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# Fiscal Policy as a Stabilization Tool

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**Abstract:** We analyze empirically the cyclical behavior of fiscal policy among a group of 23 OECD countries. We introduce a framework to capture fiscal policy stance in a way that brings together automatic stabilizers and discretionary fiscal policy. We show that, for most countries, automatic changes in the budget balance play a stronger role in stabilizing output than discretionary fiscal policy. When compared across countries, changes in fiscal policy stance are predominantly linked to differences in government size. Tax revenues are close to being proportional to GDP fluctuations and, combined with a relatively stable government spending, this leads to a countercyclical budget balance, which in turn helps stabilize aggregate demand. Furthermore, countries with less responsive automatic stabilizers, like the United States, tend to use countercyclical discretionary fiscal policy more aggressively. For all countries discretionary policy has become more aggressive in recent decades.

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# 1. INTRODUCTION

The 2008-2009 recession has shaken existing priors and frameworks about the role of fiscal policy in advanced economies, bringing it to the forefront of economic policy discussions. Prior to the crisis, academic research and debate among policy makers focused almost exclusively on monetary policy, under the assumption that fiscal policy was not a good stabilizing tool and that the risks associated with debt sustainability were contained (at least in the group of the OECD economies). The implicit consensus among academics and policy-makers could be described in the following way:

1. Automatic stabilizers were seen as "doing their thing". No one questioned their role and there were little discussions as to how they could be improved.
2. Discretionary fiscal policy as a stabilizing tool was shelved in favor of monetary policy because of the existence of lags in the decision-making process and political interference.
3. Although the issue of debt sustainability had been discussed in many advanced economies since the mid-1980s, the last economic boom and more importantly the expansion during the 1990s reduced the urgency with which the issue needed to be addressed.[1]

Since 2007 this framework has given way to one of grave concern about the sustainability of public finances and even the fear of default, combined with a growing pressure for fiscal policy to become a key instrument in economic recovery.

There are many sides to the current debate on fiscal policy, not all of which can be dealt with in this paper. We focus on a small number of issues that would seem to be central to any proposal for a new and improved framework for fiscal policy: How do automatic stabilizers work? How do governments use discretionary fiscal policy to react to economic fluctuations? Is there a relationship between the use of discretion in reacting to the cycle and the level of automatic stabilization? These questions are addressed within the more general setting of the link between fiscal policy and business cycles. It is clear that causality works both ways: fiscal policy reacts to the business cycle and the business cycle is affected by fiscal policy. The relationship between the two is at the heart of understanding the three components listed above.

Clearly, the first two issues (the role of automatic stabilizers and discretionary fiscal policy) are all about the link between fiscal policy and the cycle. But even the third, debt sustainability, cannot be resolved without a solid understanding of this relationship. The optimism of the expansion years is crucial to understanding the evolution of debt levels in advanced economies, especially in the US. The failure of

[1] "President Clinton on Monday proposed paying off the national debt by 2015 after issuing a new budget outlook that adds $1 trillion more to the overall budget surplus over the next 15 years." CNN, June 26, 1999.

the Stability and Growth Pact in Europe was not about the long-term goals around which it was designed. The exact targets can be questioned but the idea of limiting deficits and debt has to be the starting point of any plan to ensure sustainability. The real failure was in its implementation at business cycle frequency. The system failed to provide on a year-to-year basis an objective reference for fiscal policy among such a diverse group of countries. And the fact that the discussion and enforcement were left to the politicians and "potential sinners" did not help either.

We use a simple theoretical framework to understand the links between fiscal policy and the business cycle, with an emphasis on the similarities between automatic stabilizers and discretionary fiscal policy. The lack of focus on and understanding of automatic stabilizers is a weakness in current thinking about fiscal policy. The current crisis has shown that even if there is some agreement on the need to use fiscal policy to stimulate the economy, the political process through which it is translated into concrete actions can distort or even paralyze its implementation. Our theoretical framework provides some simple but powerful insights that question existing notions in the academic literature about automatic stabilizers by making clear the similarities between automatic and discretionary changes in fiscal policy stance. Using accounting identities and a relatively simple theoretical framework, we make explicit the crucial role that government size plays in the stabilization provided by the automatic reaction of the budget balance to economic fluctuations.

In essence, our analysis shows that the size of government is the best indicator of the strength of automatic stabilizers for OECD economies. Large governments stabilize the economy simply because they are large and thus control a higher percentage of total aggregate demand. While changes in spending or taxes could potentially play an automatic stabilization role, their actual response is not significant enough.

The structure of the paper is as follows. The following section provides a selective review of the academic literature. Section 3 presents both a set of accounting identities and a theoretical framework to think about the stabilizing role of fiscal policy. Section 4 presents the empirical results from the OECD panel and individual country regressions. Section 5 presents our conclusions.

# 2. LITERATURE REVIEW

Much of the macroeconomic research on fiscal policy and the business cycle can be categorized in one of three areas: (1) analysis of fiscal policy from a normative point of view; (2) descriptive exposition of how fiscal authorities actually behave; and (3) theoretical and empirical analysis of the effects of fiscal policy on the business cycle.

The normative analysis starts with RBC models, where issues of optimal taxation are key to the analysis. This line of research is not focused on the interaction between

business cycles and fiscal policy but there are some implications of their dynamic predictions. For example, Barro (1979) argues that tax rates should follow a random path and therefore not react to the cycle. Chari, Christiano and Kehoe (1994), in a richer model, challenge Barro's (1979) conclusion, arguing that taxes on labor should follow the stochastic properties of the exogenous shocks driving business cycles.

There is, of course, a much closer connection between fiscal policy and the business cycle in the traditional Keynesian IS-LM model, which provides the intuition behind the standard recipe for countercyclical fiscal and monetary policies to stabilize output. This intuition is the basis of most policy discussions on the need for countercyclical policy (IMF 2008).

New Keynesian models have been used to validate the IS-LM intuition in dynamic and optimizing environments. In addition to the richness that a fully specified dynamic model introduces, these models also enable welfare to be explicitly considered. In a static (IS-LM) model, the goal of stabilizing the cycle is taken as a given, while in dynamic New Keynesian models stabilization of economic activity is an outcome of optimal economic policy.

Because price rigidity is the distinguishing factor of these models, the analysis tends to be focused on monetary policy, with the conclusion that stabilization of inflation is the best a central bank can do. And stabilization of inflation coincides with stabilization of output (or what Blanchard and Gali (2007) refer to as the *divine coincidence*). There is also room for the analysis of optimal fiscal policy but the welfare effects of fiscal policy are then closer to the analysis of optimal taxation of the traditional RBC models (Schmitt-Grohe and Uribe (2004 and 2005)).

In discussing output stabilization, there is a sense in which fiscal policy and monetary policy can be seen as substitutes in these models. If a choice is to be made, then monetary policy becomes the preferred policy tool because it is quicker and it is not subjected to political interference (Taylor (2000)). This logic lies behind the belief that fiscal policy should not be used as a stabilizing tool. Interestingly, there is very little discussion on whether it also applies to automatic stabilizers. Potentially, if monetary policy is powerful enough to stabilize the cycle, what is the benefit of automatic stabilizers? Even those who criticize discretionary fiscal policy are more open to the role of automatic stabilizers because of their timing, but this conclusion is rarely linked to a particular model or welfare analysis (Taylor (2000)).

There are, however, instances when monetary policy cannot achieve the first best. In such cases, fiscal policy can step in as a tool to stabilize the business cycle. In particular, instances where monetary policy is constrained by the zero lower bound on interest rates have received much attention in recent years (Eggertsson and Woodford (2003, 2004, 2006)). More generally, in the presence of more than one distortion in the economy, not just price rigidity, monetary policy may not be

enough to bring the economy to the first best and fiscal policy could play a role (Blanchard and Gali (2007)).

The second strand of the literature looks at the cyclical behavior of fiscal policy from a descriptive (positive) point of view. While for the most part these are purely empirical papers, they tend to be framed within two theoretical recipes: the standard Keynesian prescription in favor of countercyclical fiscal policy and the notion of sustainability and therefore the need for fiscal policy to react to debt levels. This literature has developed in part from the observation that fiscal policy in many countries is not countercyclical but procyclical. There is evidence of procyclical fiscal policy among Latin American economies, as documented by Gavin and Perotti (1997) and by Kaminsky, Reinhardt and Vegh (2004). The evidence for OECD and European economies is somewhat mixed. While there are instances where fiscal policy is procyclical, typically we find that policy is either acyclical, slightly countercyclical or countercyclical (Lane (2003), Wyplosz (2005), Fatás and Mihov (2009) or Egert (2010)).

The observation that fiscal policy is procyclical led to a set of theoretical papers that advanced political economy arguments to explain this behavior. Tornell and Lane (1999) talked about the 'voracity effect'. Alesina, Campante and Tabellini (2008) present alternative political economy theories of this behavior, in particular how voters seek to starve governments of resources in order to reduce political rents. This is a source of procyclical spending and the predication that it is more pronounced in countries with a higher degree of corruption is validated by the data.

While most of these papers are about understanding and measuring why fiscal policy is procyclical, they are less concerned about the actual impact that fiscal policy has on output. Exceptions exist such as Woo (2009) and Aghion and Marinescu (2006), who show that procyclical fiscal policy increases the volatility of output and may hurt long-term growth.

The third strand of literature analyzes the effects of fiscal policy on the business cycle. Unlike the second stream, this strand focuses on the reverse causality by asking how fiscal policy affects the characteristics of the business cycle. It can be divided into two separate sub-fields: one dealing with discretionary policy and a second on automatic stabilizers.

Because of econometric considerations, the literature on the effects of discretionary policy on output at business cycle frequency focuses on *exogenous* changes in fiscal policy. These are changes that are, by definition, independent of the business cycle. In this sense, the literature looks at changes in fiscal policy that are not relevant to the potential stabilizing role of government spending and taxes. There remains, however, a belief that the findings can still be informative about the potential stabilizing role of countercyclical fiscal policy under the assumption that exogenous discretionary fiscal policy should have similar effects to endogenous discretionary policy. Earlier work includes Blanchard and Perotti (2002), Fatás and Mihov (2001),

and Burnside, Eichenbaum and Fisher (2004). More recent contributions can be found in Ramey (2011), Perotti (2011), Barro and Redlick (2008).

Finally, a small number of papers investigate the effects of automatic stabilizers by focusing on the effects of budget changes that are automatically triggered by tax laws and spending rules. The literature is possibly less developed than its peers.[2] Empirically, because of endogeneity considerations, it does not provide a dynamic analysis of the effects of fiscal policy, focusing more on the cross-country differences in business cycles, and conditioning for different degrees of automatic stabilizers. This stream started with a seminal paper by Gali (1994), who observed that countries with large governments tended to have less volatile business cycles. Fatás and Mihov (2001) provided broad support for the notion that this correlation could be seen as an estimate of the effectiveness of automatic stabilizers. More recently, Debrun and Kapoor (2010) have provided confirmation of these earlier estimates.

Interestingly, despite the favorable evidence on the effectiveness on automatic stabilizers, there is scant research on how this evidence relates to what we know about discretionary fiscal policy, or how to design better automatic stabilizers. This neglect partly stems from the belief that monetary policy is the right tool to stabilize aggregate demand. But, as mentioned earlier, even those who that argue that fiscal policy should not be used as a stabilizing tool (Taylor (2000)) still support the idea that automatic stabilizers should still be allowed to do their work. [3]

# 3. MEASURING FISCAL POLICY OVER THE CYCLE

Our paper is related to the last two strands of literature discussed in the previous section – those describing the cyclical behavior of fiscal policy and those dealing with its effectiveness as a stabilizing tool. One of the central challenges in both strands is the proper measurement of fiscal policy in relation to the business cycle. In this section we look at different indicators of the cyclicality of fiscal policy but we do so in the context of how it relates to economic models of stabilization. We are not simply interested in describing the cyclical behavior of the fiscal policy but in producing an indicator of how this behavior helps us understand the stabilizing role of this policy, which we refer to here as the 'fiscal policy stance'.

The measurement of fiscal policy over the business cycle requires a good understanding of how each component of the budget reacts to the cycle. Taxes and

[2] As an example of the shortage of academic papers in this area, here are two quotes from the literature in the last 10 years. Blanchard (2000) stated: "In the last 10 years automatic stabilizers have not been discussed much by academics". And five years later the same author said "Very little work has been done on automatic stabilization. JSTOR lists only 11 articles in the last 20 years", Blanchard (2004).
[3] As an illustration of this, one of the earlier papers in this literature was about letting automatic stabilizers "do their thing". Cohen and Follette (2000).

spending are normally designed to react to changes in output, what we call automatic stabilizers. When assessing whether fiscal policy is doing the right thing in a given year we normally want to understand the structural stance separately from the automatic changes that are the result of the tax code and spending laws. A second issue to be addressed is the need to find a benchmark. Do we compare it to last year? Or should we compareg it to a year where output is equal to potential?

As will become clear in our analysis, the answers to these questions will depend on the reasons why we are looking for such and indicator. Some papers look at the construction of a fiscal policy indicator from a normative point of view, as they seek to compare fiscal policy with an optimal benchmark without the influence of the business cycle. Others take a more positive point of view with the goal of describing how fiscal policy changes during the cycle and how that behavior feeds back into the cycle itself. In fact, it could be argued that summarizing fiscal policy with just one variable is an impossible task, hence we should produce a set of measures of the fiscal policy stance that inform us about different aspects of fiscal policy and are relevant for different questions about both the positive and normative side of the analysis. This is the point made in Blanchard (1993), whose arguments we discuss below, beginning with a simple accounting exercise before we introduce an economic model.

## 3.1 Fiscal policy accounting: discretion versus automatic changes

Fiscal policy can be thought of as a collection of tax and spending policies that are incorporated into the government budget. The balance summarizes these policies during the year as the difference between revenues and spending. Let's start with some basic accounting on budget balances and how to interpret changes over the cycle.

The budget balance ($BB$) is written as

$$BB_t = T_t - G_t$$

Taxes and government spending can be seen as functions of the business cycle. Methodologically, it is common to extract from the budget balance the response of taxes and spending which is automatic (i.e. built into the tax code and spending rules). We refer to this component as an automatic stabilizer ($AS$). What remains can be regarded as what the budget balance would have been if output was at a "normal" level (normally captured by potential output) and we refer to that component as the cyclically adjusted balance or $CAB$. Changes in the CAB can also be seen as a measure of discretionary fiscal policy actions.

