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## **EFFECTS OF AUSTERITY: EXPENDITURE- AND TAX-BASED APPROACHES**

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Alesina

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## Abstract

We review the debate surrounding the macroeconomic effects of deficit reduction policies (austerity). The discussion about "austerity" in general has distracted commentators and policymakers from a very important result, namely the enormous difference, on average, between expenditure- and tax-based austerity plans. Spending-based austerity plans are remarkably less costly than tax-based plans. The former have on average a close to zero effect on output and lead to a reduction of the debt over GDP ratio. Tax-based plans have the opposite effect and cause large and long lasting recessions. These results also apply to the recent episodes of European austerity which in this respect were not especially different from previous cases.

JEL Classification: E60, E62

Keywords: austerity, fiscal adjustment plans, output growth

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# Effects of Austerity: Expenditure- and Tax-based Approaches \*

Alberto Alesina, Carlo Favero, Francesco Giavazzi<sup>†</sup>

March 2019

## Abstract

We review the debate surrounding the macroeconomic effects of deficit reduction policies (austerity). The discussion about "austerity" in general has distracted commentators and policymakers from a very important result, namely the enormous difference, on average, between expenditure- and tax-based austerity plans. Spending-based austerity plans are remarkably less costly than tax-based plans. The former have on average a close to zero effect on output and lead to a reduction of the debt over GDP ratio. Tax-based plans have the opposite effect and cause large and long lasting recessions. These results also apply to the recent episodes of European austerity which in this respect were not especially different from previous cases.

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# 1 Introduction

Sometimes governments need to aggressively reduce their budget deficits. These policies are labelled "austerity." Almost always austerity is needed because excessive debt has been accumulated, as a result of policy mistakes and political distortions (see Alesina and Passalacqua (2016) and Yared (2019))

The austerity policies embraced by several European countries starting in 2010 have generated an extraordinarily harsh policy debate. One side has argued that austerity is (almost) always a bad idea. From this perspective, even European countries that were experiencing serious difficulties in financial markets – either by being totally cut off from borrowing like Greece, or by paying high risk premia, like Portugal, Spain, Ireland and Italy – should have continued to stimulate the economy with high levels of government spending. Austerity, the argument continues, was self-defeating because the recessions it induced, or extended, only increased government debt as a ratio of GDP. Blanchard and Leigh (2014) argued that this round of austerity was particularly costly: in other words, fiscal multipliers were especially high. The other side argued that postponing austerity would have caused debt defaults and bank runs, another round of financial collapses and, possibly, the crumbling of the European monetary union with unpredictable and potentially disastrous economic and political consequences.

In this paper, we argue that the focus on austerity as such misses an important distinction: austerity based upon spending cuts is much less costly than that based upon tax increases. In our 2019 book, "Austerity: When It Works and When it Doesn't" (from now on AFG 2019), we documented close to 200 austerity plans in 16 high-income OECD economies from the late 1970s until 2014. These plans have been reconstructed consulting original documents concerning about 3,500 individual fiscal measures.<sup>1</sup> Our analysis of these episodes finds a large and statistically significant difference between the effects on output of expenditure-based and tax-based austerity plans. On average, an expenditure-based austerity plan worth 1 percent of GDP implies a loss of about 1/4 of a percentage point of GDP and lasts less than two years. In contrast, tax-based austerity plans on average generate losses of more than two percentage points of GDP and the effect lasts 3-4 years. Of course, these averages conceal a broader range of outcomes. We even find a few cases of "expansionary austerity" – namely cases in which the output costs associated with an expenditure-based austerity plan have instead turned out to be output gains. Examples include Ireland, Denmark, Belgium and Sweden in the 1980s, and Canada in the 1990s. There has been vitriolic criticism of the possibility that expansionary austerity could

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<sup>1</sup>Our data are available in a user friendly form at <http://www.igier.unibocconi.it/fiscalplans>.

ever exist. This dispute has sometimes distracted from what we see as the most policy-relevant result: the enormous difference, on average, between expenditure- and tax-based austerity plans. Our conclusions are very consistent with the findings of the literature on tax versus spending multipliers as reviewed by Ramey in this symposium.

We begin with a brief overview of some reasons why one might plausibly expect the effects of spending cuts on output, and eventually on the debt/GDP ratio, to differ from those of tax increases.

We then turn to three key methodological issues that arise in measuring empirically the effects of austerity: 1) endogeneity, which in this case involves separating the effects on output of fiscal tightening from those of changes in output on the fiscal balance; 2) multi-year horizons, namely embracing the fact that austerity plans are almost always multi year events involving a mixture of announcements of future changes in policy and immediate changes; and 3) the choice of the empirical model needed to design the experiment to measure the macroeconomic effects of austerity. In each case, we describe some common approaches in the earlier literature and how our own recent work draws upon them.

After having walked the reader through these three aspects of the austerity debate, we move to a more detailed discussion of our own findings. Together with our overall finding that expenditure-based austerity has on average smaller effects on output than tax-based austerity, we look for the channels that might be responsible for this result. We find that a main difference between expenditure- and tax-based austerity plans is the reaction of private capital investment. We also find that the smaller negative effect of expenditure-base austerity plans looks much the same both before and after the Great Recession. In this discussion, we also review how the policy and the academic debates about austerity have evolved over time. In a concluding section, we offer some additional thoughts about how our framework of expenditure- and tax-based austerity plans relates to issues of redistribution, the electoral consequences of austerity, the case of Greece and whether nations of Europe should have been slower after the Great Recession to seek out austerity.

## **2 Why Might Expenditure- and Tax-Based Austerity Have Different Effects?**

When analyzing austerity measures, it has been common for both policymakers and researchers to consider only the overall change in the fiscal balance, while paying much less attention to how that change is achieved. There are a number of reasons

to suspect that the effects of expenditure-based and tax-based austerity may not be the same. The basic IS-LM model is the workhorse that informs much of the public debate amongst politicians and the vast majority of the public. This model implies that spending cuts are (much) more recessionary than tax increases because spending multipliers in the model are (much) higher, in absolute value, than tax multipliers.

This assumption on the size of multipliers has been called into question in recent research, as Ramey (in this issue) points out. Why? Several arguments concerning both the demand side and the supply side are in order. First, with expenditure based austerity forward-looking households will react to the lower path of spending by realizing that future taxes will not rise as much as previously expected, or may even fall. Thus, the permanent expected income of consumers increases supporting private consumption. This however is not true for hand to mouth consumers who cut spending one to one when their disposable income falls and do not react to changes in permanent income. In the case of expenditure-based austerity investors will also perceive their future tax burden reduced, or at least not increased as much as in the case of tax based austerity. These effects will be stronger the more credible and long lasting the expenditure cuts are perceived to be. Tax based austerity, which does not tackle automatic increases in spending programs (like entitlements) will generate expectations of additional taxes in the future, thus having the opposite effects on consumers and investors.

Second, debt consolidation policies often occur in a state of crisis or close to it when investors (and consumers) are worried and uncertain about the future. Imagine an economy, for instance as described in Alesina and Drazen (1991) Blanchard (1990) which finds itself on an unsustainable path with an exploding public debt. The longer it waits before launching a fiscal stabilization, the bigger the future austerity package will need to be. When the stabilization eventually occurs it removes the uncertainty about further delays which would have increased its costs even more. Croce et al. (2012) show that increases in government expenditure generate tax risks for firms: the extent of this uncertainty depends on the government's ability to pin down long-run tax dynamics. The removal of uncertainty is another force which boosts entrepreneurs' confidence and supports investment spending.

Third, the demand side effects may differ at different point of the cycle. For instance the relative shares of the two types of consumers (forward looking and hand to mouth) may vary over the business cycle with hand to mouth consumers likely to be more numerous during recessions. Fourth, spending cuts and tax increases have different supply side effects. Tax distortions may affect the supply in a variety of ways. In the case of labour taxes the elasticity of prime age males is low, but it is higher for the second earner in a family. Faced with higher labor taxes young-

sters may delay their entry in the labor market, weighing on their family income, and the elderly may retire sooner, putting additional burden on already stressed social security systems. Fifth, for both these demand-side and supply-side effects the consequences of expenditure- and tax-based plans vary with the persistence of the fiscal adjustment. Expenditure-based plans are less recessionary the longer lived is the reduction in government spending, since the longer lasting the spending cuts the larger the expected reduction in taxes for consumers and investors. On the other hand, the distortions associated with tax-based plans are larger the longer lasting is the increase in the tax burden. <sup>2</sup>

Austerity policies are rarely implemented in isolation: accompanying policies matter. Clearly monetary policy has a role: by lowering interest rates and buying government bonds the central bank can help. This help is harder to come by at the zero lower bound, like in the latest round of austerity in Europe. The behavior of the exchange rate matters as well, especially for small open economies. Austerity policies which are more successful in reducing interest rates, for instance by reducing risk premia on domestic bonds, may lead to a devaluation which may help next exports. Austerity programs have often been accompanied by structural reforms, like labor or goods market liberalizations which may affect the growth rate. The question is whether systematic differences in accompanying policies can explain the different output effects of expenditure based versus tax based austerity. We will show that the answer to this question is negative. This of course does not mean that accompanying policies are irrelevant, but simply that they do not explain the differences between the two type of austerity policies.

