

SAFE POLICY LETTER COLLECTION

# Austerity and Economic Growth Concepts for Europe

edited by Alfons Weichenrieder

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**SAFE Policy Letter Collection on  
Austerity and Growth**

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## Introduction

*Alfons Weichenrieder*

Many European countries feel haunted by “excess austerity”. Numerous voices claim that consolidation in response to market pressures and demands by European Union institutions and the International Monetary Fund are leading to extended spells of low growth plus excessive unemployment. While some euro area countries, as Ireland, have successfully achieved the turn-around, concerns about the southern periphery prevail and political scapegoating – including allegations against the conditionality of European bailouts – has severely increased after the Greek January elections. Beyond the acuteness of these current issues, the fundamental question of what fiscal consolidation of public budgets is costing in terms of growth is still calling for more research.

Against the background of the European debt crisis, the Research Center SAFE, in the fall of 2013, had issued a call for papers on the topic “Austerity and Economic Growth: Concepts for Europe”, with the objective of soliciting research proposals focusing on the nature of the relationship between austerity, debt sustainability and growth. An international selection committee consisting of Costas Azariadis (Washington University), Roel Beetsma (Universiteit van Amsterdam), Henning Bohn (University of California at Santa Barbara), Athanasios Orphanides (MIT Sloan School of Management) and myself looked through the almost 50 project proposals submitted in response to this call.

We identified five projects that were found particularly worthy of SAFE funding. Their authors, including Alberto Alesina, Harris Dellas, Gernot Müller, Alan M. Taylor and Linda Tesar, all coming from European and U.S. universities, presented their work at a SAFE conference, in Frankfurt, on 14 June, 2014. Each project not only culminated in an academic paper, every team of authors was also asked to produce a shortened, non-technical policy brief in the aftermath of the conference. These policy papers are presented in this collection of policy letters which is intended to help disseminate the findings of the projects to a broader audience, and, in particular, to political decision makers.

The first paper in this collection is by Alberto Alesina, Carlo Favero and Francesco Giavazzi. It looks into the possibility that previous studies may have reported biased results with respect to how fiscal consolidations influence the real economy. For this reason, the authors change the approach from previous analyses by Alesina in the sense that periods of fiscal consolidation are identified by announcements of fiscal plans rather than by mere changes of deficit-to-GDP ratios. The conclusion that fiscal consolidation is less costly for growth if it implies spending cuts rather than tax increases survives this change in the set-up and seems to contradict recent IMF findings.

The second study by Harris Dellas and Dirk Niepelt takes a more theory-based approach to fiscal austerity. Based on the observation that government debt default is often based on the unwillingness rather than the inability to service debt, Dellas and Niepelt emphasize that fiscal austerity is a signal that investors use to tell apart governments with high and low default costs that accordingly will have a high or low probability of repayment. In this signaling framework, there is also an interesting role for public investment as this policy measure can signal a future-oriented policy and may help to distinguish a credit-worthy government from one with a high default probability.

The third, more empirically oriented paper by Benjamin Born, Gernot Müller and Johannes Pfeiffer, has a strong connection with the theory paper by Dellas and Niepelt. It looks at the impact of austerity measures on government bond spreads. Overall, the authors find that fiscal consolidation indeed reduces a country's interest spreads, which seems to reflect an increased trust in sustainability; although this effect is absent if fiscal stress is already biting.

The fourth paper by Oscar Jorda and Alan M. Taylor puts into question whether the narrative records of fiscal consolidation plans are really exogenous. They find that consolidations are more likely in the face of high debt and sluggish growth, but correction of that endogeneity, by using a more robust estimator, leads to even larger negative effects of austerity measures in slumps, but not in booms. Again, this seems to point towards policy errors made in the prosperous years before the crises, where some countries failed to take sufficient precautions.

The paper by Enrique Mendoza, Linda Tesar and Jing Zhang approaches the debt problem from a different angle. Their contribution highlights that in today's open economies, a country's taxing ability is severely restricted by the mobility of capital and that tax revenues from capital may peak at a tax rate of around 30%. This suggests that fiscal consolidation should largely depend on expenditure cuts, rather than tax increases that may fail, in particular, if fiscal space is exhausted.