The calculation of the cyclically-adjusted automatic stabilizers requires using the budget during a normal year as a reference and understanding how deviations from

that normal state of the economy affect taxes and spending. It is common to use the output gap as an indicator of the cycle.

Let's assume for the moment that taxes and spending can be expressed as functions of output and that the $CAB$ is simply expressed as the budget balance that would exist if output were equal to potential:

$$CAB_t = T\left(Y_t^p\right) - G\left(Y_t^p\right)$$

where $T(\cdot)$ and $G(\cdot)$ represent how revenues and spending depend on the level of economic activity.

The $CAB$ is not observed, and specifying the functions $T(\cdot)$ and $G(\cdot)$ and evaluating them at potential output is an impossible task, so the calculation of cyclically-adjusted balances normally requires an indirect approach. We start with the values of taxes and spending that can be observed and then assume a function of how taxes and government spending are automatically affected by the cycle, as captured by deviations from potential output. In other words, we need a four-step approach:

1. Establish a measure of the cycle that is relevant for the automatic changes in fiscal variables.
2. Calculate how current output deviates from the benchmark of that cyclical variable.
3. Measure the elasticity of different tax bases and spending components for such a measure of the cycle.
4. Estimate the elasticities of revenues and spending to those tax bases.

Conceptually the four steps are clear but there are several technical difficulties in their implementation. The first problem is that no single measure of the cycle is responsible for movements in all sources of revenue and spending. While some might react to output, others react to output growth, or the output gap, or unemployment. Moreover, there could be composition effects as the empirical importance of different tax bases changes over time. Finally, the elasticities of taxes and revenues are normally assumed to be stable over time but they are likely to change as a result of changes in tax law or spending policies.

These calculations are done separately for several of the components of the budget. For simplicity we will look at just taxes and spending, and calculate the cyclically-adjusted counterparts as:

$$T_t^{CAB} = T\left(Y_t^p\right) = T_t\left(\frac{Y_t^p}{Y_t}\right)^{\epsilon_T}$$

$$G_t^{CAB} = G\left(Y_t^p\right) = G_t\left(\frac{Y_t^p}{Y_t}\right)^{\epsilon_G}$$

where $\epsilon_T$ and $\epsilon_G$ are the elasticities of taxes and spending relative to potential output.[4]

At this point it is important to highlight that these elasticities simply measure the automatic reaction of taxes and spending to the business cycle. They are normally part of what we call "automatic stabilizers", but so far the only thing that they are capturing is the *automatic* reaction of budget components to the cycle. There is nothing to indicate that these elasticities capture in any way the *stabilizing* effect of fiscal policy. In a sense, we are adhering to the US Congressional Budget Office definition of automatic stabilizers:

*"Automatic stabilizers broadly refer to elements of the budget that work to increase deficits during downturns and reduce them during times of strong economic growth."*

But if we refer to these variables as "stabilizers" it is also because we believe that they are designed to stabilize economic activity, a perspective dealt with in the next section.

## 3.2 Fiscal policy as a measure of the degree of stabilization: the fiscal policy stance

So far we have only looked at how fiscal policy reacts to the cycle. But how does this inform our understanding of the effects of fiscal policy on economic outcomes in a given year? This is normally called the fiscal policy stance, and can refer to both a contractionary or an expansionary stance depending on how fiscal policy contributes to growth.

Measuring the stabilizing effect of fiscal policy is conceptually much more difficult because it requires us to have an economic model in mind. And depending on the economic model that we have in mind, we need to look at a different variable or indicator.

Blanchard (1993) discusses this issue at length. His approach is to present a variety of models to understand how fiscal policy affects aggregate demand and how this can be translated into an indicator of the fiscal policy stance.

In a simple static IS-LM model, this effect will depend on how fiscal policy stabilizes aggregate demand (which in this model is identical to output). There are two forces:

[4] For the sake of simplicity we ignore interest payments from this equation. Hence we do not discuss the differences between overall and primary balance.

1. Spending affects aggregate demand. A high level of government spending relative to private demand will provide a boost to aggregate demand. This boost will stabilize output if spending is high when private demand is low.
2. Taxes can help stabilize disposable income if they move in the opposite direction to income. The effect is not one-to-one because the marginal propensity to consume is lower than one.

The fact that the effect of taxes is not direct but through consumption means that a standard measure of the budget balance, weighting government spending and taxes with the same coefficient, does not accurately capture the aggregate demand effect of fiscal policy. Ideally, we want to adjust taxes by a coefficient that approximates to the marginal propensity to consume. But even without this adjustment, we can see that, within the context of the IS-LM model, measuring expenditures and taxes in relationship to the level of output comes very close to capturing the effect of fiscal policy on economic activity. Based on this logic, Blanchard (1993) concludes that the inflation-adjusted budget balance as a ratio to GDP is a good proxy for the aggregate demand effect of fiscal policy in a given year. So keeping track of how the budget balance (as a percentage of GDP) changes in a given year is a good approximation of the stabilizing effects of fiscal policy.

Moving from a static model to a dynamic one, the relationship between fiscal policy and aggregate demand becomes more complicated. Now what matters for demand and output is not only current but also future fiscal policy. For example, to understand and measure the effects of a change in fiscal policy we need to assess how these changes translate into expected changes in spending and taxes, as well as how they affect other components of aggregate demand and potentially have an effect on the supply side of the economy. Blanchard (1993) shows that the previous result also applies to a simple intertemporal model that deviates from Ricardian equivalence and under the assumption of stable expectations regarding future taxes.

When looking at the change in the budget balance we can separate automatic and discretionary changes, but from the perspective of aggregate demand this is irrelevant – it is the overall balance that matters.

Hence we follow Blanchard (1993)'s recommendation of looking at (change of) the budget balance scaled by GDP as a proxy for the stabilizing effects of fiscal policy. The fiscal policy stance is simply the change of

$$bb_t = \frac{BB_t}{Y_t} = \frac{T_t - G_t}{Y_t}$$

where non-capitalized letters refer to variables expressed as a ratio to economic activity. Changes in this ratio help us understand how fiscal policy stabilizes the cycle.

To compare this with our previous analysis we now want to distinguish between changes in the fiscal policy stance that come from automatic changes and discretionary ones. We define discretionary changes in fiscal policy (from the perspective of this ratio) as changes to the cyclically-adjusted balance as a ratio to potential output. This ratio is simply

$$cab_t = \frac{CAB_t}{Y^p}$$

The automatic component (automatic stabilizers) is defined simply as the difference between the two ratios above

$$as_t = bb_t - cab_t = \frac{BB_t}{Y_t} - \frac{CAB_t}{Y^p} =$$

$$= \frac{T_t - G_t}{Y_t} - \left[\frac{T_t\left(\frac{Y^p}{Y_t}\right)^{\epsilon_T} - G_t\left(\frac{Y^p}{Y_t}\right)^{\epsilon_G}}{Y^p}\right] =$$

$$= \frac{T_t}{Y_t}\left[1 - \left(\frac{Y^p}{Y_t}\right)^{\epsilon_T - 1}\right] - \frac{G_t}{Y_t}\left[1 - \left(\frac{Y^p}{Y_t}\right)^{\epsilon_G - 1}\right]$$

Following Blanchard (1993), we now measure changes in the fiscal policy stance as changes in the budget balance from one year to the next, broken down into discretionary and automatic changes

$$\Delta bb_t = \Delta cab_t + \Delta as_t$$

What is the connection between this expression and the cyclicality of different components of the budget? The change in the fiscal policy stance is a function of two forces. First, there is the obvious connection between this variable and the elasticities of spending and taxes. We want spending to be high and taxes low when income is low so that the budget balance worsens during a recession. But there is a second consideration that matters to the change in the budget balance: the size of government, which in some cases can be the most important factor.

To illustrate this point, let's focus on a simple example where we assume that there is no discretionary change in fiscal policy and that all the action comes from automatic stabilizers. Under these two assumptions, all the variation in the budget balance will be the result of automatic stabilizers. The change in the fiscal policy stance is therefore

$$\Delta as_t = \frac{T_t}{Y_t}\left(1 - \left(\frac{Y^p}{Y_t}\right)^{\epsilon_T - 1}\right) - \frac{G_t}{Y_t}\left(1 - \left(\frac{Y^p}{Y_t}\right)^{\epsilon_G - 1}\right) -$$

$$-\frac{T_{t-1}}{Y_{t-1}}\left(1-\left(\frac{Y^p}{Y_{t-1}}\right)^{\epsilon_{T-1}}\right)+\frac{G_{t-1}}{Y_{t-1}}\left(1-\left(\frac{Y^p}{Y_{t-1}}\right)^{\epsilon_{G-1}}\right)$$

There are several parameters that matter in this equation: the output gap in each of the two periods, the elasticities of taxes and spending, and the size of tax revenues and spending relative to GDP.

We now look at a specific case that is often used in the literature and is not far from the tax and spending systems of many countries around the world. We assume a proportional tax system with a tax rate $\tau$ and a level of government spending that does not react to output. In this case we have $\epsilon_T = 1$ and $\epsilon_G = 0$. In this particular instance, the above expression simplifies to

$$\Delta as_t = \frac{G}{Y^p}\left(\frac{Y_t - Y_{t-1}}{Y_{t-1}}\right)$$

This expression is intuitive. It tells us that when taxes are proportional to income and government spending is constant, the change in the budget balance measured as a percentage of GDP is simply the product of GDP growth and the size of government as measured by government spending as a percentage of (potential) GDP.

The mechanics behind this expression are simple. Under proportional taxes, the ratio of taxes to GDP is constant. The fact that taxes move proportionally with output means that the volatility of disposable income is identical to the volatility of income. This has no stabilizing effect on consumption under the assumption that consumption depends on disposable income.[5]

Why does spending matter when it is acyclical? If spending does not change, the ratio of government spending to GDP increases during the recession. This is the only reason why we see a worsening of the budget balance. And the larger the government, the larger the change in the budget balance.

In the particular case where we assume that the economy was at potential in $t-1$, the above expression is simply

$$\Delta as_t = \frac{G}{Y^p}\, gap$$

[5] The literature is not always clear on this point. Some papers refer to the stabilizing effect of proportional taxes, because a $1 decrease in income leads to an increase in disposable income of less than $1. But in most economic models what matters is the percentage change in these variables and not the absolute change. In a proportional tax system a 1% decline in income translates into a 1% decline in disposable income, i.e. there is no stabilization in percentage terms.

Of course, in a more general case the elasticities of taxes (if larger than 1) and spending (if larger than 0) will also matter for the fiscal policy stance, but what is useful about the example above is that we see a dimension of fiscal policy that matters for stabilization beyond the responsiveness of taxes and spending to the cycle. This dimension is government size. And while the effect we are describing can be seen as simply a mechanical deterioration of the budget balance, from an economic point of view it means that larger governments provide a stronger stabilization of output.[6]

The above expression is one illustration of how government spending (even if unresponsive to the cycle) matters to the fiscal policy stance. The exact expression will depend on our initial assumption that looking at the change in the budget balance is the right way to measure the stabilizing effects of fiscal policy. If we were to start with a different logic, we would end up with a different measure for the fiscal policy stance indicator and, therefore, a different calculation for automatic stabilizers.

Another interesting question is whether government size should be measured as spending or taxes. Fedelino, Ivanova and Horton (2009) and Cottarelli and Fedelino (2010) challenge the above expression on the grounds that what matters for stabilization are taxes, not spending. Their analysis starts with a different logic: It is common practice to normalize the cyclically-adjusted balance by potential output

$$\frac{CAB}{Y^p}$$

If we also use potential output as the scaling factor for the budget balance as our indicator of fiscal policy stance, we end up with the expression

$$\frac{AS_t}{Y^p} - \frac{AS_{t-1}}{Y^p} = \frac{T_t}{Y^p}\left(1 - \left(\frac{Y^p}{Y_t}\right)^{\epsilon_T}\right) - \frac{G_t}{Y^p}\left(1 - \left(\frac{Y^p}{Y_t}\right)^{\epsilon_G}\right) - \\ - \frac{T_{t-1}}{Y^p}\left(1 - \left(\frac{Y^p}{Y_{t-1}}\right)^{\epsilon_T}\right) + \frac{G_{t-1}}{Y^p}\left(1 - \left(\frac{Y^p}{Y_{t-1}}\right)^{\epsilon_G}\right)$$

In the particular case where taxes are proportional to output so its elasticity is equal to 1, and government spending does not react to output so that $\epsilon_G = 0$, we have

[6] To illustrate this logic, we can even think about a government that collects zero taxes. The budget balance is equal to $-\frac{G}{Y}$. If government spending is constant, a downturn will increase the deficit by a factor that is equal to the product of the size of the government and the growth rate of GDP.

$$\Delta \frac{AS}{Y^p} = \tau \left( \frac{Y - Y^p}{Y^p} \right) = \tau \, gap$$

where $\tau$ is the tax rate and $gap$ is the output gap.

So in this instance we again find that the stabilizing contribution of automatic stabilizers is the product of the output gap and government size, but now it is the tax rate and not government spending that captures government size. Why is government size now measured by revenues and not spending? If we use potential output to rescale the budget balance, under the assumption that government spending is constant, the ratio of spending to potential output is constant and therefore does not contribute to changes in the budget balance. But taxes, because they change (proportionally) with output, will generate a change in the revenue to potential output ratio that will be the origin of the change in the budget balance.

Which of the two equations is more informative depends on how we match their logic to an economic model. Blanchard's (1993) analysis is done within a class of models where what matters is the budget balance relative to current output. This makes sense because what matters is the level of taxes and spending relative to the actual level of demand or output. Cottarelli and Fedelino (2010) start their analysis with the argument that it is common to use potential output to analyze the cyclically-adjusted balance. Hence, to be consistent we should also scale the budget balance by the same variable. This is correct, but it is not the right measure of stabilization in the context of an economic model. And this is one illustration of why a model is needed to produce a measure of the fiscal policy stance.

Our analysis so far has focused on automatic stabilizers, but the logic also applies to discretionary changes in response to the business cycle. But in this case the analysis is straightforward. We are looking at discretionary changes in taxes and spending from an exogenous point of view. What matters here is the size of the "shock" and there is no need to measure it in relation to the cycle.