### **3 Measuring the Effects of Austerity: three issues**

Since different theoretical models imply different multipliers – not only in size but sometimes even in sign – empirical evidence is critical in selecting among different theories. To this end the empirical specification and the design of the identification strategy should be chosen independently from any specific theoretical mechanism behind differential effects of austerity. In this section we discuss the design of empirical evidence on the macroeconomic consequences of fiscal adjustments. Such a design is difficult for three reasons: (1) endogeneity, (2) the multi-year nature of fiscal adjustments and (3) the choice of the empirical model used to measure the

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<sup>2</sup>To the extent that fiscal adjustments are carried out in the form of multi-year plans, and thus perceived to be relatively permanent, a standard neo-Keynesian model implies, as shown in Alesina et al. (2017), that spending cuts are less recessionary than tax increases.



effects of exogenous shifts in fiscal policy on output growth.

### 3.1 Endogeneity

The issue of “endogeneity” arises from the two-way interaction between fiscal policy and output growth. Suppose you observe a reduction in the government deficit together with an economic boom. It would be preposterous to jump to the conclusion that the policies that reduced deficits also generated growth. The causality is quite likely to run the other way: different factors (other than fiscal policy) increased economic growth, and by doing so led to higher tax revenues (for given tax rates), or reduced spending, say for unemployment compensation or welfare. This question has of course been at the very core of all empirical work on the effects of fiscal policy.

Identification assumptions are thus needed to measure the effects of shifts in fiscal policy on output growth, and such assumptions should be as neutral as possible with respect to competing theories.

An early literature addressed this issue by considering episodes of large reductions in the cyclically adjusted budget deficit, arguing that this approach would, supposedly, mute the reverse effects of the business cycle on the government balance. For example, Giavazzi and Pagano (1990) analyzed three cases of fiscal consolidations which occurred in the 1980s, two in Denmark and one in Ireland. They argued that reductions in the budget deficit signal that taxes may be lower in the future, with positive effects on consumers’ permanent income and thus on consumption. Later, Ardagna and Alesina (1998), identified five additional episodes of large fiscal consolidation: Belgium 1984-86, Canada 1986-88, Italy 1989-92, Portugal 1984-86, and Sweden 1983-89. In each case the cyclically adjusted primary deficit two years after the consolidation was at least 4 percentage points of GDP smaller than before the adjustment. These episodes were accompanied by growth of private consumption and investment in almost every year of the adjustment, sometimes with a year delay or so.

One finding of this early literature was that deficit reductions implemented via spending cuts were much less costly than those based upon tax increases, and that the former were sometimes associated with an expansion of GDP, even on impact. For example, McDermott and Wescott (1996) and Lambertini et al. (2005) show that a fiscal consolidation that concentrates on the expenditure side, and especially on transfers and government wages, is more likely to succeed in reducing the public debt ratio than tax-based consolidation. These results were robust to alternative measures of the cyclically adjusted budget deficit (see for example, Alesina and Perotti). Using panel data for 19 OECD countries, Perotti (1999) estimates a model that predicts

expansionary adjustments in "bad times" and contractionary adjustments in "good times". In bad times, when public debt is growing rapidly, a tax hike that rules out an even larger tax hike in the future can induce a positive response of consumption. In this vein Alesina and Ardagna (2010) study a panel of OECD countries from 1970 to 2007. They define a fiscal adjustment as a year in which the primary cyclically-adjusted budget balance improves by at least 1.5 percent of GDP. They find that these fiscal adjustments are expansionary only when they are spending-based. Moreover, they find that the fiscal adjustments associated with higher GDP growth are those in which a larger share of the reduction in the primary deficit is accounted for by cuts in current government spending, rather than in investment spending. They also find a positive reaction of private investment spending to government spending cuts.

The problem with this early literature is that cyclically adjusted measures of the deficit likely suffer from measurement error (Perotti (2012)) in a way that means they still suffer from endogeneity. Even if the change in the fiscal balance is cyclically adjusted, so that it excludes changes induced by automatic stabilizers, it still includes other legislated changes in taxes and spending that are motivated by the state of the economy.

An alternative way of identifying exogenous fiscal adjustments – and one that has been increasingly adopted in recent years – is the "narrative approach" launched by Romer and Romer (2010). These authors have recovered exogenous shifts in taxes from a painstaking analysis of the motivations that U.S. legislatures have offered for each of their tax decisions. This approach has been labelled narrative identification. The motivation underlying each tax decision is assessed consulting original sources: budget documents, records of Congressional debates, speeches, etc. The authors define as exogenous, that is not related to the business cycle, all episodes of changes (up and down) in U.S. federal taxes from 1947 to 2007 which were motivated by the aim of either improving long run growth or reducing an inherited deficit. Economists in the research department of the IMF (Devries et al. (2011)) used the narrative methodology to construct a panel of exogenous shifts in fiscal variables for 17 OECD countries over the sample 1978-2009. These data only cover episodes of deficit reduction, but include both changes in taxes and expenditures.

In Alesina et al. (2019) we have addressed endogeneity using the narrative approach.<sup>3</sup> We have documented close to 200 exogenous austerity plans – that is plans

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<sup>3</sup>Jordà and Taylor (2016) use narratively identified shifts in fiscal variables as an instrument for studying the effects of the changes in the cyclically-adjusted fiscal balance. They overlook the difference between tax-based and expenditure-based austerity and concentrate on the issue of the recessionary versus expansionary effect of fiscal consolidations. These authors also question the

not adopted by considerations related to the business cycle – in 16 OECD economies (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Portugal, Spain, Sweden, the United Kingdom, and the United States) from the late 1970s until 2014. To construct this time series of exogenous shifts in fiscal variables, we took the Devries et al. (2011) dataset as a starting point and extended it in many important dimensions. First, we added the period 2010 to 2014, which is of course critical given the large amount of austerity plans that occurred in those years. Second, going back to the original sources, we complemented their data so as to keep track of the implementation of austerity plans over time – an issue whose importance we address in the next section. Third, we disaggregated these austerity plans depending on their composition. Our main disaggregation is between austerity plans mostly based on expenditure cuts and plans mostly based on tax hikes. But in addition, spending measures were further disaggregated between cuts in transfers and cuts in other government consumption (and investment). The measures on the tax side were broken down into indirect and direct taxes. While doing this, we double checked the Devries et al. (2011) classifications and introduced some modifications.

### 3.2 Multi-Year Austerity

Much of the literature on fiscal policy in general and austerity in particular has evaluated the effects individual shifts in taxes or spending on an a year by year (or even quarter by quarter) basis. Especially when it is applied to austerity policies, this approach overlooks two important facts. One is the multi-year nature of fiscal adjustments. Virtually all austerity programs are multi-year plans announced in advance and sometimes revised along the way. Since expectations matter for consumers' and investors' decisions, these announcements and the multi-year nature of these plans need to be taken into account – a point first made by ?. The other point is that decisions about how much to cut spending and how much to raise taxes are interconnected and cannot be assumed to be independent of one another. Typically, a legislature first decides by how much the deficit should be reduced (in the case of EU countries, this target has to be agreed upon with the European Commission). Given this target, its allocation between spending cuts and tax hikes is then decided through political bargaining in the legislature.

For example, the round of austerity which took place in Europe around 2010-2014

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validity of the narrative fiscal instrument used by (Guajardo et al., 2014) and propose an alternative econometric strategy. We discuss their criticism and their proposed strategy in the online Appendix available with this paper at <http://e-jep.org>.

typically took the form of three-year plans of deficit reduction, announced by various countries in agreement with the EU or the "Troika" (the European Commission, the European Central Bank, and the International Monetary Fund.) In some cases, these signposts were a precondition for receiving financing from the EU and the IMF, as happened in Greece, Portugal, and Ireland. In other cases they were the conditions needed to avoid the "excessive deficit procedure", a status that implies automatic deficit reduction targets. In these agreements, the Troika did not care much about the composition of deficit reduction policies: they just cared about the bottom line in terms of multi-year deficit targets.