There has been – as it is usual in the academic production of knowledge – quite a lag between the SAFE call for projects and this final output. Writing this introduction just a few days after the landslide election in Greece, however, I am sure that the contributions are still at the heart of an ongoing debate and have the potential for stimulating further research. In particular, the question arises how to make sure that the simple message that consolidation ideally should happen in good times, is adequately transmitted to the policy arena.



## The Output Effects of Fiscal Consolidation Plans

*Alberto Alesina, Carlo Favero and Francesco Giavazzi*

### The Research Question

Do sharp reductions of government deficits (labeled fiscal adjustments or fiscal consolidations) cause large output losses?

The key question in estimating the effects of fiscal policy on output is how to identify shifts in fiscal policy that are “exogenous”, that is are not a response to the state of output – as would be the case, for instance, of a fiscal expansion induced by a fall in output.

### Our Methodology

This paper argues that the correct methodology to answer this question requires studying fiscal plans, rather than individual shifts in fiscal variables as it is normally done in the literature. Large fiscal consolidations are typically multi-year processes in which a government announces and then implements a sequence of deficit reduction policies. These plans are often revised and adjusted during the course of their implementation generating a complex interaction of expected and unexpected policy actions which should be accounted for.

We build fiscal plans starting from the episodes of fiscal adjustment constructed at the IMF by Devries et al. (2011) and used in Guajardo et al. (*forthcoming*). These episodes cover 17 OECD countries between 1978 and 2009. Among all stabilization episodes these authors have selected those that were designed to reduce a budget deficit and to put the public debt on a sustainable path. As a result, they are unlikely to be systematically correlated with other developments affecting output in the short term, and thus they can be considered as exogenous for the estimation of the short-term effects of fiscal consolidation on economic activity. It has been observed (Jordà and Taylor 2013) that shifts in fiscal variables identified through the narrative method – and in particular the episodes we use in this paper to construct plans – are predictable. We show that this finding is a consequence of the fact that fiscal policy is conducted through multi-year plans. The fact that episodes of fiscal consolidation can be predicted from their past realizations, or from the realization of other variables, different from output growth, does not invalidate exogeneity of the plan.

The Devries et al. data document the shifts in taxes or spending that are implemented in a given year – say year  $t$  – and announced in year  $t$  for future periods with a 3-year horizon. Using these data we

construct fiscal plans. A plan is composed, for each year, of unexpected fiscal adjustments (announced upon implementation at time  $t$ ), adjustments implemented at time  $t$  but which had been announced in previous years, and future announced corrections (announced at time  $t$  for implementation in the future). We find that countries adopt different styles for their fiscal consolidations. The degree of correlation between the unanticipated and announced part of a plan varies from being very strong and positive, to being negative. We have “reversal plans”, in which a fiscal tightening in the year a plan is first introduced is accompanied by the announcement of looser fiscal policy in subsequent years, and “persistent plans” in which unanticipated and announced fiscal actions move in the same direction.

Having constructed exogenous fiscal plans we classify them in tax-based (TB) and expenditure-based (EB) on the basis of the relative importance of tax increases and spending cuts in each plan.

This allows us to capture the intra-temporal correlation between tax hikes and expenditure cuts. Allowing for shifts in taxes and spending to be correlated is crucial for evaluating (for instance through an impulse response) fiscal multipliers. To analyze the impact of fiscal plans on macroeconomic variables we follow Romer and Romer (2010) and estimate a truncated moving average (MA) representation of various macroeconomic variables: output growth, consumption growth, etc. We do this for a panel of countries, since if we were to study the macroeconomic effects of fiscal consolidations using plans for a single country we would have too few observations. We thus pool together fiscal adjustment plans from different countries. Pooling, however, is problematic in the presence of heterogeneity. We address heterogeneity estimating a quasi-panel, that is pooling the international evidence but allowing for two sources of heterogeneity: (i) different styles of fiscal consolidations across countries and (ii) different effects of TB and EB plans within each country.