Given the importance of relying on a model to produce an indicator of the fiscal policy stance, it is interesting to understand how the intuition in Blanchard (1993) applies to other models. We show in the next section that this intuition carries over to a dynamic model with "enough" Keynesian. This model will also allow us to frame some of our empirical results.

## 3.3 A model-derived analysis of the fiscal policy stance and the role of government size

We now analyze the effectiveness of fiscal policy as a stabilizing tool in the dynamic model developed by Mankiw and Weinzeri (2011). This is a highly stylized model that captures the aggregate demand effects of monetary and fiscal policy. We refer to their paper for a full analysis of the model. We will ignore their analysis of

optimal monetary policy and simply use their settings and some of their basic results to illustrate the effectiveness of fiscal policy, paying special attention to the role of government size.

There are two periods and the representative household maximizes

$$\max \{u(C_1) + \mathrm{v}(G_1) + \beta\,[u(C_2) + \mathrm{v}(G_2)]\}$$

where $C_t$ is consumption and $G_t$is government spending.

From a welfare point of view, the inclusion of government spending in the utility function is important, but in our analysis, as we do not look at the issue of welfare, this functional form will be irrelevant.

Firms only produce with capital. First period capital is predetermined ($K_1$). The capital stock fully depreciates and the stock of capital in the second period is simply the investment done in period 1. Production in period $t$ is given by the production function

$$Y_t = A_t\, K_t$$

As there is no labor, all the income that the household receives comes from the profits of firms. So the budget constraint of the private sector can be written as

$$P_1(\Pi_1 - T_1 - C_1) + \frac{P_2(\Pi_2 - T_2 - C_2)}{(1+i)} = 0$$

where $T_t$ are the taxes set by governments in each period and $i$ is the nominal interest rate between the two periods.

The only shock to the economy is a change in the technology parameter $A_2$. Although this is a technology shock, it implies a reduction in wealth and leads, under certain assumptions, to a decrease in aggregate demand in the first period.

Fiscal policy sets government spending and taxes on both periods to satisfy a budget constraint

$$P_1\,(T_1 - G_1) + \frac{P_2(T_2 - G_2)}{(1+i)} = 0$$

Because taxes are lump sum and there are no financial constraints, the timing of taxes will not matter in equilibrium (Ricardian equivalence). The only dimension of fiscal policy that matters is government spending.

Households are required to hold money to purchase the consumption good so that

$$M_t = P_t\, C_t$$

The money supply is assumed to be perfectly elastic in the first period, while the central bank sets the nominal interest rate and the money supply in the second period.

Mankiw and Weinzeri (2011) first analyze the equilibrium with flexible prices. We refer to their analysis for the solution to this case. With flexible prices, money is neutral and optimal fiscal policy seeks to maximize consumer welfare by equating marginal utility of consumption and government services.

Since we are interested in a model with Keynesian features, we focus on the case of price rigidity. Following Mankiw and Weinzeri (2011), we introduce price rigidity by fixing the first period price and at a level that is too high. By high we mean that there will be a shortage of demand relative to the potential level of output $A_1K_1$.

Assuming an isoelastic utility function for private consumption

$$u(C_t) = \frac{C_t^{(1-\frac{1}{\sigma})} - 1}{1 - \frac{1}{\sigma}}$$

we will be assuming that $\sigma < 1$, so that a decrease in $A_2$ leads to a decrease in demand in the first period. This assumption ensures that income effects dominate substitution effects.

We obtain the following solution for output in period 1

$$Y_1 = A_2^{(1-\sigma)} \beta^{-\sigma} \frac{M_2}{(1+i)\, P_1} + \frac{M_2}{(1+i)P_1} + \frac{G_2}{A_2} + G_1$$

This equation looks like an aggregate demand curve and, as we can see from the first term, a decrease in $A_2$ reduces aggregate demand (under the assumption $\sigma < 1$). In this setting monetary policy can have a real effect on output. From the perspective of fiscal policy there are two potential scenarios:

1. The central bank can replicate the flexible price equilibrium with a combination of the right interest rate $(i)$ and money supply in period 2 $(M_2)$, so that output in the first period is equal to potential output $A_1K_1$. In this case, optimal fiscal policy is identical to the case of flexible prices. Fiscal policy plays no role in stabilizing output.
2. The central bank cannot replicate the flexible price equilibrium. This is the scenario that Mankiw and Weinzeri (2011) label 'restricted monetary policy'. In this case, optimal fiscal policy will play a stabilizing role. A higher level of $G_1$ will lead to output being closer to its efficient level.

The type of constraints that Mankiw and Weinzeri (2011) have in mind for monetary policy is where interest rates have reached the zero-lower bound and the government is unable to commit to a credible increase in the money supply in period 2 to restore the flexible-price equilibrium.[7] Our analysis does not look at monetary policy, so we do not need to be specific about where constraints come from; we simply assume that monetary policy is unable to bring output equal to potential after setting a certain value for the interest rate and committing to a level of $M_2$. We take those two values as given in the above solution and ask how different fiscal policies contribute to stabilizing the economy.

As discussed earlier, taxes do not show up in this equation because we are under the Ricardian equivalence assumption. But government spending affects current output via two channels. First, $G_2$has a positive effect on output through the effect it has on investment. In addition, it also affects the response of output to a shock. The cross derivative is equal to

$$\frac{\partial^2 Y}{\partial A_2 \, \partial G_2} = -\frac{1}{(A_2)^2}$$

The interpretation of this cross derivative is that larger government spending mitigates the negative effect of a decline in second period productivity. The intuition is that with higher $G_2$, a negative shock to $A_2$ leads to a smaller decline in the first period investment as firms still have to build their capital stock for producing in period 2 to satisfy demand from the government. If $G_1 = G_2$, i.e. government spending is kept constant, then we see that larger governments can stabilize economic fluctuations via the investment channel.

But this is not the effect that we are interested in. We want to focus on the contemporaneous effect that fiscal policy $G_1$has on output $Y_1$. As we can see from the solution of the model, there is a one-to-one connection between the two. In absolute terms a $1 increase in government spending raises output by $1. In other words, we have a multiplier of 1.

We can think about $G_1$reacting to news about $A_2$, but also think simply about a larger government (a higher level of $G_1$). In this instance a larger government stabilizes aggregate demand and as a result output, because we have a model that is demand driven. The stabilization is one-to-one if calculated in absolute terms. But if we think in terms of the volatility of output growth, we then have the following expression (assuming $G_2 = 0$)

$$\frac{\partial \ln (Y_1)}{\partial \ln(A_2)} = (1-\sigma) - \frac{(1-\sigma)}{1 + A_2^{(1-\sigma)}\beta^{-\sigma}} - \frac{(1-\sigma)\, A_2^{(1-\sigma)}\beta^{-\sigma}}{1 + A_2^{(1-\sigma)}\beta^{-\sigma}} \frac{G_1}{Y_1}$$

[7] In their model, the flexible price equilibrium can be achieved even if the nominal interest rate is zero by committing to a large enough money supply in period 2.

$$\frac{\partial \ln (Y_1)}{\partial \ln(A_2)} = \frac{A_2^{(1-\sigma)}\beta^{-\sigma}}{1 + A_2^{(1-\sigma)}\beta^{-\sigma}}(1 - (1-\sigma)\frac{G_1}{Y_1})$$

So the volatility of output growth decreases with government size (under the assumption that $\sigma < 1$).

Mankiw and Weinzeri (2011) also consider the case where a proportion of consumers is financially constrained and their consumption depends on disposable income. In this case we obtain two additional effects:

1. A larger multiplier for government spending, as the stabilization of income that $G_1$ provides also leads to a more stable disposable income and therefore a more stable consumption. In this scenario, government size also helps stabilize private consumption.
2. Taxes matter for stabilization. In particular, a low value of $T_1$ helps keep disposable income stable and therefore consumption stable.

In summary, we end up with an intuition that is similar to the static IS-LM model. What matters for stabilization is how spending and taxes affect aggregate demand. High spending and low taxes relative to the current level of income raise aggregate demand and stabilize economic activity.

How general is this result? The above analysis is certainly specific to a class of models. In particular it is a model of stabilization of aggregate demand that is only relevant to theories where demand is relevant for output determination in the short run. Moreover, it ignores other potential effects of fiscal policy in terms of volatility. For example, government size or distortionary taxation can affect steady state levels of employment or investment and therefore affect the response of these variables to shock. Indeed this is the analysis of Gali (1994), who looks at the effects of government size on the volatility of GDP in a standard RBC model with technology shocks. Government size measured by taxes is destabilizing because the more distortionary they are, the higher the elasticity of labor to productivity shocks (lower steady state employment). When it comes to government spending, and depending on how spending behaves over the cycle, we can get a small stabilizing effect. Gali (1994)'s model is an RBC model with optimizing agents without financial constraints. Andrés, Domenech and Fatás (2008) extend Gali's (1994) model to incorporate Keynesian effects via price rigidities and consumers who are financially constrained. In their analysis, if these effects are strong enough we can again generate results that are similar to those of Mankiw and Weinzeri (2011). In particular, in that model government size stabilizes output (both total output and private demand).

## 3.4 From theory to empirics: estimating fiscal policy reaction functions.

A large body of empirical literature has analyzed the relationship between business cycles and fiscal policy. This relationship goes both ways: we want to understand how fiscal policy reacts to business cycles as much as we want to assess the effect that fiscal policy has on business cycles.

The empirical analysis of fiscal policy variables tends to be done in the context of fiscal policy reaction functions that capture the behavior of governments. To be more explicit, let's think about a standard fiscal policy reaction function such as

$$FP_t = \alpha + \beta_1 Cycle_t + \beta_2 Z_t$$

where $FP_t$ is an indicator of fiscal policy.

Of all the determinants of fiscal policy, we highlight one: the economic cycle itself ($Cycle_t$). The other determinants are included in the vector $Z_t$. Within this vector we normally include the level of debt to incorporate (sustainability). It is also possible to think about interactions between different variables where, for example, the reaction of fiscal policy to the cycle is a function of the level of debt.

As argued in the previous section, these reaction functions are designed to understand the behavior of governments and cannot simply be interpreted as a way of assessing the stabilizing effects of fiscal policy. In other words, the cyclicality of a certain fiscal policy variable does not capture the strength of that variable as a stabilizer.

To illustrate this point again – but now in the context of empirically estimated policy reaction functions – let's think about the stylized example discussed earlier: a government where there are no discretionary changes in fiscal policy and where all the action comes from automatic stabilizers. For simplicity, we will think about two components of the budget: taxes and spending, and ignore issues of different taxes or spending categories. We also ignore the issue of interest payments to keep the analysis as simple as possible.

Let's start by capturing the business cycle by output growth and measure revenues and taxes as growth rates as well. We then have regressions of the type

$$\Delta t_t = \alpha + \beta_1^T \Delta y_t + \beta_2^T Z_t + \varepsilon_t^T$$

$$\Delta g_t = \alpha + \beta_1^G \Delta y_t + \beta_2^G Z_t + \varepsilon_t^G$$

where non-cpaitalized letters denote natural logarithms and $Y$ is output. The parameters $\beta_1^G$ and $\beta_1^T$ represent the elasticities of spending and taxes to output growth. They are the empirical counterparts of $\epsilon_G$ and $\epsilon_T$ in our theoretical analysis.

Let's think about the case where the elasticity of spending is zero (government spending is constant). If we were to run these regressions, we would get $\beta_1^G = 0$, and $\beta_1^T$ would be positive and a function of the progressivity of the tax system. We would normally use the expression "government spending is acyclical" and taxes are "countercyclical" in the sense that revenues increase when output increases so that disposable income increases by less than output.

We now move to the budget balance as a percentage of GDP as a measure of the fiscal policy stance. This, again, is the empirical counterpart of our earlier analysis:

$$\Delta \frac{T_t - G_t}{Y_t} = \alpha + \beta_1^B \Delta y_t + \beta_2^B Z_t + \varepsilon_t^B$$

Under the above assumptions, where spending is constant but taxes react to output, $\beta_1^B$ will be positive. We will be referring to countercyclical fiscal. The parameter $\beta_1^B$ is just the semi-elasticity of the budget balance relative to output, and it is this that informs us of the fiscal policy stance. How does the value of $\beta_1^B$ relate to the elasticities of each of the budget components?

In the case where spending is constant and the tax rate can be expressed as a function of income $\tau(Y)$, it can be shown that

$$\beta_1^B = \tau'(Y)\, Y + \frac{G}{Y}$$

In the case where taxes are simply proportional to output $\tau'(Y) = 0$, the expression simplifies to

$$\beta_1^B = \frac{G}{Y}$$

This is the same result discussed in the previous section. The stabilizing effects of fiscal policy in this particular case can be approximated by the size of the government measured by the ratio of spending to output. In other words, acyclical spending combined with proportional taxes help stabilize output by a factor that is simply the size of government.

The confusion in the empirical literature comes from the fact that the coefficients $\beta_1^G$ and $\beta_1^T$ are sometimes interpreted as a measure of the strength of automatic stabilizers. While from an economic point of view what matters is $\beta_1^B$, which does depend on these two other elasticities, it also depends on the size of government. In the extreme case above, when $\beta_1^G = 0$ and $\beta_1^T = 1$ (a standard assumption in the literature), the only thing that matters is the ratio of government expenditures to GDP.

### 3.5 Fiscal policy reaction functions: behavior or stabilization?

A different but related issue is the question of how comprehensive these policy reaction functions should be. Many other variables could be included in the estimation. We can think about these reaction functions as representing the behavior of the government to economic and political variables. One of the variables to be included is, of course, a measure of the cycle, but we can also include others if we want to understand all the determinants of fiscal policy including, in some cases, channels through which the cycle might lead to movements in components of the budget.

For example, Beatrix and Lane (2010), when looking at the behavior of fiscal policy during the 2008-09 period, run regressions of the type

$$\Delta \frac{T_t - G_t}{Y_t} = \alpha + \beta_1^B \Delta y_t + \beta_2^B U_t + \beta_3^B Debt_t + \beta_4^B Housing_t + \varepsilon_t^B$$

where they include several variables that capture the business cycle (output growth and unemployment) because some components of the budget react to one, while others react to the other, debt because of sustainability concerns, and variables that capture the housing cycle (possibly prices or activity) because variation in taxes could be a function of this sector.