We used our narrative data to construct multi-year austerity plans. For each of the austerity plans, the total fiscal adjustment over time was divided into three categories: 1) measures announced and implemented immediately; 2) announcements of measures to be implemented in future periods; and 3) measures which had been legislated in the past but are implemented in the current year ( For simplicity of exposition here we use only two time periods, one for the present and one for the future but in our empirical work we consider three-year plans.) Of course, not all austerity plans need not involve all three of these components. For each of these three categories, we estimate separately the increase in taxes and the cut in expenditures. Tax increases are measured by the expected revenue effect of each change in the tax code, either due to a change in tax rates or in the tax base, as a percent of GDP the year before the tax change is introduced. Ideally one would want to distinguish between changes in the tax base and the tax rate, because they may have different economic effects (see Riera-Crichton et al. (2016)) but this was not feasible with our data. Spending cuts are changes in expenditure relative to the level that would have occurred absent the change in policy, as it is standard. We then calculate, for each plan, which component dominates, whether spending cuts or tax increases. In the data, very few plans are close to being half and half, and our results are robust to dropping them. Note that considering tax hikes and expenditure cuts as independent would overlook the fact that they are linked by the decided target of deficit reduction. In any event our results are robust (although more difficult to interpret) if tax hikes and spending cuts were considered as independent variables (see AFG (2019) for details).

We call the first category of measures (those announced and immediately implemented) unexpected policy changes, where the total adjustment is given by the sum of spending cuts and tax increases ( $e_{i,t}^u = \tau_{i,t}^u + g_{i,t}^u$ ). Of course, we recognize that even a measure announced and implemented immediately could have been anticipated based upon the legislative discussions that preceded its adoption ( $e_{i,t,t-1}^a = \tau_{i,t,t-1}^a + g_{i,t,t-1}^a$ ). For the second category (announcements of policies to be adopted in

the future) we make the admittedly restrictive assumption that these announcements are believed by economic agents, even though we of course also take account of changes when they happen. An important improvement in this line of research would imply a better characterization of expectations of the public and different degrees of credibility of policy announcements. Finally we consider policy announced at time  $t$ , to be implemented in the following years ( $e_{i,t,t+1}^a = \tau_{i,t,t+1}^a + g_{i,t,t+1}^a$ )

Consider a specific example: the fiscal consolidation in Belgium in 1992-4. The first column shows that in 1992, 1993 and 1994 new immediate overall reductions in the primary deficit equivalent respectively to 1.85, 0.52, and 0.38 percent of GDP in the previous year are announced. The second column says that no previously announced austerity was carried out in 1992, while in 1993 and 1994 previously announced measures for, respectively, 0.47 and 0.83 of GDP, were carried out. The third column notes that further deficit reductions to be implemented in the following year are announced in 1992 and 1993, equivalent respectively to 0.47 percent of GDP and 0.83. The next three columns show tax increases: the tax increase carried out immediately in 1992, the zero tax increase that had been preannounced in an earlier year, and the small tax increase announced for the future. The final three columns show the spending cuts: the immediate spending cuts of 0.82, 0.12 and 0.38 percent of GDP, the cuts that had been announced in an earlier year, and the spending cuts announced for the future. The adjustment in 1992 and 1994 are counted as expenditure-based (EB), because the largest share of measures is on the expenditure side, while the adjustment in 1993 is labelled TB.

<i>Year</i>	$e_{i,t}^u$	$e_{i,t-1,t}^a$	$e_{i,t,t+1}^a$	$\tau_{i,t}^u$	$\tau_{i,t-1,t}^a$	$\tau_{i,t,t+1}^a$	$g_{i,t}^u$	$g_{i,t-1,t}^a$	$g_{i,t,t+1}^a$	
1992	1.85	0	0.47	1.03	0	0.05	0.82	0	0.42	<i>EB</i>
1993	0.52	0.47	0.83	0.40	0.05	0.55	0.12	0.42	0.28	<i>TB</i>
1994	0.38	0.83	0	0	0.55	0	0.38	0.28	0	<i>EB</i>

### 3.3 The Model

To analyze the effects of austerity, one needs an empirical model to generate two paths for macroeconomic variables: in the presence and in the absence of the shift in fiscal variables.<sup>4</sup> The difference between these two paths is the impulse response that describes the dynamic reaction of the economy to the policy correction.

<sup>4</sup>In the online Appendix available at <http://e-jep.org>, we describe several alternative empirical models that can be used to simulate the macroeconomic effects of a plan. Along with moving averages and vector autoregressions, we discuss an alternative empirical strategy, the Local Projection method proposed by Jordà (2005) which implies computing impulse responses through the

One example is the model used by Romer and Romer (2010) in their study: a truncated moving average representation of output growth in terms of (narratively identified) tax changes only. In practice, they estimate an ordinary least squares regression of output growth on (three-year lags) of exogenous changes in taxes. The implicit assumption is that narratively identified changes in taxes are orthogonal to all other structural shocks in the economy. The truncation at a three-year horizon is not a problem provided the variables excluded are correlated with the included narrative adjustments. Their regression also lumps together unexpected shifts in taxes and announcements, assuming that the response of economic agents to the two policy shifts is identical. These assumptions have been relaxed in a number of subsequent contributions. For example, Mertens and Ravn (2013) find that unexpected changes in taxes produce short-run effects on aggregate output that are larger than those associated with announcements. Favero and Giavazzi (2012) avoid the truncation problem by including narrative shocks in a VAR which includes government expenditure, government receipts, output growth, inflation, and the average interest cost of the public debt.

In our view, dynamic models such as vector autoregressions have several advantages. First, the estimated coefficients on the narratively-identified shifts in fiscal variables measure the effect on output growth of the component of such shifts that is orthogonal to lagged included variables: thus, the estimated multipliers are not affected by the possible predictability of plans on the basis of past information. Second, by including in the vector autoregression changes in revenues and spending (as a fraction of GDP), one can track the effect of the narratively identified shifts in fiscal variables on total revenues and total spending. This allows to check the strength of narratively identified instruments – for instance verifying if, following a positive shift in taxes, revenues indeed increase. Finally, dynamic models allow a researcher to reconstruct the response of the debt/GDP ratio to a fiscal adjustment.

AFG 2019 discuss how to insert narratively identified EB and TB plans in a fiscal vector autoregressive model. The parameters estimated in such a vector autoregression can then be used to generate two alternative paths for the macroeconomic and policy variables, in the presence or absence of the austerity plan. This vector autoregression can be linear or non-linear. The non-linearity allows for the dynamic response to a fiscal plan to differ depending on the regime the economy is in when the plan is introduced – for example, during an expansion or a recession, or with an increasing or stable debt/GDP ratio.<sup>5</sup>

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estimation of a battery of single equations, each of them capturing the effect of an exogenous shift in fiscal variables at a given horizon.

<sup>5</sup>In a multiyear plan, unexpected measures are typically accompanied by the announcement of

Finally, how to measure the fiscal multipliers? In this symposium, Ramey discusses several alternatives used in the literature. The most common one considers the total output response over time to a given fiscal adjustment (typically 1 per cent of GDP), as in Romer and Romer (2010). We prefer the option of looking at the total output response over time divided by total change in fiscal variables over time, an approach suggested by Woodford (2011) and used by Mountford and Uhlig (2009); Uhlig (2010); Fisher and Peters (2010) and Auerbach and Gorodnichenko (2012a)). This approach has the advantage of taking into account the response of taxes and spending to the fiscal plan, as well as considering the persistence of fiscal shocks.

## 4 Tax-based vs. Expenditure-based Austerity: Results

Three figures summarize the key results in AFG (2019). Figures 1 and 2 show the effect on *per capita* GDP and on private investment of an expenditure-based austerity plan (blue line) and a tax-based austerity plan (red line).

