with regard to responses to the output gap, the automatic response is weaker than is often thought and the discretionary component is stronger. Attempts to calculate the discretionary component which rely on smoothing the data may understate the true magnitude of the discretionary response because the smoothing process may strip out that part of the discretionary response which occurs at business cycle frequency. Also, the standard view of automatic fiscal stabilisers is that they operate with respect to the output gap. However, in our model, they are assumed to operate with respect to the tax base- i.e. actual GDP, rather than some deviation from trend GDP. Under this assumption, the relation between automatic fiscal policy and the output gap is correspondingly weaker, because changes in the level of output are not perfectly correlated with changes in the output gap.

However, our results do not necessarily imply that fiscal policymakers are wrong to attempt to run counter-cyclical discretionary policies. Simply attempting to hold the cyclically adjusted balance constant across the cycle may be just as difficult as stabilisation, since output gap uncertainty means that in practice it is difficult to know what the cyclically adjusted balance is in real time. Thus, unlike monetary policy, the real time measurement problem exists both with the instrument and with the variables to which the policymaker responds.

Our results suggest that proposals to modify policymakers incentives or constrain discretion are unlikely to be very successful in improving the “counter-cyclicality” of fiscal policy- although this does not mean they will be ineffective at achieving other goals such as promoting fiscal discipline or

eliminating the effects of the electoral cycle.

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Table 4: Poolability Test

Regression	p-values
baseline- table 2	
(A)	0.13
(B)	0.95
(C)	0.66
(D)	1.00
with <i>maastricht</i> and <i>eyear</i> - table 3	
(A)	0.90
(B)	0.92
(C)	0.99
(D)	1.00

Figures represent p-values of the  $F$ -test for equal slope coefficients across countries.

Table 5: Stationarity Test of Variables

	p-values
$capb_{t t}$	0.03
$capb_{t f}$	0.00
$pb_{t f}$	0.02
$gap_{t t}$	0.00
$gap_{t f}$	0.00
$debt_{t t}$	0.00
$v_{t t}$	0.00
$z_{t t}$	0.00

Figures represent p-values of the Unit Root test proposed by Im, Peseran and Shin assuming individual unit root process across countries

Table 6: Sensitivity Test

Country dropped	(A)	(B)		(C)	(D)	
	$gap_{t f}$	$gap_{t f}$	$z_{t t}$	$gap_{t t-1}$	$gap_{t f}$	$z_0$
Austria	0.033	<b>0.420*</b>	<b>0.467***</b>	<b>0.260**</b>	<b>0.973***</b>	<b>0.627***</b>
Belgium	0.041	<b>0.392*</b>	<b>0.516***</b>	<b>0.298***</b>	<b>0.899***</b>	<b>0.699***</b>
Germany	0.078	<b>0.403*</b>	<b>0.538***</b>	<b>0.253**</b>	<b>0.866***</b>	<b>0.675***</b>
Denmark	0.077	<b>0.409*</b>	<b>0.530***</b>	<b>0.257**</b>	<b>0.908***</b>	<b>0.687***</b>
Spain	0.051	<b>0.379*</b>	<b>0.505***</b>	<b>0.255**</b>	<b>0.895***</b>	<b>0.673***</b>
Finland	0.077	<b>0.205***</b>	<b>0.466***</b>	<b>0.262**</b>	<b>0.726***</b>	<b>0.611***</b>
France	0.064	<b>0.386*</b>	<b>0.495***</b>	<b>0.252**</b>	<b>0.887***</b>	<b>0.663***</b>
Greece	0.017	0.291	<b>0.439***</b>	<b>0.254**</b>	<b>0.811***</b>	<b>0.644***</b>
Ireland	0.063	<b>0.576**</b>	<b>0.697***</b>	<b>0.360**</b>	<b>1.121***</b>	<b>0.917***</b>
Italy	0.025	0.284	<b>0.454***</b>	<b>0.250**</b>	<b>0.809***</b>	<b>0.584***</b>
Netherlands	0.063	<b>0.472*</b>	<b>0.584***</b>	<b>0.300***</b>	<b>0.949***</b>	<b>0.742***</b>
Portugal	0.087	<b>0.480*</b>	<b>0.536***</b>	<b>0.252**</b>	<b>1.058***</b>	<b>0.725**</b>
Sweden	0.078	<b>0.396*</b>	<b>0.519***</b>	<b>0.285***</b>	<b>0.913***</b>	<b>0.680***</b>
UK	0.051	<b>0.313*</b>	<b>0.412***</b>	<b>0.183**</b>	<b>0.834***</b>	<b>0.567***</b>
None	0.047	<b>0.387*</b>	<b>0.506***</b>	<b>0.264***</b>	<b>0.901***</b>	<b>0.675***</b>
Min	-0.08	0.20	0.41	0.18	0.73	0.57
Max	0.09	0.58	0.70	0.36	1.12	0.92

Note: Figures show the coefficients measuring fiscal reaction when the country listed in the first column is excluded from regressions. Bold figures: significant at 5%, italic figures: significant at 10%

Table 7: Gaps in Dataset

Country	Variable	Vintage	Year	Action Taken
Greece	Debt	Final Data (EO 80)	1994	Observation Dropped
Ireland	Debt	Final Data (EO 80)	1994	Take latest available (EO78)
"	"	"	1995	"
"	"	"	1996	"
"	"	"	1997	"
Italy	Debt	Final Data (EO 80)	1995	Take latest available (EO 77)