Is $\beta_1^B$ the right measure of the degree of stabilization that fiscal policy provides? No, according to our interpretation. For example, when comparing two economies, looking at the coefficient on output growth cannot be interpreted as the strength of fiscal policy as a stabilizer. The above expression is about behavior, it is no longer one of stabilization. What matters for the strength of the stabilizers is the *unconditional* co-movement between the budget balance and the cycle. For this reason, the following analysis will be done using simple reaction functions that capture the cyclicality of policy without trying to understand the channels through which these effects happen.

## 4. Empirical Analysis

We now provide an analysis of fiscal policy in OECD countries. The choice of these countries is partly due to data availability, but also to have, as far as possible, a homogeneous sample so that we can concentrate our analysis on differences in fiscal policy. We use a sample of 23 OECD economies. Details on the countries and data sources can be found in the appendix.

### 4.1 Fiscal policy stance in a panel of 23 countries

Our baseline specification is

$$FP_t = \alpha + \beta_1 Cycle_t + \beta_2 Z_t + \varepsilon_t$$

Our starting point is the framework developed earlier. We are interested in understanding how fiscal policy reacts to the cycle and how this reaction is related to stabilization of output. Our focus will be on the reaction of the budget balance, measured as a percentage of GDP to the business cycle. We will also look at components of the budget to better understand the observed movements in the balance.

We expect the coefficients for each country to be different and will seek to explain these differences later in our analysis, but as a starting point we begin with a set of panel regressions. The advantage of panel regressions is the size of the sample, which allows a much more consistent description of the data and the average behavior of fiscal policy.

Table 1 provides the results of running eight different specifications for the budget balance (as a percentage of GDP). We keep the control variables to a minimum. In some of the specifications we include the lagged value of gross government debt. As indicated, our interest is not in fully describing the behavior of governments but in an understanding of how fiscal policy moves in response to business cycles.

We will be agnostic about the econometric specification, and for this reason we include regressions in differences and levels with the lagged value of the endogenous variable on the right-hand side. We measure the business cycle in two ways: using output growth or the output gap. While the output gap is a more natural choice to measure the business cycle, it is not observed and there are always methodological questions on its measurement. In addition, for some countries output growth seems to provide a better description of the cycle from the perspective of fiscal policy (see Fatás and Mihov (2009)).

The results across all eight columns of Table 1 are consistent. The budget balance moves in a countercyclical manner, regardless of the measure of the cycle used or the econometric specification.[8] The coefficient is in the range 0.3-0.5. It tends to be higher when we control for the lagged value of debt. These results are consistent with previous results in the literature (See Egert (2010) for a recent survey).

Table 2 displays the results of running the same eight specifications, but we now use the primary balance as opposed to the general balance. The numbers are almost identical to those in Table 1, as expected. The behavior of interest payments over the cycle does not make a large difference to the cyclicality of the budget balance. Because of this similarity, going forward we will limit our analysis to the overall balance instead of the primary balance.

[8] We use the term countercyclical to refer to fiscal policy which is supposed to stabilize the business cycles. This means higher taxes, higher balance and lower spending during expansions.

The interpretation of the coefficients on Tables 1 and 2 is straightforward. When output growth falls by 1%, the budget balance deteriorates by about 0.3-0.5% as a ratio to GDP.

How much of that change is caused by automatic stabilizers and how much is due to discretionary changes in policy? Table 3 replicates the results in the previous two tables, but the dependent variable is now the cyclically-adjusted balance. The coefficient on the cycle is much smaller. We now have a range of 0.09-0.2. This is expected, as automatic stabilizers are larger in size than discretionary changes in policy. The size of automatic stabilizers can be read as the difference between the two coefficients, which is somewhere around 0.3. Because the cyclically-adjusted balance is constructed from estimated elasticities of taxes and spending, this coefficient is simply an estimate of the elasticities used in that calculation. The elasticities provided by the OECD are indeed around that value for the OECD group (Andre and Girouard (2005)).

Where is the cyclicality of the budget balance coming from? Is it about changes in taxes or about changes in spending?

We start with a specification where we look at the response of tax growth rates on the two measures of the cycle. Table 4 presents the results. The coefficient is very close to 1 when we use the GDP growth rate and about 0.9 when using the output gap. This is consistent with previous results in the literature: where it has been shown the elasticity of taxes is around 1, taxes are close to being proportional to output. The last columns of Table 4 present the results of running a specification where we regress the change in the revenues-to-GDP ratio on the cycle. This specification is the closest to that run for the budget balance. The coefficient is close to zero and insignificant when using output growth, and significant but small when using the output gap. In other words, the ratio of revenues to GDP is close to being acyclical and does not contribute to the change in the budget balance (measured as a percentage of GDP). This is consistent with the fact that taxes move proportionally with output.

We now run the same regression but for government expenditures. Table 5 displays the results. When regressing the growth rate of expenditures on output growth, we find that spending is mildly countercyclical or acyclical. When measuring the cycle with the output gap, we find spending to be acyclical or procyclical but with a small coefficient. Even in cases where the coefficient is positive and significant, spending reacts less than one-to-one to changes in output. And because spending does not react much to output, the spending-to-GDP ratio is clearly countercyclical as it goes up when output decreases, as shown in the last columns. So during recessions, government spending is high relative to the other components of output. And this is the result of the not very strong response of spending to the cycle.

Therefore, the result that the government balance worsens in recessions when measured as a percentage of GDP can be seen as the result of taxes moving one-to-one with GDP and spending remaining stable and its ratio increasing during recessions. This reading of the data is not far from the theoretical example we have contemplated several times in previous sections, where we assumed unit tax elasticity and a zero spending elasticity. In this particular scenario, the cyclical semi-elasticity of the budget balance (measured as a ratio to GDP) should be similar to the size of government. And this is indeed what we find. The semi-elasticity of the budget balance as measured by the coefficient on the cycle in Tables 1 to 3 is close to the average government size for our sample (about 40% as measured by spending).

All the regressions we have run above are descriptive and cannot be interpreted in terms of causality. In fact, the very fact that we are discussing the stabilizing role of fiscal policy implies that fiscal policy has an effect on output so we need to take care of reverse causality. The literature has struggled with the issue of endogeneity and there is no consensus on how to completely avoid the endogeneity problem. Many of the papers use OLS, and those which use instrumental variables tend to make use of either lags or measures of the cycle in the US or the rest of the world. We check whether the use of instrumental variables affects our results by running some of our regressions instrumenting the cycle with the weighted sum of either GDP growth or the output gap for all other countries (a method used in Gali and Perotti (2003) and several other papers in the literature).

Results are presented in Table 6. The results are not far from the OLS results presented in Table 1. The budget balance reacts positively to the business cycle. The size of the coefficient is always higher than we obtained using OLS. One possible interpretation is that if countercyclical policy (say an increase in government spending during recessions) is helping to stabilize output, this would induce a negative correlation between the budget balance and output growth that would bias downwards the OLS regressions of Table 1. This is partly confirmed by the results in Table 7 that applies instrumental variables just to the cyclically-adjusted balance. These coefficients are much larger than when using OLS, suggesting that the bias in the OLS estimates is coming from discretionary changes in fiscal policy and not automatic stabilizers, as expected.

We now check whether the above responses are different if we restrict our sample to more recent years. In particular, we restrict our sample to the post-1990 period. The reason for choosing this period is that we have a monetary policy regime that is stable and similar for most economies (characterized by low and stable inflation). During the 1990-2010 period most countries have seen three recessionary periods around the early 1990s, 2001-2003, and the most recent recession.

Tables 8 to 10 reproduce our first three tables for the post-1990 period. We find that the budget balance is more responsive to changes in the cycle in this shorter sample. Comparing Table 1 and Table 8, we find that regardless of the column, the

coefficient on the cycle is larger in the post-1990 period. When comparing Table 2 and Table 9 (for the primary balance) we find that the response is closer when comparing both samples. This is probably an indication that some of the increased countercyclicality that we observe in the post-1990 sample is due to interest rates being more countercyclical in that sample. When looking at the cyclically-adjusted balance we also see that there is a small increase in countercyclicality in the post-1990 sample.

From this exercise we conclude that fiscal policy is overall countercyclical in these countries and that the countercyclicality has increased in the last part of the sample. Tax elasticities are close to one, while spending is not far from being acyclical. The empirical estimates are close to the theoretical exercise we have explored before of proportional taxes and stable spending. In this environment the cyclical semi-elasticity of the budget balance is driven by government size. The panel regressions do not allow us to explore differences across countries in some of these parameters. This is done in the next section.

## 4.2. Response of individual countries

We now look at the behavior of fiscal policy for individual countries. The advantage of fitting a fiscal policy rule for each country is that we allow parameters to differ across countries. We expect these parameters to be different and we plan to explore these differences by analyzing the cross-country variability. The disadvantage of using country data is that the number of observations is smaller and therefore the analysis becomes noisier. In addition, from a presentation point of view it is more difficult to summarize the large number of estimated parameters.

We start with an analysis of the budget balance as in the panel regressions. In order to maximize the number of observations, we use the simplest specification where we run the budget balance just against a measure of the cycle without debt as a control. And we do so for the overall budget balance, the cyclically-adjusted one and the one labelled 'automatic stabilizers' (which is simply the difference between the previous two).

Table 11 displays the results. Given the number of regressions and specifications, we simply include the value and significance of the coefficient on the measure of the cycle. The first six columns are a regression of the budget balance as a percentage of GDP on either output growth or the output gap. The last three columns include a linear and quadratic trend, which makes a difference for countries with large swings in the fiscal balance (such as Japan).

Overall we find that fiscal policy is countercyclical in most countries and the coefficient is significant at the 10% level or better for all except five countries. When we focus on the two components of fiscal policy, automatic versus discretionary, we find that in the case of automatic stabilizers we consistently get a strong significance

and countercyclical policy. This should not be a surprise given that the mechanisms behind automatic stabilizers, proportional or progressive taxes, and stable government spending are present in all these countries.

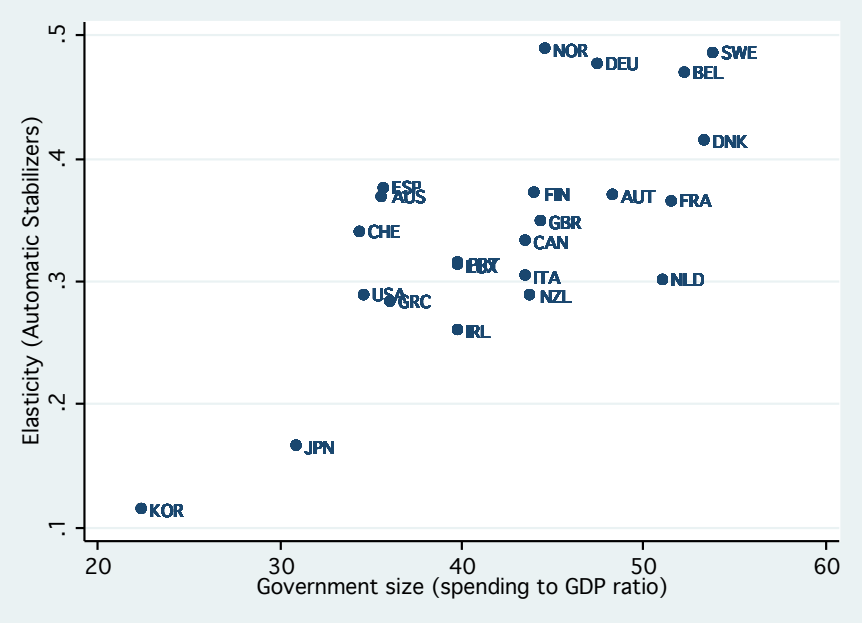
More specifically, we are looking at a coefficient of a regression such as

$$\Delta as_t = \alpha + \beta \Delta y_t + \varepsilon_t^B$$

We know from the panel regressions that taxes are almost proportional to output and that spending is not that reactive. In this environment, $\beta$ is just the size of government as measured by spending.

In Figure 1 we plot this coefficient against government size (measured as total government spending as a ratio to GDP). As expected, the correlation is strong and not far from the 45 degree line. There is, of course, some noise around it because of the use of a regression and the fact that taxes and spending are not perfectly described by a proportional tax system and stable spending.

**Figure 1. Government size and the cyclical semi-elasticity of automatic stabilizers**




When it comes to discretionary fiscal policy there are large variations across countries. For most countries we cannot reject the hypothesis that the coefficient is zero, i.e. discretionary fiscal policy is acyclical. There are, however, some countries where discretionary fiscal policy is clearly countercyclical. For example, for the US, Norway, Ireland, Canada and Australia the coefficient is significant at less than the 1% level. The coefficient is large for some of these countries.

In the US, countercyclical discretionary policy is almost as large as automatic stabilizers. This is very different from a country like Germany where all the countercyclical behavior of the budget balance is coming from automatic stabilizers and the coefficient in discretionary fiscal policy is in fact negative, although close to zero and non-significant.

Table 12 checks whether we have seen significant changes in these individual country coefficients in the post-1990 sample. Confirming what we observed in the panel regressions, we see that in most countries fiscal policy has become more countercyclical in the post-1990 period. Most of the change is due to changes in discretionary fiscal policy.

In the case of the US, the coefficient on the overall balance has increased from 0.54 to 0.84 and all this increase is due to a more responsive discretionary fiscal policy. We observe a very similar phenomenon for the UK and Canada, where discretionary fiscal policy has changed from being acyclical to clearly countercyclical.

As before, we now check whether the use of instrumental variables changes our conclusions. We replicate the regressions for the three measures of the balance for the post-1990 period using the same instrument as in Table 6, and we compare the results to the OLS coefficients. The results (Table 13) show that the use of instrumental variables consistently leads to higher coefficients for all countries and that the difference comes from discretionary fiscal policy. Beyond this difference, the results look very similar to those in the OLS regressions. For example, the same list of countries appears to be more aggressive when it comes to the use of discretionary fiscal policy.

Are the observed differences in fiscal policy due to differences in tax behavior or spending behavior? We start with the analysis of revenues in Table 14. As in the panel, we look at the growth rate of revenues, the growth rate of cyclically-adjusted revenues and the change in the revenue to GDP ratio. For completeness, we look at both the full sample and the post-1990 period.