### PLEASE INSERT FIGURE 1 HERE

The two continuous lines in the figures show the response of GDP (and private investment) to a plan which reduces the deficit over GDP ratio of 1 per cent relative to the path that these variables would have followed in the absence of the fiscal plan. As mentioned above, the figures are based on the simulation of a panel vector autoregression approach for about 200 episodes of austerity across the 16 countries in our sample for the period 1978-2014. The difference between the effects of expenditure- and tax-based plans is striking. As the dotted lines show, the two types of austerity plans are statistically different from one another. Tax-based austerity plans lead to deep and prolonged recessions, lasting several years. Expenditure-based plans on

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future measures. This means that one cannot simulate the effect of an unexpected measure in isolation – that is, assuming that it is not accompanied by any announcement. Doing so would assume that unexpected measures and announcements are uncorrelated – which they are not in our data. This problem can be addressed by exploiting the in-sample correlation between announcements and unexpected measures. More specifically, one can estimate parameters that relate announcements to unanticipated shifts in fiscal variables. Then, when simulating the effects of an unexpected measure, one can accompany it with an "artificial" announcement constructed using the value estimated in the sample.

average exhaust their mild recessionary effect within two years after a plan is introduced. Of course, these findings represent averages of many plans. In AFG (2019), we provide details on specific episodes and detailed case studies.<sup>6</sup>

The detailed data from our narrative approach also allows us to look at some broad categories of spending and taxes. For example, when we distinguish the effect of cuts in expenditure on goods, services and investment from cuts in transfer payments (where transfers include both monetary, such as social security, and in-kind, such as health expenditures, transfers), we find that the results are broadly similar, although cuts in transfers imply even lower costs on terms of GDP growth than cuts in spending on goods and investment. This finding suggests that if one wishes to aggregate transfers with other items of the government budget, they ought to be aggregated with spending and not considered akin to negative taxes. In constructing our expenditure-based austerity plans, we would have liked to separate current government consumption from public investment but there are almost no austerity plans where the main component is a cut in public investment. Across the austerity plans we consider, when aggregating cuts in government consumption and investment, the former component represents around 80 percent of the total correction. The spending-based plans we study thus describe austerity programs mostly based on cuts in current government spending. The effects of cuts in public investment spending is obviously an important question for future research since they may have long term costs which are not considered here.

The component of aggregate demand which mostly drives the heterogeneity between the effects of tax- and expenditure-based austerity is private investment. Figure 2 reports the responses of private investments to fiscal plans, and illustrates an even stronger heterogeneity than that observed for output growth. Private consumption instead behaves relatively similarly in the two cases of austerity. Net exports also do not behave differently during expenditure- and tax-based episodes. This fact sheds serious doubts about movements in the exchange rate being an important factor in explaining the differences in the effects of EB versus TB austerity.

## PLEASE INSERT FIGURE 2 HERE

Figure 3 shows the effects of tax- and expenditure-based austerity plans on the debt/GDP ratio. The effects vary depending on the initial level of debt and its cost. We consider two situations: the case of a high (around 120 per cent of GDP) and a low level of debt at the time the fiscal adjustment is implemented. In both cases

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<sup>6</sup>Estimating the truncated moving average representation of these variables, as done in Romer and Romer(2010), instead of simulating a vector autoregression, gives very similar results.



the cost of debt service is the same and assumed to be relatively low. This Figure is derived from a vector autoregression that includes taxes, government expenditure, net interest expenses on government debt, output growth and inflation, along with the narratively identified austerity plans. In the scenario with high public debt an expenditure-based plan (blue line) has a stabilizing effect on the debt dynamics while a tax based plan (red line) a destabilizing effect. In the scenario with low public debt the expenditure based adjustment remains stabilizing, while the effect of a tax based plan becomes neutral.

### **PLEASE INSERT FIGURE 3 HERE**

Summing up: the anti-austerity argument, namely that the latter creates large recessions and is self-defeating because it does not reduce the debt/GDP ratio – applies only to tax based austerity, not to expenditure-based austerity. This distinction has been vastly overlooked. To our knowledge, only the government of Ireland in presenting its austerity plan in 2010 made an explicit reference to the academic literature emphasizing the different effects of tax hikes versus spending cuts. The Ireland Stability Programme Update (December 2009, p.15) explains:

”In framing Budget 2010, the Government focused on curbing spending to adjust expenditure needs to the revenue base which has been reduced as a result of the overall contraction of the economy and the loss of certain income streams. In addition, in formulating policy the Government took on board evidence from international organizations, such as the EU Commission, the OECD, and the IMF, as well as the relevant economic literature which indicates that consolidation driven by cuts in expenditure is more successful in reducing deficits than consolidation based on tax increases. Past Irish experience also supports this view and suggests that confidence is more quickly restored when adjustment is achieved by cutting expenditure rather than by tax increases.”

Although our work focused on 16 high-income OECD economies, many of our results may apply to other countries. Gunter et al. (2018) show that this is indeed the case for Latin American countries with a relatively large government sector. They find that fiscal adjustments carried out mainly through tax increases might be heavily recessionary in Latin American countries with high levels of taxation, such as Argentina and Uruguay (similarly to our OECD countries), but fairly innocuous where initial taxation is low. They also find that the output costs of spending cuts are lower the more gradual is the fiscal adjustment.

In the remainder of this section, we discuss various questions which we suspect may have already occurred to the readers: whether the effects of expenditure- and

tax-based austerity might differ in expansions vs. recessions or at the zero lower bound, as well as whether the milder effects of expenditure-based, compared to tax-based austerity, might be more likely when austerity is implemented in combination with structural reforms or accommodative monetary policies. None of these possibly confounding factors alters our central finding that expenditure-based austerity plans are less costly to the economy and more effective in reducing the debt/GDP ratio.

## 4.1 Austerity During Expansions and Recessions

Government spending is likely to have larger expansionary effects in recessions than in expansions because, when the economy has slack, an increase in government spending is less likely to crowd out private demand. It might seem intuitively obvious that the reverse should hold true: that is, a cut in government spending should have a larger effect in recessions than in expansions. But while this argument seems intuitive, testing it proves to be difficult. A central problem is that recessions and booms evolve dynamically. An economy in a recession may have already put in place a dynamic recovery mechanism, or a growing economy may already be sputtering.

Auerbach and Gorodnichenko (2012a,b) allow for the effects of shifts in fiscal policy to differ depending on whether they are introduced during an expansion or a recession, using a version of the model of taxes, government spending and output by Blanchard and Perotti (2002) that allows for the estimated parameters to be different in expansions and recessions. They find very different tax and expenditure multipliers in recession and in expansion. These authors, however, when simulating a shift in fiscal policy do not allow the economy to change state during recessions and booms: they assume that the state of the economy is constant for at least the 20 quarters over which multipliers are computed. Ramey and Zubairy (2017) note that this is not a reasonable assumption for recessions, which in their sample have a mean duration of only 3.3 quarters. Ramey and Zubairy (2017), instead, compute multipliers allowing the state of the economy to evolve during their simulation. Using quarterly US data covering wars and deep recessions (1889-2015), they find that government spending multipliers are less than one both in recessions and in booms.

Those papers consider both fiscal expansions and contractions. In AFG (2019), we instead look only at periods of austerity. We find that on average expenditure-based adjustments have consistently much lower costs than tax-based ones; the costs of the former are close to zero regardless of the state of the economy. If austerity begins in a recession, it does look a bit more costly than if it starts in a boom, but the difference is small and it does not affect the comparison between expenditure- and tax-based plans. When we use the methodology of Auerbach and Gorodnichenko (2012a,b) we

find larger negative effects of austerity during recessions but the difference between expenditure- and tax-based episodes remains clear.

Whether expansionary fiscal policies and austerity measures have identical effects with opposite signs remains an open question and a topic for future research. For some evidence of an asymmetric effect of positive and negative fiscal measures, Barnichon and Matthes (2016) is a useful starting point. The problem arises because the narrative identification of exogenous expansionary episodes is often difficult. Fiscal expansions typically occur during an economic downturn and are motivated by the state of the cycle, thus they are endogenous. Conversely, the narrative identification strategy which we adopt tends to exclude austerity plans beginning in a boom, because they could be confused with stabilization policies. Thus our estimates of the cost of austerity should be considered an upper bound, because austerity starting in booms may be less costly. In any case, these considerations do not affect the comparisons between expenditure- and tax-based plans, with the former being more likely to be expansionary when started in a boom.

## 4.2 Austerity at the Zero Lower Bound

Do our results on the comparisons between expenditure- and tax-based plans also hold when the policy interest rate set by the central bank is at the zero lower bound? This is a difficult question to answer because cases of austerity at the zero lower bound are essentially those which occurred in Europe in 2010-2014, plus a few episodes in Japan. There were many other factors at play in these episodes: the cases of European austerity started in the middle of very large recessions and occurred at the same time in many highly integrated economies, with some countries also facing major banking problems, like Ireland and Spain. Thus it is hard to identify what caused what given that so many factors were at play at the same time and the relatively few data points we have.