Tax elasticities tend to be close to 1 and cyclically-adjusted taxes tend to be less countercyclical (in many cases they are acyclical). There are some interesting changes from the full sample to the post-1990 sample. For example, the UK has a strong countercyclical policy after 1990 but not if we look at the full sample. Interestingly, four Anglo-Saxon countries are the ones where taxes react more than one-to-one to changes in output so that the ratio of taxes to income becomes countercyclical in the post-1990 period. There are other countries (Norway and Spain) where policy is also countercyclical, although not significant in all specifications.

To complete the analysis, Table 15 presents a similar analysis for spending. If we focus on the post-1990 sample, there are countries that engage in both

countercyclical tax and spending policy (such as the US or Canada). Others, such as Ireland, have countercyclical spending but acyclical taxes.

In the case of the US, we confirm that fiscal policy after the 1990s has become much more countercyclical when looking at spending.

## 4.3 Automatic stabilizers and discretionary policy: substitutes?

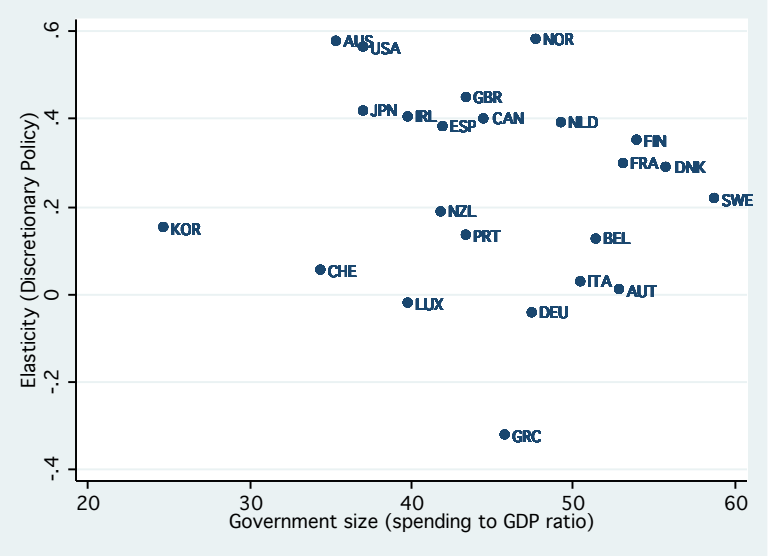
In our analysis we argue that the fiscal policy stance should be measured by the cyclicality of the budget balance, and the degree to which the budget balance is countercyclical is a good indicator of the stabilizing effects of fiscal policy. But we have also seen that some countries have large automatic stabilizers, while others rely more on discretionary fiscal policy. Does discretionary fiscal policy serve as a substitute for small automatic stabilizers?

This is a possibility given that the degree of automatic stabilizers is to a large extent determined by government size. Countries choose government size for reasons other than stabilization and, given those choices, some countries end up with stronger stabilizers. Assuming preferences for stabilization to be similar across countries, we would expect to see the countries with smaller governments being more aggressive when it comes to the use of discretionary fiscal policy.

Figure 2 shows that there is some evidence of this behavior. We focus our analysis on the post-1990 period to get a more consistent and balanced sample of years across countries. We plot the countercyclicality of discretionary policy on the vertical axis against government size on the horizontal axis (as an indicator of automatic stabilizers).

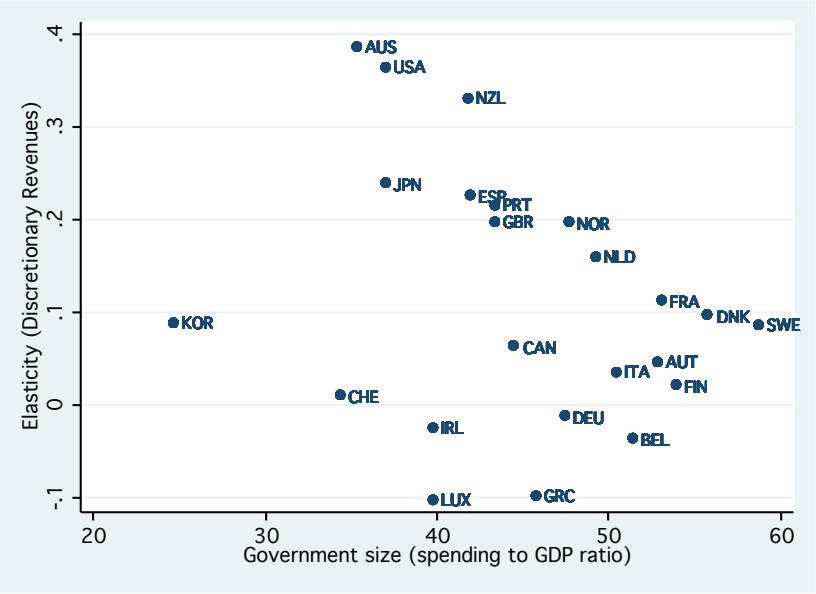
The relationship is negative, although a regression produces a non-significant estimate partly because of the presence of outliers (such as Greece). But for some countries we see clearly that countercyclical policy is related to smaller government. And for some of the countries with large governments the aggressiveness of fiscal policy is smaller.

**Figure 2. Government size versus discretionary policy (post-1990 sample)**




Similar evidence can be derived by just looking at the countercyclicality of discretionary taxes (measured as movements in the cyclically adjusted revenues-to-GDP ratio (Figure 3).

**Figure 3. Government size versus (revenues) discretionary policy (post-1990 sample)**



## 4.4 Are recessions different? Was the Great Recession different?

Our analysis has looked at the cyclical behavior of fiscal policy over a large number of years. We have treated all years similarly, whether they were expansion years or recessions. There are reasons to believe that fiscal policy can be asymmetric, in particular more countercyclical during recessions. The issue of asymmetric fiscal policy has been analyzed in the literature with mixed results (Sorensen and Yosha (2001), Lane (2003), Wyplosz (2002), Balassone, Francese (2004), Egert (2010)).

We look for asymmetries in our sample by modifying our panel regressions. In particular, we create a dummy variable that takes the value 1 if the output gap is below -1%. We use this cut-off as an indicator of a significant recession. We interact this dummy with the business cycle and run a regression similar to those in Tables 1 to 3. Results are shown in Table 16 for the overall balance and Table 17 for the cyclically-adjusted balance. We find that the interaction term tends to be positive but only significant when measuring the cycle by the output gap.

We repeat a similar analysis but the dummy variable now takes the value 1 for the years 2008 and 2009 and we also interact it with the cycle. Tables 18 and 19 reproduce the results. In some specifications we include both the interaction with the last recession and with recessions in general (as in Tables 16 and 17). In all cases we see that the interaction is positive and significant, signaling that relative to a typical year the behavior of fiscal policy was more countercyclical during the last recession. This effect is to some extent due to the stronger aggressiveness of discretionary fiscal policy, as shown in Table 18. [9]

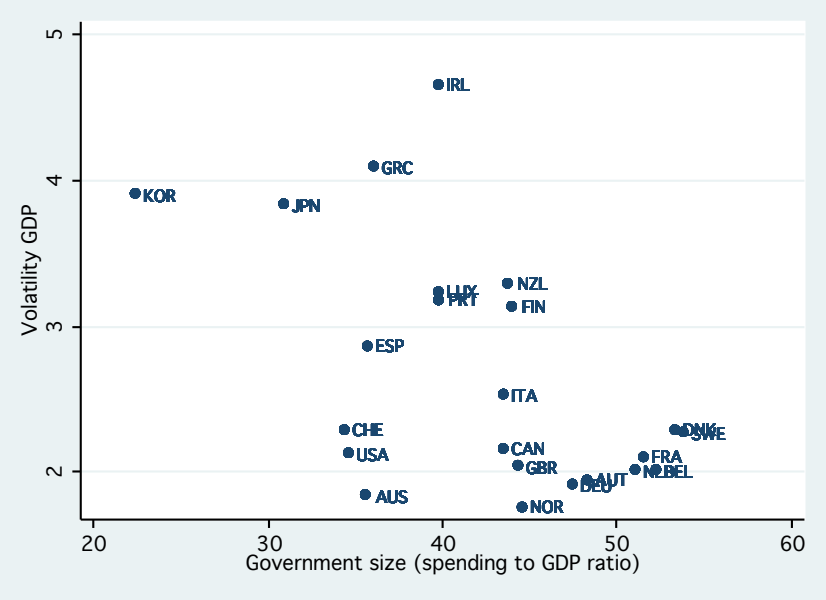
## 4.5 Effectiveness of fiscal policy

We have looked at the countercyclicality of fiscal policy as an indicator of the degree to which fiscal policy stabilizes output. Our interpretation of this coefficient is based on theoretical arguments derived from a framework where stabilization of aggregate demand matters. But our empirical analysis so far has not shown in any way that such behavior of fiscal policy provides any stabilization of economic activity. What do we know about the effectiveness of fiscal policy? The coefficient we have been analyzing has two components: the discretionary and the automatic part. When it comes to the effects of discretionary fiscal policy, empirical work has measured the multiplier effects of discretionary changes in fiscal policy, but it focuses only on exogenous changes – never those that are a response to business cycles. The reason for this is because econometrically they need to deal with exogenous events. In addition, the evidence is subject to a debate with very limited consensus on the size of the multiplier.

[9] Beatrix and Lane (2010) produce a detailed analysis of the fiscal response to the 2008-09 recession although in their results the cyclicality of fiscal policy looks is more similar to that of previous events.

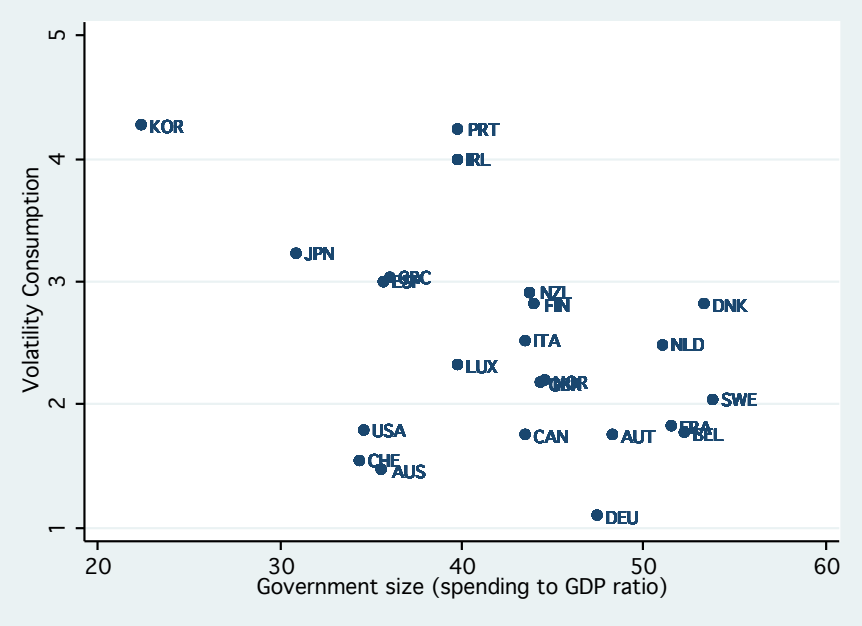
When it comes to automatic stabilizers, research has looked at their effects using a cross section of countries and the logic that government size is responsible for most of the automatic response of the budget balance (as a percentage of GDP) to the cycle. Because government size can potentially be seen as an exogenous variable to volatility, we can run a regression of volatility of output on government size to check the effectiveness of automatic stabilizers. We do not replicate here all the results in the literature, but we want to show that the same result applies to our sample. Figures 4 and 5 below show that there is a negative correlation between government size and the volatility of both GDP and consumption, as suggested by our model in Section 3.

**Figure 4. Automatic stabilizers (government size) and volatility of GDP growth**




Of course, the correlation of the figure does not imply causation, but Fatás and Mihov (2001) show that the result is robust to a large number of controls and the use of instrumental variables. More recently, Debrun and Kapoor (2010) have updated the analysis and shown that the result is robust to a variety of samples and specifications. In addition, and in the context of a simple Keynesian model, Fatás (2009) has calculated that the correlation between government size and the volatility of GDP requires parameters that will generate a fiscal multiplier of about 1.6-1.8. This multiplier is not far from those calculated in the literature that looks at discretionary fiscal policy. In particular, those studies that look at recessionary episodes (where the automatic stabilizers matter), tend to obtain higher estimates of multipliers.

**Figure 5. Automatic stabilizers (government size) and volatility of consumption growth**




# 5. Conclusions

The 'great recession' has brought fiscal policy back to the centre of discussion among both academics and policy makers. After years in which it was seen as a poor stabilization tool and always second to monetary policy, the limitations faced by central banks when reaching the zero-lower bound on interest rates has led to a renewed interest in the stabilization potential of fiscal policy.

Our paper provides an analysis of the stabilization effects of fiscal policy among OECD economies. Our starting point is to build a framework to measure the potential stabilizing effects of changes in spending and revenues. This framework cannot simply be an accounting exercise; it requires an economic model. We follow Blanchard (1993) and present a model along the lines of Mankiw and Weinzerl (2011) where aggregate demand determines output. In this context, the stabilization effects of fiscal policy are related to two factors: the cyclical elasticities of spending and taxes as well as government size. The first factor is straightforward and well recognized in the literature: lower taxes and higher spending during a recession help stabilize aggregate demand. The second factor, government size, is not properly understood. To illustrate its importance, we study a particular case where taxes are proportional to income and spending is acyclical. In this case, what matters for stabilization of aggregate demand and output is simply the size of the government (as measured by the spending to GDP ratio).

When we look at the data, we find that for a panel of OECD countries this scenario is not far from reality. On average, for the period 1960-2010, taxes among these countries are close to being proportional to output and spending does not react much to business cycles. The main stabilizing factor is therefore the size of government. This is the key channel through which automatic stabilizers operate and discretionary policies are small compared to automatic stabilizers.

There are interesting differences across countries and over time. Some countries make more use of discretionary policy. In particular, we find that Anglo-Saxon economies are more aggressive when it comes to discretionary fiscal policy. In some cases we show that this can be seen as a reaction to the fact that government size and therefore automatic stabilizers are small in these countries. We also find that in recent decades there has been a change towards stronger use of discretionary policy among many of the OECD economies.

While most of our paper is about describing the behavior of fiscal policy as a stabilization tool, we conclude with some evidence about its effectiveness in terms of reducing volatility in both output and private consumption.