In order to shed some tentative light on this issue, we split the data in two subsamples: euro area countries (Austria, Belgium, France, Finland, Germany, Ireland, Italy, Portugal and Spain) from 1999 onwards and non- euro-area countries (Australia, Denmark, UK, Japan, Sweden, United States and Canada) together with euro area countries before 1999. We do this because, as in the case of the zero lower bound, the presence of a common currency prevents monetary policy from responding to fiscal developments in a specific country, while the presence of year fixed effects allows us to control for the fact that the European Central Bank might have responded to fiscal consolidations implemented in a large number of countries at the same time. Obviously, this test is imperfect, but our evidence does not indicate a

large difference between consolidations at or away from the zero lower bound.

### 4.3 European Austerity in 2010-2014

Did the recent episodes of austerity which occurred after the financial crisis – mostly in Europe in the aftermath of the euro crisis – differ from previous cases? Blanchard and Leigh (2014) answer yes to this question considering the results of an ordinary least squares regressions on a cross-section of 27 advanced economies. The dependent variable is the difference between actual cumulated real GDP growth (year-over-year) during 2010-11 (based on the latest available data) and the forecast prepared for the April 2010 IMF World Economic Outlook. The explanatory variable is the forecasted change, over the same period, of the general government cyclically adjusted fiscal balance measured in percent of potential GDP. They interpret the significant coefficient (- 1.09) on the regressor as evidence that fiscal multipliers generated by the fiscal adjustments in 2011 were higher than those predicted by forecasters.

In our opinion, these results should be interpreted extremely cautiously. To begin with, we discussed above the limitations of the cyclically adjusted budget balance as a measure of fiscal stance. In addition, one-third of the fiscal adjustments considered in Blanchard and Leigh (2014) were in fact fiscal expansions, not contractions: asymmetries between the effects of expansions and contractions could invalidate the result. Finally as we show in AFG (2019) the fiscal adjustments expected as of April 2010 were in fact correlated with the change in long-term interest rates: the estimated coefficient in the regression run by Blanchard and Leigh (2014) could thus simply measure the recessionary effect of the contemporaneous rise in the long-term interest.<sup>7</sup>

In other words, suppose that harsher austerity was implemented in those European countries that were fiscally weaker and more exposed to a sudden increase in the cost of financing the debt because of the high level of debt and of the "doom loop". Eventually, as a consequence of the Greek crisis, the worst case scenario materialized: not only the feared hike in interest rates, but also the amplification via the "doom loop" Brunnermeier et al. (2016). The contractionary effect of the increase of long-term rates was amplified by an unusual contraction in lending caused the weakening of banks' balance sheets, which were heavily invested in government bonds. In this case, the stronger recessionary impact of austerity on growth could simply measure the unusual strength of the effect of the hike in long-term rates caused by this "doom loop". If the doom loop channel is not included in the model used to

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<sup>7</sup>See Ramey (2018) in this symposium for a more extensive discussion of the method used by Blanchard and Leigh (2014) .

produce the forecasts, then the forecast error for output is correlated with the shock to interest rates, for which the fiscal correction works as an instrument.

An interesting observation is that the Blanchard and Leigh (2014) results, if taken at face-value, suggest that the multipliers assumed by the IMF models, as by the models used by other international organizations, were "too small", around 0.5. However, at least in the case of tax-based plans, those multipliers are much smaller than those revealed by our plan-based reduced form empirical evidence, which hover around 2.

In AFG 2019, we investigate in detail these European episodes of austerity and conclude that one cannot reject the hypothesis that their effects on output were not statistically different from previous cases. The analysis of these episodes also confirms that countries that chose tax-based austerity suffered deeper recessions compared to those that decided to adopt expenditure-based plans. The very large size of recessions in some countries (Greece, Spain, Portugal, Italy) are consistent with the large "tax multipliers" which we found for previous periods, given the size and composition of some plans adopted in 2010-14. Most of these plans included large tax increases. The two countries which adopted almost exclusively expenditure cuts (Ireland) or a majority of expenditure cuts (the UK) had much smaller and shorter recessions, despite, in the case of Ireland, a massive banking problem. The United Kingdom, which had kept the pound rather than switching to the euro, was also helped by an exchange rate devaluation.

## 4.4 Accompanying Policies

If expenditure-based plans were systematically accompanied by more accommodative policies, then the difference between expenditure- and tax-based plans would result from these other policies and have nothing to do with different fiscal multipliers. Guajardo et al. (2014) suggest that the stance of monetary policy may explain the difference between expenditure- and tax-based measures. In AFG (2019), we show that only a very small fraction of the different effect on output of expenditure and tax-based adjustments can be ascribed to monetary policy. We come to this conclusion (Alesina et al. (2015)) augmenting the model used throughout with a monetary policy channel.<sup>8</sup> When this channel is closed, in a counterfactual that prevents monetary policy from reacting to fiscal adjustments, an important heterogeneity between EB

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<sup>8</sup>This channel produces estimates of the impact of monetary policy on output which lie in between the typical response obtained on U.S. data (see e.g. Christiano et al. (1999) and that obtained on euro area data, which is smaller than that observed for the U.S. (see e.g. Peersman and Smets (2001)).

and TB plans is still observed. Finally note that the response of monetary policy may be endogenous in the sense that the central bank may on purpose react differently to more or less credible austerity plans, and credibility of a fiscal plan may be related to its composition.

The same line of analysis applies to the behavior of the exchange rate. If an expenditure-based plan reduces interest rates and leads to a devaluation, it may in turn sustain output growth. However, a devaluation occurring before the beginning of an expenditure-based austerity plan (ignoring the possible significant effects of expectations of a plan on exchange rates) may lead to a spurious attribution of low output cost to the plan, since the benefits of the devaluation are overlooked. In AFG (2019) we find no systematic difference in the behavior of the exchange rate before expenditure or tax based austerity plans. We also exclude in a variety of different ways plans which were preceded by significant (or even small) devaluations, and show that our results are robust. Also, if the main explanation for the difference between the output effects of expenditure and tax based plans were the exchange rate, then the component of aggregate demand which would reflect it should be net exports. This is not the case.

Periods of austerity are sometimes accompanied by structural reforms which may include products and/or labor market liberalizations. The latter may stimulate growth and, if they were systematically occurring along with expenditure-based austerity plans, could explain our findings. But the answer to this conjecture is also "no". In fact, structural reforms do not occur systematically during periods of spending cuts. Note that this result is not inconsistent with the evidence and the case studies reported in Perotti (2012); Alesina et al. (1998); Alesina and Ardagna (2013). What these papers show is that amongst all fiscal adjustments, the least costly were those accompanied by supply side reforms and by wage moderation. Our robustness check is different: we check whether the choice of expenditure- or tax-based austerity plans can be explained by supply side reforms, and we find that it cannot.

## 5 Further Thoughts

In this final section, we briefly discuss a few additional issues regarding the trade-offs between expenditure-based and tax-based austerity. First, redistributive effects may differ between austerity achieved through tax hikes or spending cuts. There is a common, though untested, perception that spending cuts may raise inequality more than tax increases, but clearly this conclusion depends on which taxes are raised and which spending items are cut. In the context of high-income OECD countries, total government spending is close to 50 percent of GDP. It seems quite plausible then

that budget cuts of the magnitudes needed to reduce a deficit by, say, 3-4 per cent of GDP can be achieved without affecting the welfare of the really poor. In fact much of the modern welfare state supports the middle class, in some cases even the upper middle class which often enjoys almost free health care regardless of income levels, heavily subsidized university education, and (especially in Continental Europe) subsidized services like transportation. In addition, issues of redistribution arise not just at a point in time, but also across generations. For example, an increase in the mandatory retirement age may lead to a more equitable distribution of resources across generations. Cuts in current public investment rather than current transfers, also have important redistributive consequences across generations. Passing a large debt burden to future generations will have consequences for intergenerational redistribution. Of course, the question of how different spending or tax changes might affect redistribution is separate from an analysis of whether austerity plans adopted in this or that country had these goals in mind.

Second, what are the electoral consequences of austerity? A common view amongst commentators is that deficit reduction policies are the kiss of death for the governments which implement them. However, as we show in AFG (2019), the electoral effects of austerity are not clear cut or easy to predict. Several governments (and not only in Germany) have extended their time in office during periods of austerity.

Third, although a great deal has been written about the experience of Greece during 2010-2014, with the many errors, confusion, messy choices, we have not discussed it specifically here. We discuss Greece in AFG (2019) and also see the excellent work by Gourinchas et al. (2017) and Ardagna and Caselli (2014). The Troika paid very little attention to the composition of austerity plans, whether in Greece or anywhere else, and demanded an extraordinarily heavy dose of both, which only in part were implemented in a very unclear and hard to measure way. Using the (admittedly rough) data available for Greece, we used our model of fiscal adjustments, developed in Alesina et al. (2019), to simulate the effects of the Greek austerity plans. This exercise predicts the Greek recession quite well. It is baffling that the Troika seemed surprised by the size of the Greek recession. The "surprise" of the Troika seems an hypocritical attempt at deflecting responsibility.

Fourth, was 2010 too soon to start austerity plans in some European countries? It is obviously impossible to know what would have happened if countries across Europe had continued to expand their borrowing beyond 2010 and for several years afterwards. We suspect that the rosy scenario painted by the anti-austerity side is too optimistic. Our analysis however suggests a few conclusions. The effects of austerity would have been lighter if it had been focused mostly on the spending side: Ireland

and (in part) the United Kingdom, did exactly that and had much smaller and shorter recessions than Italy, Portugal and Spain where a large portion of austerity was on the tax side. Spending-based austerity plans that were less front-loaded, but credible, would probably have worked better, leading to smaller recessions and debt stabilization. An earlier intervention by the European Central Bank would have been a welcome help, too.

Finally one may wonder: if spending cuts are so much less contractionary than taxes increases, then why don't policymakers incorporated this knowledge into their decisions? They typically did not, with the exception of the Irish government in 2010 as we showed above. Yared (2018) documents a steady rise in debt levels in many countries. If one considers the cross-sectional variation in the government debt ratio between the start and the end of our sample (1978-2014) for the OECD economies in our sample. We show that austerity policies based upon budget cuts would have been much more successful in stabilizing debt over GDP ratios, but they were often not followed. Blanchard and Leigh (2014) argued that the IMF had underestimated the size of multipliers. Our results show that indeed the IMF had underestimated tax multipliers but not spending multipliers. More importantly the IMF had failed to distinguish between the two, implicitly sending the message that it did not much matter how deficit were reduced, with taxes or expenditures. In addition, even if policymakers had internalized the different effects of spending cuts versus tax increases, they may face political difficulties in cutting spending. The first one is the issue of timing. Austerity policies are almost always the result of past mistakes that lead to a crisis that needs to be dealt with immediately. Tax hikes are faster to implement and bring revenue more rapidly than cuts in government spending programs, and this is why policy makers might adopt them even if they suspect that they may be more recessionary. Second spending cuts often affect specific groups, say retirees, students, public sector unions, certain categories with specific fiscal subsidies. These categories are more organized than tax payers and they may be able to oppose these policies with strikes, pretest, cuts of campaign contributions, namely a series of political activities which go well above and beyond voting. On the other hand tax payers are not politically organized and don't have any other political tools than casting a vote. This is a perfect example of the effects of concentrated benefits, blocking specific spending cuts, versus generalized costs, namely higher taxes.



## 6 Figures

Figure 1: Response of GDP to two different austerity plans

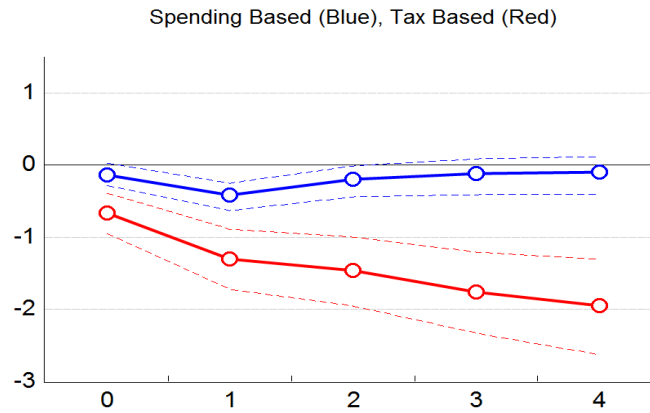


Figure 2: Response of private investment to two austerity different plans

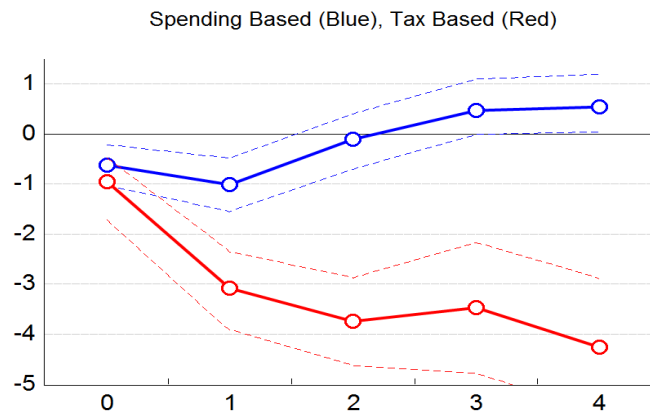
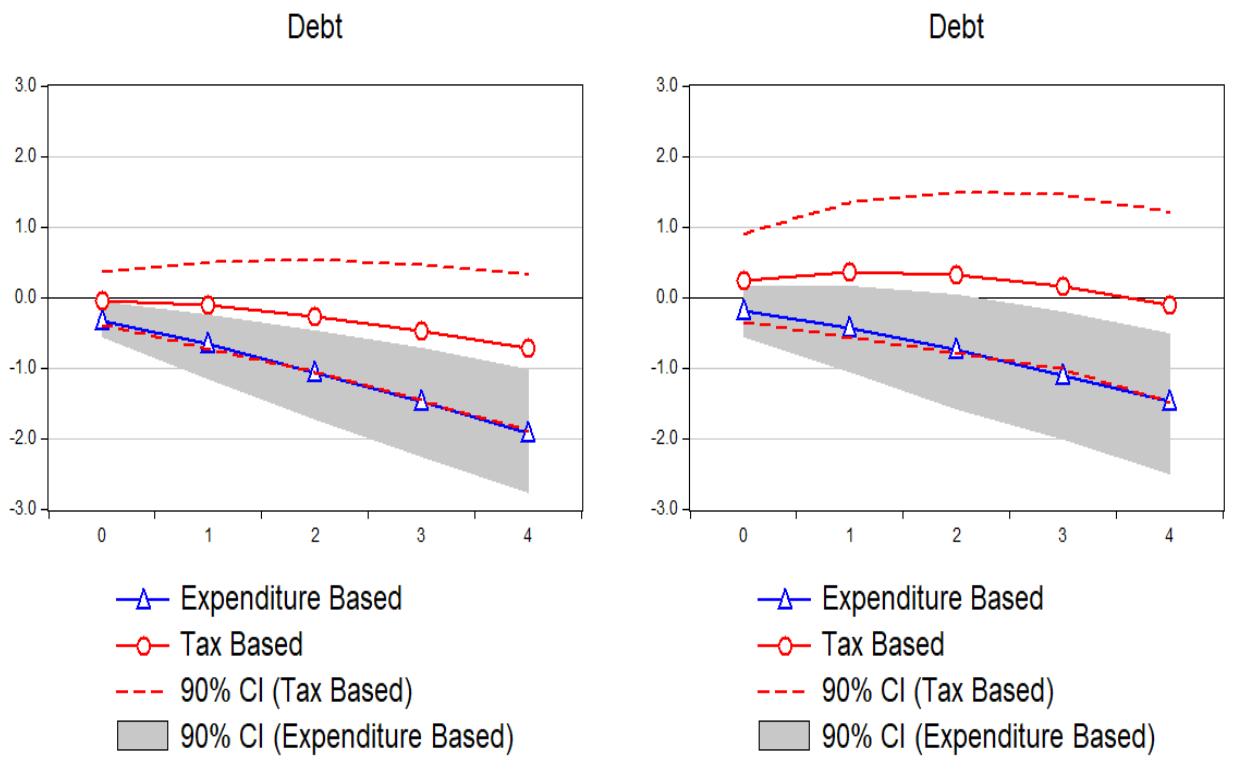


Figure 3: Debt dynamics with Low Debt (to GDP) - Low Cost of Debt and High Debt (to GDP) - Low Cost of Debt



## 7 Appendix: Empirical Models for Fiscal Policy Simulation

The analysis of the effects of austerity requires the choice of an empirical model to measure them, that is one needs to choose an empirical model that maps fiscal plans into macroeconomic outcomes. In this appendix we will first describe the general structure of models used for fiscal policy simulation. Then we shall illustrate the specific model used in AFG 2019 to simulate the effect of fiscal plans on output growth and the debt to GDP ratio.