From a policy point of view, our paper makes clear that for many of the OECD economies fiscal policy has been a stabilizing tool, mostly through the mechanical way in which large governments seek to stabilize aggregate demand. This stabilization is not by design. The size of governments is not determined by calculations about what constitutes optimal stabilization policy but by political choices. In addition, and from a welfare point of view, government size has implications that go beyond the potential benefits of stabilization.

Countries with smaller governments, such as the US, show a more aggressive use of discretionary fiscal policy, which can be seen as a substitute for the lack of strong automatic stabilizers. But as the experience of the last three years has shown, relying on quick political decisions to achieve changes in fiscal policy may be less than ideal.

Given the strong role that government size plays as the stabilizing mechanism of fiscal policy and the fact that discretion may not be a solution either, the question is whether we can design automatic stabilizers that rely less on the size of government but are still automatic and therefore not subject to political debate and interference. Theoretically this is possible, although there is limited academic research on the subject. Moreover,there are both political and technical challenges to be overcome. On the technical side, the biggest difficulty will be to find an objective and accurate measure of cyclical fluctuations that can be used as an automatic trigger of fiscal policy actions. On the political side, the challenge will be to design stabilizers in a way that are seen as independent of other (political) goals.

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# 7. Data Appendix

All data are from the OECD Economic Outlook. Sample period is 1960-2010 although data availability is uneven across countries and variables. The variables used in the analysis and the corresponding codes are:

Overall balance: NLG
    As a ratio to GDP: NLGQ
Primary Balance: NLGX
    As a ratio to GDP: NLGXQ
Government spending: YPGT
    As a ratio to GDP: YPGTQ
Current disbursements: YPG
    Current disbursements as % of GDP: YPGQ
Current receipts: YRG
    Current receipts as % of GDP: YRGQ
Total receipts: YRGT
    Total receipts as % of GDP: YRGTQ
Cyclically-adjusted overall balance: NLGA
    As % GDP: NLGQA
Cyclically-adjusted primary balance: NLGXA
    As % of potential GDP: NLGXQA
Cyclically-adjusted current disbursements: YPGA
    As % of potential GDP: YPGQA
Cyclically-adjusted current receipts: YRGA
    As % of potential output: YRGQA
Real GDP: GDPV
Output gap: GAP
Debt as % of GDP: GGFLQ

# TABLE 1. Cyclicality of Budget Balance

| | (1) ΔBB/GDP | (2) ΔBB/GDP | (3) BB/GDP | (4) BB/GDP | (5) ΔBB/GDP | (6) ΔBB/GDP | (7) BB/GDP | (8) BB/GDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.354*** | | 0.378*** | | 0.531*** | | 0.527*** | |
| | (0.0241) | | (0.0232) | | (0.0301) | | (0.0296) | |
| Output Gap | | 0.271*** | | 0.388*** | | 0.364*** | | 0.503*** |
| | | (0.0314) | | (0.0311) | | (0.0342) | | (0.0341) |
| Lagged BB/GDP | | | 0.842*** | 0.763*** | | | 0.893*** | 0.741*** |
| | | | (0.0173) | (0.0215) | | | (0.0206) | (0.0242) |
| Lagged Debt/GDP | | | | | 0.0231*** | 0.0223*** | 0.0186*** | 0.0148*** |
| | | | | | (0.00326) | (0.00390) | (0.00331) | (0.00367) |
| Constant | -1.200*** | -0.0423 | -1.561*** | -0.527*** | -2.911*** | -1.388*** | -2.841*** | -1.402*** |
| | (0.0953) | (0.0755) | (0.0994) | (0.0828) | (0.230) | (0.248) | (0.226) | (0.229) |
| Observations | 916 | 787 | 916 | 787 | 704 | 670 | 704 | 670 |
| R-squared | 0.195 | 0.089 | 0.762 | 0.720 | 0.330 | 0.170 | 0.767 | 0.735 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 2. Cyclicality of Primary Budget Balance

| VARIABLES | (1) ΔPBB/GDP | (2) ΔPBB/GDP | (3) PBB/GDP | (4) PBB/GDP | (5) ΔPBB/GDP | (6) ΔPBB/GDP | (7) PBB/GDP | (8) PBB/GDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.423*** | | 0.347*** | | 0.474*** | | 0.501*** | |
| | (0.0276) | | (0.0230) | | (0.0345) | | (0.0292) | |
| Output Gap | | 0.322*** | | 0.329*** | | 0.333*** | | 0.463*** |
| | | (0.0339) | | (0.0311) | | (0.0369) | | (0.0344) |
| Lagged PBB/GDP | | | 0.848*** | 0.789*** | | | 0.857*** | 0.728*** |
| | | | (0.0189) | (0.0225) | | | (0.0207) | (0.0246) |
| Lagged Debt/GDP | | | | | -0.0211*** | -0.0178*** | 0.0197*** | 0.0209*** |
| | | | | | (0.00377) | (0.00420) | (0.00318) | (0.00360) |
| Constant | -3.424*** | -2.313*** | -1.157*** | -0.00503 | -2.304*** | -1.231*** | -2.600*** | -1.200*** |
| | (0.110) | (0.0815) | (0.0911) | (0.0708) | (0.264) | (0.267) | (0.223) | (0.228) |
| Observations | 905 | 786 | 905 | 786 | 700 | 670 | 700 | 670 |
| R-squared | 0.210 | 0.106 | 0.726 | 0.698 | 0.265 | 0.148 | 0.752 | 0.722 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 3. Cyclicality of Cyclically-Adjusted Budget Balance

| VARIABLES | (1) ΔCAB/PGDP | (2) ΔCAB/PGDP | (3) CAB/PGDP | (4) CAB/PGDP | (5) ΔCAB/PGDP | (6) ΔCAB/PGDP | (7) CAB/PGDP | (8) CAB/PGDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.172*** | | 0.185*** | | 0.225*** | | 0.233*** | |
| | (0.0276) | | (0.0266) | | (0.0297) | | (0.0289) | |
| Output Gap | | 0.0978*** | | 0.142*** | | 0.163*** | | 0.219*** |
| | | (0.0274) | | (0.0269) | | (0.0293) | | (0.0291) |
| Lagged CAB/PGDP | | | 0.833*** | 0.818*** | | | 0.847*** | 0.806*** |
| | | | (0.0219) | (0.0226) | | | (0.0253) | (0.0263) |
| Lagged Debt/GDP | | | | | 0.0161*** | 0.0168*** | 0.0124*** | 0.0128*** |
| | | | | | (0.00334) | (0.00343) | (0.00331) | (0.00334) |
| Constant | -0.522*** | -0.0329 | -0.983*** | -0.480*** | -1.631*** | -1.063*** | -1.785*** | -1.254*** |
| | (0.0963) | (0.0668) | (0.111) | (0.0849) | (0.231) | (0.220) | (0.227) | (0.213) |
| Observations | 748 | 748 | 748 | 748 | 645 | 645 | 645 | 645 |
| R-squared | 0.051 | 0.017 | 0.680 | 0.671 | 0.109 | 0.073 | 0.665 | 0.660 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 4. Cyclicality of Revenues

| VARIABLES | (1) Δt | (2) Δt | (3) Δt | (4) Δt | (5) $\Delta(T/Y)$ | (6) $\Delta(T/Y)$ | (7) $\Delta(T/Y)$ | (8) $\Delta(T/Y)$ |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.948*** | | 1.030*** | | -0.0215 | | -0.0108 | |
| | (0.0731) | | (0.0764) | | (0.0148) | | (0.0194) | |
| Output Gap | | 0.878*** | | 0.823*** | | 0.0539*** | | 0.0499** |
| | | (0.0864) | | (0.0793) | | (0.0172) | | (0.0195) |
| Lagged Debt/GDP | | | -0.0943*** | -0.101*** | | | -0.00746*** | -0.00711*** |
| | | | (0.00828) | (0.00904) | | | (0.00211) | (0.00222) |
| Constant | 5.699*** | 8.228*** | 9.873*** | 13.09*** | 0.272*** | 0.181*** | 0.616*** | 0.581*** |
| | (0.289) | (0.208) | (0.580) | (0.576) | (0.0584) | (0.0415) | (0.148) | (0.141) |
| Observations | 897 | 782 | 691 | 665 | 897 | 782 | 691 | 665 |
| R-squared | 0.162 | 0.120 | 0.348 | 0.295 | 0.002 | 0.013 | 0.019 | 0.029 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 5. Cyclicality of Expenditures

| VARIABLES | (1) $\Delta g$ | (2) $\Delta g$ | (3) $\Delta g$ | (4) $\Delta g$ | (5) $\Delta(G/Y)$ | (6) $\Delta(G/Y)$ | (7) $\Delta(G/Y)$ | (8) $\Delta(G/Y)$ |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.102 | | -0.150** | | -0.378*** | | -0.546*** | |
| | (0.0797) | | (0.0730) | | (0.0221) | | (0.0257) | |
| Output Gap | | 0.280*** | | 0.0381 | | -0.217*** | | -0.314*** |
| | | (0.0899) | | (0.0717) | | (0.0297) | | (0.0311) |
| Lagged Debt/GDP | | | -0.147*** | -0.151*** | | | -0.0306*** | -0.0295*** |
| | | | (0.00791) | (0.00818) | | | (0.00278) | (0.00355) |
| Constant | 8.572*** | 8.311*** | 16.41*** | 16.23*** | 1.483*** | 0.223*** | 3.534*** | 1.970*** |
| | (0.315) | (0.217) | (0.555) | (0.521) | (0.0875) | (0.0716) | (0.195) | (0.226) |
| Observations | 895 | 782 | 691 | 665 | 895 | 782 | 691 | 665 |
| R-squared | 0.002 | 0.013 | 0.341 | 0.353 | 0.251 | 0.066 | 0.440 | 0.191 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 6. Cyclicality of Budget Balance (IV)

| VARIABLES | (1) ΔBB/GDP | (2) ΔBB/GDP | (3) BB/GDP | (4) BB/GDP | (5) ΔBB/GDP | (6) ΔBB/GDP | (7) BB/GDP | (8) BB/GDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.524*** | | 0.520*** | | 0.698*** | | 0.673*** | |
| | (0.0409) | | (0.0388) | | (0.0470) | | (0.0458) | |
| Output Gap | | 0.434*** | | 0.578*** | | 0.474*** | | 0.628*** |
| | | (0.0516) | | (0.0536) | | (0.0521) | | (0.0544) |
| Lagged BB/GDP | | | 0.830*** | 0.718*** | | | 0.895*** | 0.707*** |
| | | | (0.0178) | (0.0242) | | | (0.0210) | (0.0269) |
| Lagged Debt/GDP | | | | | 0.0253*** | 0.0240*** | 0.0206*** | 0.0155*** |
| | | | | | (0.00337) | (0.00398) | (0.00341) | (0.00371) |
| Constant | -1.712*** | 0.0218 | -2.013*** | -0.553*** | -3.468*** | -1.446*** | -3.330*** | -1.460*** |
| | (0.139) | (0.0785) | (0.141) | (0.0850) | (0.263) | (0.251) | (0.257) | (0.232) |
| Observations | 916 | 787 | 916 | 787 | 704 | 670 | 704 | 670 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 7. Cyclicality of Primary Budget Balance (IV)

| VARIABLES | (1) ΔCAB/PGDP | (2) ΔCAB/PGDP | (3) CAB/PGDP | (4) CAB/PGDP | (5) ΔCAB/PGDP | (6) ΔCAB/PGDP | (7) CAB/PGDP | (8) CAB/PGDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.346*** | | 0.434*** | | 0.365*** | | 0.470*** | |
| | (0.0468) | | (0.0477) | | (0.0456) | | (0.0475) | |
| Output Gap | | 0.150*** | | 0.195*** | | 0.174*** | | 0.252*** |
| | | (0.0438) | | (0.0539) | | (0.0439) | | (0.0550) |
| Lagged BB/GDP | | | 0.663*** | 0.611*** | | | 0.648*** | 0.566*** |
| | | | (0.0199) | (0.0247) | | | (0.0217) | (0.0274) |
| Lagged Debt/GDP | | | | | 0.0172*** | 0.0169*** | 0.0144*** | 0.0110*** |
| | | | | | (0.00342) | (0.00347) | (0.00357) | (0.00377) |
| Constant | -0.970*** | -0.0100 | -2.214*** | -1.115*** | -2.033*** | -1.068*** | -3.116*** | -1.846*** |
| | (0.138) | (0.0686) | (0.149) | (0.0873) | (0.255) | (0.221) | (0.262) | (0.237) |
| Observations | 748 | 748 | 766 | 766 | 645 | 645 | 657 | 657 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 8. Cyclicality of Budget Balance (post-1990 sample)

| VARIABLES | (1) ΔBB/GDP | (2) ΔBB/GDP | (3) BB/GDP | (4) BB/GDP | (5) ΔBB/GDP | (6) ΔBB/GDP | (7) BB/GDP | (8) BB/GDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.577*** | | 0.579*** | | 0.637*** | | 0.643*** | |
| | (0.0380) | | (0.0366) | | (0.0410) | | (0.0401) | |
| Output Gap | | 0.315*** | | 0.523*** | | 0.447*** | | 0.655*** |
| | | (0.0441) | | (0.0447) | | (0.0459) | | (0.0463) |
| L.NLGQ | | | 0.838*** | 0.669*** | | | 0.870*** | 0.674*** |
| | | | (0.0264) | (0.0323) | | | (0.0281) | (0.0329) |
| Lagged Debt/GDP | | | | | 0.0180*** | 0.0446*** | 0.00887 | 0.0281*** |
| | | | | | (0.00636) | (0.00727) | (0.00651) | (0.00675) |
| Constant | -1.524*** | -0.0211 | -1.797*** | -0.463*** | -2.764*** | -2.893*** | -2.392*** | -2.230*** |
| | (0.125) | (0.106) | (0.128) | (0.105) | (0.422) | (0.482) | (0.420) | (0.439) |
| Observations | 478 | 478 | 478 | 478 | 436 | 436 | 436 | 436 |
| R-squared | 0.337 | 0.101 | 0.737 | 0.687 | 0.393 | 0.218 | 0.758 | 0.736 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 9. Cyclicality of Primary Budget Balance (post-1990 sample)