We start from the specification, estimation and simulation of a model that describes the behavior of a set of macro variables,  $\mathbf{Y}_t$ , as a function of their past values,  $\mathbf{Y}_{t-1}$ , the past values of a few policy variables  $\mathbf{P}_{t-1}$  (in our case fiscal policy variables) and macroeconomic shocks. Similarly, the dynamics of policy variables can be decomposed into a "rule" – which describes the response of current policy to past policy and past macroeconomic conditions – and deviations from the rule, that include our fiscal plans. Plans are constructed considering a sequence of announced and implemented fiscal adjustments that replicate the in-sample correlation between announcements and unexpected measures. The estimated parameters of the equations used to describe plans allow to simulate the average fiscal plan in the data: they do so because, when the effects of an unanticipated shift in some fiscal variable is simulated, announcements should move consistently with what has been observed in the sample. For the same reason, when we simulate an EB or a TB plan we do not move taxes (spending) keeping spending (taxes) constant because this has almost never happened in the plans we reconstructed. Instead, we move taxes and spending according to what we have observed, on average, in the EB or TB consolidations present in our sample. Finally, by simulating plans that explicitly include announcements, the approach based on narratively identified fiscal plans addresses the "fiscal foresight" problem (Leeper (2010))

The more general model one can use to map fiscal plans into macroeconomic variables can be written as:

$$\mathbf{Y}_t = f_1(\mathbf{Y}_{t-1}, \mathbf{P}_{t-1}, \Theta_1) + f_2(\mathbf{plan}_t, \Theta_2) + \mathbf{u}_{1t} \quad (1)$$

$$\mathbf{P}_t = f_3(\mathbf{Y}_{t-1}, \mathbf{P}_{t-1}, \Theta_3) + f_4(\mathbf{plan}_t, \Theta_4) + \mathbf{u}_{2t} \quad (2)$$

$$\mathbf{plan}_t = g(e_{i,t}^u, e_{i,t-1,t}^a, e_{i,t,t+1}^a, \Phi) + \mathbf{u}_{3t} \quad (3)$$

Once the variables to be included in  $\mathbf{Y}_t$  (the macro variables) and  $\mathbf{P}_t$  (the policy variables) are chosen (a choice that is limited by the scarcity of data), in order to use the model to run a simulation a functional form for  $f_1, f_2, f_3, f_4$  must be also

chosen and the parameters  $\Theta_1, \Theta_2, \Theta_3, \Theta_4$  must be estimated. Once the model is estimated, simulations allows to construct an impulse response ( $IR$ ) that describes the difference between the forecast of the macro variables conditional on the scenario in which a fiscal plan is implemented and the forecast for the same variables absent fiscal plans:

$$IR(t, s, d_i) = E(\mathbf{Y}_{i,t+s} | plans_t; I_t) - E(\mathbf{Y}_{i,t+s} | no\ plans_t; I_t) \quad s = 0, 1, 2, \dots$$

The impact of fiscal plan is then usually reported in the form of multipliers.

There are several approaches to experimenting with empirical models. Independently of the preferred model, a number of conditions need to be satisfied to obtain a valid simulation. First, empirical reduced forms must be simulated keeping all parameters constant: this is the reason why the literature typically chooses deviations from a policy rule as the relevant policy experiment. In addition, if deviations from the policy rule occur via plans, i.e. through correlated, unexpected and announced fiscal adjustment measures, simulation with constant parameters is only possible if the relation between the different fiscal measures in simulation is coherent with that observed in sample. Counterfactual experiments are very risky. It is tempting to try and answer the question on what is the response of the economy to some fiscal plan constructed differently from the estimated pattern within sample (for example exclusively via announced measures or via unanticipated measures, while in the sample a mix of them has been typically adopted). Running such experiments would require simulating the model choosing for some of the parameters values that are different from the estimated ones. This is risky because changing some parameters while leaving others unchanged might lead the model astray. An obvious case is the one in which the variation of the parameters perturbed implies a change in the parameters that are arbitrarily kept constant (see Lucas (1976)). Deviations from the policy rule (our plans) must satisfy three further conditions (see Ramey (2016)): (1) they must be exogenous for the estimation of the model parameters; (2) they must be uncorrelated with other structural macroeconomic shocks; (3) they should not mix anticipated with unanticipated shifts in policy variables. Condition (1) allows to identify the relevant information from the observed correlation in the data: if we can identify fiscal actions that are exogenous with respect to current fluctuations in output, then we can measure the output effect of fiscal policy analyzing the response of output to such policy actions. Condition (2) allows simulation of the effect of a shift in fiscal policy muting other potential sources of macroeconomic fluctuations (i.e. shifts in technology, or in monetary policy, or in consumers' preferences), so that their effect can be assessed by keeping all the other shocks constant. Condition (3) allows to identify the response of economic agents to changes in the information

set from their response to the implementation of fiscal measures.

The empirical model used in AFG 2019 to compute fiscal multipliers is a linear dynamic model (a VAR) or a non-linear one (a Smooth-Transition VAR) – used when the dynamic path of the economy depends on the probability of being in different regimes, e.g. in an economic expansion or recession or with high or low debt over GDP ratios. The use of a dynamic model has several advantages. First, including in the VAR changes in revenues and spending (as a fraction of GDP) allows to track the impact of the narratively identified shifts in fiscal variables on total revenues and total spending thus checking the strength of narratively identified instruments – for instance it allows to verify if, following a positive shift in taxes, revenues indeed increase. Second, in a dynamic model the estimated coefficients on the narratively identified shifts in fiscal variables measure the effect on output growth of the component of such adjustments that is orthogonal to lagged included variables: thus the estimated multipliers are not affected by the possible predictability of plans on the basis of the lagged information included in the model. Third, a dynamic model allows to compute multipliers in two different ways: with respect to an initial fiscal impulse and with respect to the cumulated change in fiscal variables. The limited set of variables in the specification of a dynamic model in this case does not affect the identification of the exogenous fiscal measures because these are not derived from VAR innovations but are directly observed. Estimates of the output response to a fiscal plan, however, might also depend on the effect that plans have on variables not included in the VAR: this omission will not affect the measurement of the final effect but it prevents the identification of different transmission channels. Finally, dynamic models allow naturally to reconstruct the response of the debt over GDP ratio to fiscal adjustment. This is achieved by appending to the model the dynamic identity that describes the evolution of the debt/GDP given the average cost of financing the debt, real growth and the ratio of primary surplus to GDP.

The empirical literature based on narratively identified adjustments has traditionally adopted a simplified version of the full dynamic models by using a single equation approach to the computation of impulse responses. Romer and Romer (2010) have inaugurated this tradition by using the moving average representation of output in terms of the narratively identified fiscal adjustment to derive the impulse response function that describes the tax multiplier. The validity of such an approach requires the orthogonality of the included adjustments to structural shocks in the economy and the appropriate choice of the truncation of the length of the lag of policy instruments. Jordà (2005) has refined this approach to propose a Local Projection method to compute impulse responses via estimation of a series of single equations that captures the effect of exogenous adjustments on a given variable at

each period after implementation of the policy. If the underlying model is linear and the structural shocks are correctly identified, then LP recovers exactly the impulse response computed from the VAR. If instead the underlying model is non linear, Local Projections can be interpreted as a linear approximation of the true model (see e.g. the applications in Auerbach and Gorodnichenko (2016); Ramey and Zubairy (2015, 2017)). The validity of the Local Projections method requires that the exogenous adjustment variable is not correlated over time, which makes the application of this method practically impossible when plans are the relevant adjustment. Moreover, in the presence of non linearities — arising, for instance, because the dynamic response to a fiscal plan depends on the regime the economy is in when the plan is introduced — Local Projections do not offer a good approximation of the non-linearity described by a Smooth Transition VAR (STVAR). This is because in a STVAR impulses responses depend on the state of the economy in each period from the initial one, in which the impulse occurs, and the final one in which the response of the relevant variable is observed. Such a non linearity cannot be replicated when the Local Projection Method is adopted.<sup>9</sup>

Further refinements to the econometric approach are proposed by Jordà and Taylor (2016), who question the validity of the narrative fiscal instrument used by Guajardo et al. (2014). Building on evidence initially provided by De Cos and Moral-Benito (2016) they transform the narrative fiscal instrument into a binary "treatment" variable to show that it is predictable. Consolidation is more likely when public debt to GDP is high, when the economy is growing below potential, when growth slows down (in contrast with the common-sense timing of countercyclical policies) and when some consolidation has been introduced in the past. Predictability, however, does not per se imply the failure of exogeneity: it would do so if the (excluded) controls, that are good predictors, were correlated with output growth. Jordà and Taylor (2016) propose a statistical design based on taking "triple insurance" against the potential endogeneity. First, they take all episodes of consolidation from the IMF narrative instruments as a subset of all consolidation episodes that are a candidate for random allocation, second they add all the statistically significant predictors as covariates in the regression that measures the effect of the instruments on the macroeconomic outcome of interest, third they use inverse probability score weighting to re-randomise allocation of the IMF consolidation events (the more predictable is an event the less is the weight attributed to it in order to measure the macroeconomic outcome of fiscal consolidation). Finally, they propose to measure the macroeconomic consequences of consolidations by using an IPWRA (Inverse

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<sup>9</sup>Batini et al. (2012) clearly illustrate the importance of allowing the regime to evolve as function of the fiscal impulse.