| VARIABLES | (1) ΔPBB/GDP | (2) ΔPBB/GDP | (3) PBB/GDP | (4) PBB/GDP | (5) ΔPBB/GDP | (6) ΔPBB/GDP | (7) PBB/GDP | (8) PBB/GDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.466*** | | 0.561*** | | 0.517*** | | 0.622*** | |
| | (0.0420) | | (0.0362) | | (0.0460) | | (0.0396) | |
| Output Gap | | 0.327*** | | 0.482*** | | 0.391*** | | 0.640*** |
| | | (0.0446) | | (0.0452) | | (0.0482) | | (0.0473) |
| Lagged PBB/GDP | | | 0.819*** | 0.682*** | | | 0.828*** | 0.644*** |
| | | | (0.0278) | (0.0348) | | | (0.0285) | (0.0345) |
| Lagged Debt/GDP | | | | | -0.00727 | 0.0152** | 0.00968 | 0.0340*** |
| | | | | | (0.00713) | (0.00763) | (0.00622) | (0.00650) |
| Constant | -3.736*** | -2.484*** | -1.420*** | 0.243** | -3.247*** | -3.390*** | -2.145*** | -1.908*** |
| | (0.138) | (0.107) | (0.120) | (0.103) | (0.474) | (0.506) | (0.416) | (0.437) |
| Observations | 478 | 478 | 478 | 478 | 436 | 436 | 436 | 436 |
| R-squared | 0.213 | 0.106 | 0.726 | 0.665 | 0.236 | 0.138 | 0.748 | 0.721 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 10. Cyclically-Adjusted Budget Balance (post-1990 sample)

| VARIABLES | (1) ΔCAB/PGDP | (2) ΔCAB/PGDP | (3) CAB/PGDP | (4) CAB/PGDP | (5) ΔCAB/PGDP | (6) ΔCAB/PGDP | (7) CAB/PGDP | (8) CAB/PGDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.249*** | | 0.279*** | | 0.280*** | | 0.312*** | |
| | (0.0349) | | (0.0335) | | (0.0379) | | (0.0370) | |
| Output Gap | | 0.117*** | | 0.209*** | | 0.209*** | | 0.308*** |
| | | (0.0363) | | (0.0366) | | (0.0384) | | (0.0390) |
| Lagged CAB/PGDP | | | 0.781*** | 0.747*** | | | 0.805*** | 0.744*** |
| | | | (0.0313) | (0.0342) | | | (0.0343) | (0.0367) |
| Lagged Debt/GDP | | | | | 0.0162*** | 0.0283*** | 0.00550 | 0.0180*** |
| | | | | | (0.00589) | (0.00610) | (0.00598) | (0.00596) |
| Constant | -0.635*** | 0.00338 | -1.136*** | -0.446*** | -1.762*** | -1.835*** | -1.513*** | -1.608*** |
| | (0.115) | (0.0873) | (0.131) | (0.103) | (0.392) | (0.405) | (0.380) | (0.385) |
| Observations | 477 | 477 | 477 | 477 | 435 | 435 | 435 | 435 |
| R-squared | 0.100 | 0.022 | 0.627 | 0.599 | 0.145 | 0.096 | 0.640 | 0.633 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 11. Cyclicality of Budget Balance

| CONTROLS | No controls | | | | | | Time and Squared Trends | | |
|---|---|---|---|---|---|---|---|---|---|
| FISCAL POLICY | ΔBB/GDP | ΔBB/GDP | Aut. Stab. | Aut. Stab. | ΔCAB/ PGDP | ΔCAB/ PGDP | ΔBB/GDP | AS | ΔCAB/PG DP |
| MEASURE OF CYCLE | GDP growth | Output Gap | GDP growth | Output Gap | GDP growth | Output Gap | GDP growth | GDP growth | GDP growth |
| Australia | 0.871*** | 0.743*** | 0.370*** | 0.245*** | 0.751*** | 0.564** | 1.081*** | 0.376*** | 0.675*** |
| Austria | 0.290*** | 0.294** | 0.370*** | 0.273*** | -0.082 | -0.00145 | 0.366*** | 0.376*** | -0.107 |
| Belgium | 0.377** | -0.00464 | 0.470*** | 0.230*** | -0.0768 | -0.235 | 0.464*** | 0.517*** | -0.053 |
| Canada | 0.519*** | 0.327*** | 0.334*** | 0.173*** | 0.269*** | 0.154* | 0.683*** | 0.361*** | 0.319*** |
| Switzerland | 0.396*** | 0.162 | 0.342*** | 0.119 | 0.0542 | 0.0426 | 0.339** | 0.335*** | 0.00444 |
| Germany | 0.439 | 0.319 | 0.478*** | 0.365* | -0.0403 | -0.0286 | 0.429 | 0.489*** | -0.0701 |
| Denmark | 0.768*** | 0.661*** | 0.415*** | 0.332*** | 0.385*** | 0.358*** | 0.798*** | 0.413*** | 0.388*** |
| Spain | 0.372*** | 0.188 | 0.376*** | 0.141*** | 0.345** | 0.0464 | 0.476*** | 0.399*** | 0.302* |
| Finland | 0.482*** | 0.363*** | 0.372*** | 0.169*** | 0.286*** | 0.193** | 0.519*** | 0.372*** | 0.301*** |
| France | 0.577*** | 0.201 | 0.366*** | 0.203*** | 0.210* | -0.00166 | 0.596*** | 0.372*** | 0.224* |
| UK | 0.356*** | 0.206 | 0.350*** | 0.216*** | 0.0694 | -0.0173 | 0.338*** | 0.360*** | 0.0161 |
| Greece | 0.039 | -0.199 | 0.284*** | 0.192*** | -0.281* | -0.416** | 0.0535 | 0.283*** | -0.305* |
| Ireland | 0.668*** | 0.695*** | 0.260*** | 0.222*** | 0.408** | 0.472** | -0.086 | 0.268*** | -0.354 |
| Italy | 0.176** | 0.0952 | 0.305*** | 0.239*** | -0.0174 | -0.11 | 0.460*** | 0.401*** | 0.0584 |
| Japan | 0.168** | 0.283* | 0.167*** | 0.150*** | 0.174 | 0.13 | 0.422*** | 0.231*** | 0.273** |
| Korea | 0.208*** | 0.109 | 0.115*** | 0.104*** | 0.0819 | -0.00682 | 0.233*** | 0.148*** | 0.0723 |
| Luxembourg | 0.292* | 0.0897 | 0.314*** | 0.175*** | -0.0212 | -0.0855 | 0.268 | 0.317*** | -0.0494 |
| Netherlands | 0.532*** | 0.274 | 0.302*** | 0.291*** | 0.295 | -0.0155 | 0.548*** | 0.300*** | 0.294 |
| Norway | 0.571*** | 0.284 | 0.489* | -0.0952 | 0.411** | 0.366*** | 0.826*** | 0.526* | 0.506*** |
| New Zealand | 0.346* | 0.243 | 0.289*** | 0.126** | 0.0569 | 0.118 | 0.382* | 0.301*** | 0.0816 |
| Portugal | 0.308** | 0.0687 | 0.316*** | 0.0897* | 0.0122 | -0.00416 | 0.294* | 0.373*** | -0.0472 |
| Sweden | 0.550*** | 0.325** | 0.487*** | 0.202*** | 0.226 | 0.128 | 0.629*** | 0.491*** | 0.207 |
| United States | 0.540*** | 0.383*** | 0.290*** | 0.182*** | 0.344*** | 0.265*** | 0.568*** | 0.296*** | 0.332*** |

*** p<0.01, ** p<0.05, * p<0.1

# TABLE 12. Cyclicality of Budget Balance (Full Sample and post-1990 Sample)

| FISCAL POLICY | ΔBB/GDP | | Aut. Stab. | | ΔCAB/PGDP | |
|---|---|---|---|---|---|---|
| MEASURE OF CYCLE | GDP Growth | | GDP Growth | | GDP Growth | |
| SAMPLE | Full Sample | Post-1990 | Full Sample | Post-1990 | Full Sample | Post-1990 |
| **Australia** | 0.871*** | 0.901*** | 0.370*** | 0.321*** | 0.751*** | 0.580*** |
| **Austria** | 0.290*** | 0.404** | 0.370*** | 0.394*** | -0.082 | 0.0106 |
| **Belgium** | 0.377** | 0.631*** | 0.470*** | 0.504*** | -0.0768 | 0.127 |
| **Canada** | 0.519*** | 0.746*** | 0.334*** | 0.343*** | 0.269*** | 0.403*** |
| **Switzerland** | 0.396*** | 0.396*** | 0.342*** | 0.342*** | 0.0542 | 0.0542 |
| **Germany** | 0.439 | 0.439 | 0.478*** | 0.478*** | -0.0403 | -0.0403 |
| **Denmark** | 0.768*** | 0.704*** | 0.415*** | 0.411*** | 0.385*** | 0.293** |
| **Spain** | 0.372*** | 0.773*** | 0.376*** | 0.387*** | 0.345** | 0.386* |
| **Finland** | 0.482*** | 0.724*** | 0.372*** | 0.373*** | 0.286*** | 0.351*** |
| **France** | 0.577*** | 0.673*** | 0.366*** | 0.371*** | 0.210* | 0.302** |
| **United Kingdom** | 0.356*** | 0.818*** | 0.350*** | 0.366*** | 0.0694 | 0.452*** |
| **Greece** | 0.039 | -0.0213 | 0.284*** | 0.300*** | -0.281* | -0.321 |
| **Ireland** | 0.668*** | 0.668*** | 0.260*** | 0.260*** | 0.408** | 0.408** |
| **Italy** | 0.176** | 0.456*** | 0.305*** | 0.426*** | -0.0174 | 0.0295 |
| **Japan** | 0.168** | 0.675*** | 0.167*** | 0.254*** | 0.174 | 0.420** |
| **Korea** | 0.208*** | 0.277** | 0.115*** | 0.124*** | 0.0819 | 0.152 |
| **Luxembourg** | 0.292* | 0.292* | 0.314*** | 0.314*** | -0.0212 | -0.0212 |
| **Netherlands** | 0.532*** | 0.734** | 0.302*** | 0.339*** | 0.295 | 0.395 |
| **Norway** | 0.571*** | 1.233** | 0.489* | 0.647* | 0.411** | 0.586** |
| **New Zealand** | 0.346* | 0.499*** | 0.289*** | 0.308*** | 0.0569 | 0.191 |
| **Portugal** | 0.308** | 0.452** | 0.316*** | 0.318*** | 0.0122 | 0.134 |
| **Sweden** | 0.550*** | 0.704*** | 0.487*** | 0.485*** | 0.226 | 0.219 |
| **United States** | 0.540*** | 0.840*** | 0.290*** | 0.276*** | 0.344*** | 0.565*** |

*** p<0.01, ** p<0.05, * p<0.1

# TABLE 13. Cyclicality of Budget Balance (post-1990 Sample)

| FISCAL POLICY | ΔBB/GDP | | AS | | ΔCAB/PGDP | |
|---|---|---|---|---|---|---|
| MEASURE OF CYCLE | GDP Growth | | GDP Growth | | GDP Growth | |
| ESTIMATION | OLS | IV | OLS | IV | OLS | IV |
| **Australia** | 0.901*** | 1.653*** | 0.321*** | 0.397*** | 0.580*** | 1.256** |
| **Austria** | 0.404** | 0.508** | 0.394*** | 0.357*** | 0.0106 | 0.151 |
| **Belgium** | 0.631*** | 0.882*** | 0.504*** | 0.483*** | 0.127 | 0.399 |
| **Canada** | 0.746*** | 1.013*** | 0.343*** | 0.322*** | 0.403*** | 0.691*** |
| **Switzerland** | 0.396*** | 0.432** | 0.342*** | 0.386*** | 0.0542 | 0.0455 |
| **Germany** | 0.439 | 0.706 | 0.478*** | 0.501*** | -0.0403 | 0.205 |
| **Denmark** | 0.704*** | 0.801*** | 0.411*** | 0.412*** | 0.293** | 0.390*** |
| **Spain** | 0.773*** | 1.226*** | 0.387*** | 0.418*** | 0.386* | 0.808*** |
| **Finland** | 0.724*** | 0.745*** | 0.373*** | 0.374*** | 0.351*** | 0.372*** |
| **France** | 0.673*** | 0.835*** | 0.371*** | 0.358*** | 0.302** | 0.477*** |
| **United Kingdom** | 0.818*** | 0.984*** | 0.366*** | 0.425*** | 0.452*** | 0.558*** |
| **Greece** | -0.0213 | 1.33 | 0.300*** | 0.363*** | -0.321 | 0.967 |
| **Ireland** | 0.668*** | 0.454* | 0.260*** | 0.257*** | 0.408** | 0.197 |
| **Italy** | 0.456*** | 0.597*** | 0.426*** | 0.451*** | 0.0295 | 0.145 |
| **Japan** | 0.675*** | 0.905** | 0.254*** | 0.318*** | 0.420** | 0.587 |
| **Korea** | 0.277** | 1.005* | 0.124*** | 0.164*** | 0.152 | 0.841 |
| **Luxembourg** | 0.292* | 0.619** | 0.314*** | 0.311*** | -0.0212 | 0.307 |
| **Netherlands** | 0.734** | 0.776** | 0.339*** | 0.251*** | 0.395 | 0.525 |
| **Norway** | 1.233** | 2.453*** | 0.647* | 1.424** | 0.586** | 1.029*** |
| **New Zealand** | 0.499*** | 0.702** | 0.308*** | 0.330*** | 0.191 | 0.372 |
| **Portugal** | 0.452** | 1.048** | 0.318*** | 0.318*** | 0.134 | 0.730* |
| **Sweden** | 0.704*** | 0.659*** | 0.485*** | 0.482*** | 0.219 | 0.177 |
| **United States** | 0.840*** | 0.958*** | 0.276*** | 0.299*** | 0.565*** | 0.659*** |