Probability Weighted Regression Adjusted) estimator.

The methodology adopted by Jordà and Taylor (2016) suffers, in our view, from a potentially serious problem of loss of information that occurs when the narrative adjustments are transformed into a binary treatment variable. There are two sources of identification of narrative adjustments: the timing of a fiscal correction and its size. Transforming fiscal adjustments into a 0/1 dummy completely neglects the importance of size as a source of identification. This is a crucial shortcoming for an analysis of the effects of fiscal policy. Alesina et al. (2018) show that an indicator variable that takes the value of 1 when an adjustment is implemented and 0 otherwise, explains a very low share of the variance of the narrative instrument, supporting the conjecture that the main source of identification is the size of the adjustment, not its timing. In addition, the evidence that the timing of narrative adjustments can be predicted does not imply that the fiscal correction itself is predictable because, as we have seen, its size cannot be predicted. In other words, fiscal policy is different from a medical treatment in which a group of patients are given the same dose of a medicine and a control group no medicine. How much medicine is given matters a lot and the dose is different across different "patients". The evidence that the timing of narrative adjustments can be predicted does not imply that the fiscal correction itself is predictable if its size cannot be predicted.

## 7.1 An example

To illustrate the practical implementation of model specification we give a detailed representation of the model used to derive the dynamic response of the debt/GDP ratio to fiscal adjustment plans. The dynamics of the debt ratio,  $d$ , for country  $i$  is

$$\begin{aligned} d_{it} &= \frac{1 + i_{it}}{(1 + x_{it})} d_{it-1} + g_{i,t} - \tau_{i,t} + u_{6,i,t} \\ x_{it} &\equiv \Delta p_{it} + \Delta y_{it} + \Delta p_{it} \Delta y_{it} \end{aligned}$$

where  $i_{it}$  is the nominal average net cost of financing the debt,  $x_{it}$  nominal output growth,  $\Delta p_{it}$  is GDP inflation,  $\tau_{i,t}$  is tax revenue as a fraction of GDP, and  $g_{i,t}$  is primary government spending, also as a fraction of GDP.  $u_{6,i,t}$  is a stock-flow adjustment, namely a term that tracks the difference between the actual change in the debt ratio and the change associated with the three variables in the foregoing equation. The need for stock-flow adjustment arises, for example, in the presence of revenue from sales or purchases of financial and nonfinancial assets; revaluations, in the case the debt is valued at market prices; debt write-offs, and so forth, all items that do not enter the definition of the primary surplus ( $g_{i,t} - \tau_{i,t}$ ). To track

the effect on the debt ratio of austerity plans the model must be specified so that  $\mathbf{Y}_t = (\Delta y_{i,t}, \Delta p_{it}, i_{it}, d_{it})$ ,  $\mathbf{P}_t = (\Delta g_{i,t}, \Delta \tau_{i,t})$ . We therefore adopt the following specification

$$\mathbf{z}_{i,t} = \begin{bmatrix} \Delta y_{i,t} \\ \Delta p_{i,t} \\ i_{i,t} \\ \Delta g_{i,t} \\ \Delta \tau_{i,t} \end{bmatrix}, \mathbf{e}_{i,t} = \begin{bmatrix} e_{i,t}^u \\ e_{i,t-j,t}^a \\ e_{i,t,t+j}^a \end{bmatrix}, \mathbf{a}_i = \begin{bmatrix} a_{1,i} \\ a_{2,i} \\ a_{3,i} \end{bmatrix} \text{ similarly for } \mathbf{b}_i$$

$$\Delta y_{i,t} = A_1(L) \mathbf{z}_{i,t-1} + \begin{bmatrix} \mathbf{a}'_1 \mathbf{e}_{i,t} & \mathbf{b}'_1 \mathbf{e}_{i,t} \end{bmatrix} \begin{bmatrix} TB_{i,t} \\ EB_{i,t} \end{bmatrix} + \lambda_{1,i} + \chi_{1,t} + u_{1,i,t}$$

$$\Delta p_{i,t} = A_2(L) \mathbf{z}_{i,t-1} + \begin{bmatrix} \mathbf{a}'_2 \mathbf{e}_{i,t} & \mathbf{b}'_2 \mathbf{e}_{i,t} \end{bmatrix} \begin{bmatrix} TB_{i,t} \\ EB_{i,t} \end{bmatrix} + \lambda_{2,i} + \chi_{2,t} + u_{2,i,t}$$

$$i_{it} = A_3(L) \mathbf{z}_{i,t-1} + \begin{bmatrix} \mathbf{a}'_3 \mathbf{e}_{i,t} & \mathbf{b}'_3 \mathbf{e}_{i,t} \end{bmatrix} \begin{bmatrix} TB_{i,t} \\ EB_{i,t} \end{bmatrix} + \lambda_{3,i} + \chi_{3,t} + u_{3,i,t}$$

$$\Delta g_{i,t} = A_4(L) \mathbf{z}_{i,t-1} + \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} \end{bmatrix} \begin{bmatrix} g_{i,t}^u \\ g_{i,t-1,t}^a \\ \tau_{i,t}^u \\ \tau_{i,t-1,t}^a \end{bmatrix} + \lambda_{4,i} + \chi_{4,t} + u_{4,i,t}$$

$$\Delta \tau_{i,t} = A_5(L) \mathbf{z}_{i,t-1} + \begin{bmatrix} \beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} \end{bmatrix} \begin{bmatrix} g_{i,t}^u \\ g_{i,t-1,t}^a \\ \tau_{i,t}^u \\ \tau_{i,t-1,t}^a \end{bmatrix} + \lambda_{5,i} + \chi_{5,t} + u_{5,i,t}$$

$$d_{it} = \frac{1 + i_{it}}{(1 + x_{it})} d_{it-1} + g_{i,t} - \tau_{i,t} + u_{6,i,t}$$

$$x_{it} \equiv \Delta p_{it} + \Delta y_{it} + \Delta p_{it} \Delta y_{it}$$

To recover the effect of adjustment plans on the fiscal and macroeconomic variables, the empirical model for  $\mathbf{Y}_t$  and  $\mathbf{P}_t$  must be accompanied by a set of equations describing the response of announcements to contemporaneous corrections and the relative weights of tax and spending measures within a plan. We allow both correlations to be different according to the type of plan, *TB versus EB*. In other words, we allow for plans to have a different intertemporal and intratemporal structure according to



their type. The following equations complete the model:

$$\begin{aligned}
\tau_{i,t}^u &= \delta_0^{TB} e_{i,t}^u * TB_{i,t} + \delta_0^{EB} e_{i,t}^u * EB_{i,t} + \epsilon_{0,i,t} \\
g_{i,t}^u &= \vartheta_0^{TB} e_{i,t}^u * TB_{i,t} + \vartheta_0^{EB} e_{i,t}^u * EB_{i,t} + \nu_{0,i,t} \\
\tau_{i,t,t+j}^a &= \delta_j^{TB} e_{i,t}^u * TB_{i,t} + \delta_j^{EB} e_{i,t}^u * EB_{i,t} + \epsilon_{j,i,t} \quad j = 1, 2 \\
g_{i,t,t+j}^a &= \vartheta_j^{TB} e_{i,t}^u * TB_{i,t} + \vartheta_j^{EB} e_{i,t}^u * EB_{i,t} + \nu_{j,i,t} \quad j = 1, 2
\end{aligned} \tag{4}$$

where the first two equations describe the average tax ( $\delta$ ) and spending ( $\vartheta$ ) share of *EB* and *TB* plans. The next two equations describe the relation between unexpected shifts and those announced for years  $t + 1$  and  $t + 2$ , differentiating between *EB* and *TB* plans. (These auxiliary regressions allow us to construct the  $e_{i,t,t+j}^a = \tau_{i,t,t+j}^a + g_{i,t,t+j}^a$  needed to compute impulse responses). The coefficients in the equations describing the dynamic evolution of the plans are allowed to vary across the type of plan. This is to capture the fact that *TB* plans tend to be front-loaded relative to *EB* plans because cutting expenditures takes longer than raising taxes. The model is non linear and therefore impulse response will depend on initial conditions, this is the reason why in the text we report different impulse response according to different levels of the initial level of debt and of the initial cost of debt servicing.

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