*** p<0.01, ** p<0.05, * p<0.1

# TABLE 14. Cyclicality of Revenues (Full Sample and post-1990 Sample)

| **FISCAL POLICY** | **Δt** | | **$\Delta t^{CAB}$** | | **Δ(T/Y)** | |
|---|---|---|---|---|---|---|
| **MEASURE OF CYCLE** | **GDP Growth** | | **GDP Growth** | | **GDP Growth** | |
| **SAMPLE** | **Full Sample** | **Post-1990** | **Full Sample** | **Post-1990** | **Full Sample** | **Post-1990** |
| **Australia** | 1.043** | 2.201** | 0.138 | 1.009** | 0.138 | 0.464* |
| **Austria** | 1.159*** | 0.763** | -0.286 | 0.133 | -0.0563 | -0.116 |
| **Belgium** | 0.602* | 0.620** | -0.167 | -0.0801 | -0.222*** | -0.14 |
| **Canada** | 1.324*** | 1.063*** | 0.804** | 0.444 | -0.00241 | -0.0342 |
| **Switzerland** | 0.673* | 0.673* | -0.116 | -0.116 | -0.0481 | -0.0481 |
| **Germany** | 0.672** | 0.672** | -0.179 | -0.179 | -0.083 | -0.083 |
| **Denmark** | 1.112*** | 1.007*** | 0.439 | 0.390** | 0.0351 | -0.0442 |
| **Spain** | 1.034** | 1.784*** | 0.706 | 1.101** | 0.048 | 0.201 |
| **Finland** | 0.863*** | 0.831*** | 0.438* | 0.231 | -0.148** | -0.113 |
| **France** | 1.004* | 0.935*** | 0.47 | 0.417** | -0.0617 | -0.0221 |
| **United Kingdom** | -0.137 | 1.387*** | -0.894* | 0.545** | -0.189* | 0.234** |
| **Greece** | -0.21 | 0.251 | -0.934* | -0.427 | -0.114*** | -0.0951 |
| **Ireland** | 1.430*** | 1.430*** | 0.858*** | 0.858*** | -0.0175 | -0.0175 |
| **Italy** | 1.101*** | 0.987** | 1.280** | 0.376 | -0.0626 | -0.0654 |
| **Japan** | 1.545*** | 1.517*** | 1.189*** | 0.984*** | 0.0314 | 0.146 |
| **Korea** | 1.185*** | 1.264*** | 0.431 | 0.718** | -0.00537 | 0.0314 |
| **Luxembourg** | 0.654*** | 0.654*** | -0.127 | -0.127 | -0.162 | -0.162 |
| **Netherlands** | 1.160*** | 1.189*** | 0.518 | 0.691** | -0.0471 | 0.0165 |
| **Norway** | 1.835*** | 1.820* | 0.339 | 0.296 | 0.321*** | 0.295 |
| **New Zealand** | 1.360*** | 1.696*** | 0.745* | 1.022*** | 0.259* | 0.296** |
| **Portugal** | 1.671** | 1.782*** | 0.722 | 1.212** | 0.11 | 0.177 |
| **Sweden** | 0.710** | 0.713*** | -0.173 | -0.0256 | -0.0125 | -0.00975 |
| **United States** | 1.234*** | 1.899*** | 0.742*** | 1.317*** | 0.153*** | 0.303*** |

*** p<0.01, ** p<0.05, * p<0.1

# TABLE 15. Cyclicality of Expenditures (Full Sample and post-1990 Sample)

| **FISCAL POLICY** | $\Delta g$ | | $\Delta(G/Y)$ | | $\Delta g^{CAB}$ | |
|---|---|---|---|---|---|---|
| **MEASURE OF CYCLE** | **GDP Growth** | | **GDP Growth** | | **GDP Growth** | |
| **SAMPLE** | **Full Sample** | **Post-1990** | **Full Sample** | **Post-1990** | **Full Sample** | **Post-1990** |
| **Australia** | -1.559** | -0.45 | -0.736*** | -0.437*** | -0.123 | -0.107 |
| **Austria** | 0.544* | -0.00743 | -0.346*** | -0.520** | 0.0592 | 0.0372 |
| **Belgium** | -0.0537 | -0.579 | -0.599*** | -0.771*** | 0.0114 | -0.117 |
| **Canada** | -0.0405 | -0.594** | -0.605*** | -0.780*** | -0.117 | -0.336*** |
| **Switzerland** | -0.51 | -0.51 | -0.444*** | -0.444*** | -0.217*** | -0.217*** |
| **Germany** | -0.297 | -0.297 | -0.522* | -0.522* | -0.0516 | -0.0516 |
| **Denmark** | -0.362 | -0.268* | -0.733*** | -0.748*** | -0.13 | -0.210* |
| **Spain** | 0.0961 | -0.0729 | -0.324*** | -0.572*** | -0.12 | -0.158** |
| **Finland** | -0.0833 | -0.516*** | -0.630*** | -0.836*** | -0.236*** | -0.304*** |
| **France** | -0.0837 | -0.311 | -0.638*** | -0.695*** | -0.0852 | -0.228*** |
| **United Kingdom** | -0.949** | -0.469 | -0.577*** | -0.584*** | -0.206*** | -0.192** |
| **Greece** | -0.318 | 0.358 | -0.153*** | -0.0738 | 0.125 | 0.201 |
| **Ireland** | -0.0304 | -0.0304 | -0.685*** | -0.685*** | -0.210*** | -0.210*** |
| **Italy** | 0.700* | 0.0908 | -0.239*** | -0.521*** | -0.00924 | -0.0575 |
| **Japan** | 1.077*** | -0.277 | -0.136** | -0.528*** | -0.0363 | -0.0597 |
| **Korea** | 0.291 | 0.216 | -0.214*** | -0.245** | -0.0516** | -0.0149 |
| **Luxembourg** | -0.102 | -0.102 | -0.454*** | -0.454*** | -0.0646 | -0.0646 |
| **Netherlands** | 0.0875 | -0.34 | -0.579*** | -0.717*** | -0.104 | -0.145 |
| **Norway** | 0.658* | -0.728*** | -0.261 | -0.937*** | -0.116 | -0.384** |
| **New Zealand** | 0.455 | 0.486 | -0.0868 | -0.203 | -0.00955 | 0.00465 |
| **Portugal** | 0.921 | 0.747 | -0.198* | -0.275* | 0.095 | 0.067 |
| **Sweden** | -0.234 | -0.453* | -0.563*** | -0.713*** | -0.0632 | -0.0744 |
| **United States** | -0.333* | -0.429** | -0.386*** | -0.537*** | -0.0605* | -0.141** |

*** p<0.01, ** p<0.05, * p<0.1

# TABLE 16. Cyclicality of Budget Balance (Recessions)

| VARIABLES | (1) ΔBB/GDP | (2) ΔBB/GDP | (3) BB/GDP | (4) BB/GDP | (5) ΔBB/GDP | (6) ΔBB/GDP | (7) BB/GDP | (8) BB/GDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.539*** | | 0.363*** | | 0.502*** | | 0.518*** | |
| | (0.0473) | | (0.0252) | | (0.0339) | | (0.0335) | |
| GDP growth x Recession | 0.0822 | | 0.0576 | | 0.0888* | | 0.0298 | |
| | (0.0611) | | (0.0387) | | (0.0490) | | (0.0497) | |
| Output Gap | | 0.0893 | | 0.186*** | | 0.207*** | | 0.318*** |
| | | (0.0650) | | (0.0609) | | (0.0729) | | (0.0678) |
| Output Gap x Recession | | 0.295*** | | 0.332*** | | 0.247** | | 0.293*** |
| | | (0.0928) | | (0.0860) | | (0.101) | | (0.0932) |
| Lagged BB/GDP | | | 0.849*** | 0.760*** | | | 0.896*** | 0.737*** |
| | | | (0.0179) | (0.0213) | | | (0.0212) | (0.0240) |
| Lagged Debt/GDP | | | | | 0.0225*** | 0.0221*** | 0.0186*** | 0.0144*** |
| | | | | | (0.00327) | (0.00389) | (0.00332) | (0.00364) |
| Constant | -1.466*** | 0.191* | -1.528*** | -0.271** | -2.839*** | -1.189*** | -2.819*** | -1.165*** |
| | (0.133) | (0.105) | (0.102) | (0.105) | (0.232) | (0.261) | (0.229) | (0.240) |
| Observations | 478 | 787 | 916 | 787 | 704 | 670 | 704 | 670 |
| R-squared | 0.339 | 0.101 | 0.763 | 0.725 | 0.334 | 0.177 | 0.767 | 0.739 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

# TABLE 17. Cyclicality of Cyclically-Adjusted Budget Balance (Recessions)

| VARIABLES | (1) ΔCAB/PGDP | (2) ΔCAB/PGDP | (3) CAB/PGDP | (4) CAB/PGDP | (5) ΔCAB/PGDP | (6) ΔCAB/PGDP | (7) CAB/PGDP | (8) CAB/PGDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.151*** | | 0.176*** | | 0.207*** | | 0.227*** | |
| | (0.0317) | | (0.0308) | | (0.0343) | | (0.0336) | |
| GDP growth x Recession | 0.0552 | | 0.0236 | | 0.0509 | | 0.0165 | |
| | (0.0403) | | (0.0391) | | (0.0477) | | (0.0468) | |
| Output Gap | | 0.00128 | | 0.0287 | | 0.0995 | | 0.135** |
| | | (0.0578) | | (0.0555) | | (0.0639) | | (0.0614) |
| Output Gap x Recession | | 0.155* | | 0.184** | | 0.0987 | | 0.131 |
| | | (0.0820) | | (0.0786) | | (0.0883) | | (0.0848) |
| Lagged CAB/PGDP | | | 0.835*** | 0.816*** | | | 0.849*** | 0.804*** |
| | | | (0.0220) | (0.0226) | | | (0.0255) | (0.0263) |
| Lagged Debt/GDP | | | | | 0.0159*** | 0.0166*** | 0.0123*** | 0.0125*** |
| | | | | | (0.00335) | (0.00343) | (0.00332) | (0.00334) |
| Constant | -0.494*** | 0.0902 | -0.968*** | -0.340*** | -1.595*** | -0.981*** | -1.772*** | -1.147*** |
| | (0.0983) | (0.0931) | (0.114) | (0.104) | (0.234) | (0.232) | (0.230) | (0.224) |
| Observations | 748 | 748 | 748 | 748 | 645 | 645 | 645 | 645 |
| R-squared | 0.054 | 0.022 | 0.680 | 0.674 | 0.111 | 0.075 | 0.665 | 0.662 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 18. Cyclicality of Budget Balance (08-09 and Recessions)

| VARIABLES | (1) ΔBB/GDP | (2) ΔBB/GDP | (3) BB/GDP | (4) BB/GDP | (5) ΔBB/GDP | (6) ΔBB/GDP | (7) BB/GDP | (8) BB/GDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.299*** | | 0.328*** | | 0.286*** | | 0.328*** | |
| | (0.0260) | | (0.0251) | | (0.0267) | | (0.0261) | |
| GDP Growth x '08-'09 | 0.486*** | | 0.441*** | | 0.415*** | | 0.442*** | |
| | (0.0948) | | (0.0910) | | (0.0999) | | (0.0961) | |
| Output Gap | | 0.169*** | | 0.293*** | | 0.107* | | 0.188*** |
| | | (0.0321) | | (0.0327) | | (0.0624) | | (0.0592) |
| Output Gap x '08-'09 | | 0.751*** | | 0.602*** | | 0.725*** | | 0.556*** |
| | | (0.0851) | | (0.0816) | | (0.0879) | | (0.0844) |
| Lagged BB/GDP | | | 0.847*** | 0.792*** | | | 0.846*** | 0.788*** |
| | | | (0.0171) | (0.0211) | | | (0.0177) | (0.0211) |
| GDP growth x Recession | | | | | 0.0892** | | -0.00163 | |
| | | | | | (0.0406) | | (0.0403) | |
| Output Gap x Recession | | | | | | 0.106 | | 0.183** |
| | | | | | | (0.0918) | | (0.0867) |
| Constant | -0.997*** | 0.0170 | -1.367*** | -0.420*** | -1.001*** | 0.0990 | -1.367*** | -0.287*** |
| | (0.102) | (0.0723) | (0.106) | (0.0813) | (0.102) | (0.101) | (0.107) | (0.103) |
| Observations | 916 | 787 | 916 | 787 | 916 | 787 | 916 | 787 |
| R-squared | 0.218 | 0.173 | 0.768 | 0.739 | 0.222 | 0.175 | 0.768 | 0.740 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

# TABLE 19. Cyclicality of Cyclically-Adjusted Budget Balance (08-09 and Recessions)

| VARIABLES | (1) ΔCAB/PGDP | (2) ΔCAB/PGDP | (3) CAB/PGDP | (4) CAB/PGDP | (5) ΔCAB/PGDP | (6) ΔCAB/PGDP | (7) CAB/PGDP | (8) CAB/PGDP |
|---|---|---|---|---|---|---|---|---|
| GDP growth | 0.138*** | | 0.154*** | | 0.128*** | | 0.154*** | |
| | (0.0312) | | (0.0301) | | (0.0335) | | (0.0325) | |
| GDP Growth x 08-09 | 0.222** | | 0.196** | | 0.202** | | 0.195** | |
| | (0.0942) | | (0.0908) | | (0.0976) | | (0.0941) | |
| Output Gap | | 0.0401 | | 0.0902*** | | 0.0117 | | 0.0354 |
| | | (0.0288) | | (0.0286) | | (0.0568) | | (0.0548) |
| Output Gap x '08-'09 | | 0.417*** | | 0.355*** | | 0.406*** | | 0.332*** |
| | | (0.0755) | | (0.0732) | | (0.0779) | | (0.0756) |
| Lagged CAB/PGDP | | | 0.835*** | 0.830*** | | | 0.835*** | 0.828*** |
| | | | (0.0219) | (0.0224) | | | (0.0220) | (0.0225) |
| GDP growth x Recession | | | | | 0.0327 | | 0.00187 | |
| | | | | | (0.0417) | | (0.0404) | |
| Output Gap x Recession | | | | | | 0.0482 | | 0.0941 |
| | | | | | | (0.0832) | | (0.0803) |
| Constant | -0.410*** | -9.66e-05 | -0.880*** | -0.422*** | -0.404*** | 0.0372 | -0.879*** | -0.354*** |
| | (0.107) | (0.0658) | (0.120) | (0.0845) | (0.107) | (0.0921) | (0.121) | (0.102) |
| Observations | 748 | 748 | 748 | 748 | 748 | 748 | 748 | 748 |
| R-squared | 0.058 | 0.057 | 0.682 | 0.682 | 0.059 | 0.058 | 0.682 | 0.682 |
| Number of countries | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1