## Our Findings

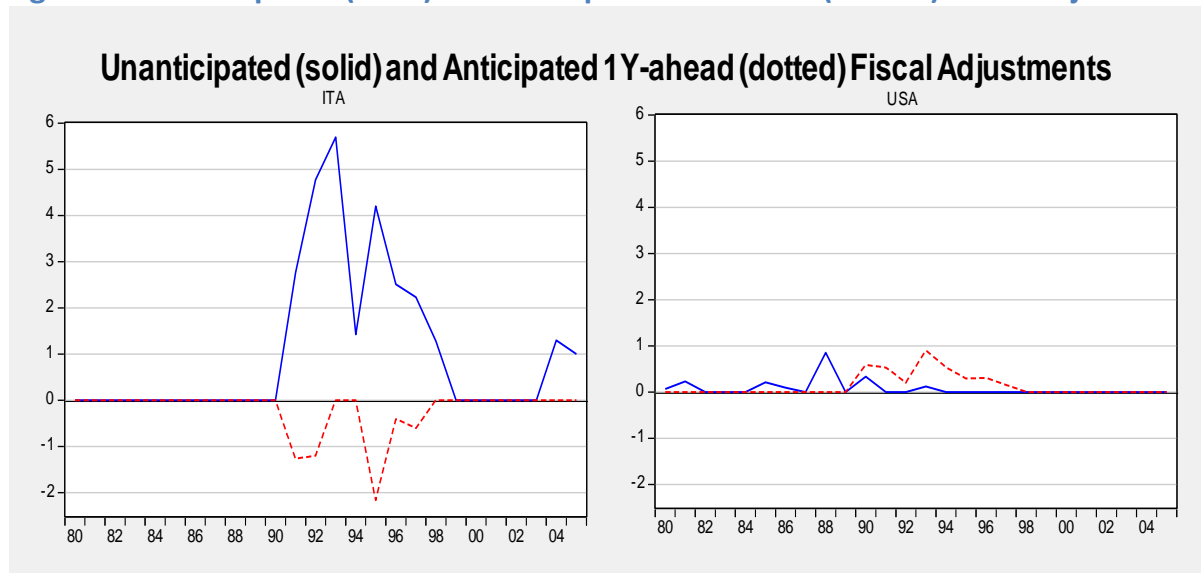
Our results show that the effects of fiscal consolidations depend on their design and in particular on two characteristics: their composition (tax hikes vs. spending cuts) and their consistency over time (i.e. whether changes in revenues and spending are permanent or transitory). Spending-based adjustments have been associated on average with mild and short-lived recessions, in many cases with no recession at all. Instead, tax-based adjustments have been followed by prolonged and deep recessions. It is worth emphasizing that these are averages, estimated over several plans: an average of small or zero recession can be the result of some bigger recessionary episodes and, in some cases, even of expansionary fiscal adjustments. We also find that fiscal adjustments may be associated with especially low output costs when they are permanent rather than stop and go. The difference between spending-based and tax-based adjustments is remarkable in its size and cannot be explained by different

monetary policy responses. The difference in the output effects of the two types of fiscal adjustment is mainly due to the response of private investment, rather than that of consumption growth. Interestingly, the responses of business and consumers' confidence to different types of fiscal adjustment show the same asymmetry as investment and consumption: business confidence (unlike consumer confidence) picks up immediately after the start of an expenditure-based adjustment.

### Different Styles of Fiscal Policy

We label “unanticipated and permanent” a shock that is unanticipated with no future reversals associated to it; “unanticipated transitory” are shocks that are also unanticipated, but associated with the anticipation of a policy reversal in the future – for instance a spending cut associated with the announcement that it will be reversed at some future date. While it is always interesting to study the effects of announcements of future changes in taxes or spending, we highlight one particular aspect of such anticipations: the possibility that they may signal a policy reversal. We find that the effects of these two types of policy shifts is different and that there is a clear distinction between countries which follow stop-and-go policies and those which stay on course of the adjustments. As illustrated in Figure 1, Italy and the U.S. are the two extreme cases in our sample.

**Figure 1: Unanticipated (solid) and Anticipated 1 Y-ahead (dotted) Fiscal Adjustments**



In the U.S. fiscal adjustment are usually permanent: there is a positive correlation between the unanticipated shifts in taxes and spending introduced by a stabilization plan, and the future (anticipated) shifts announced upon the introduction of the plan. In the case of Italy, instead, the correlation between the unanticipated shifts in taxes and spending introduced by a stabilization plan,

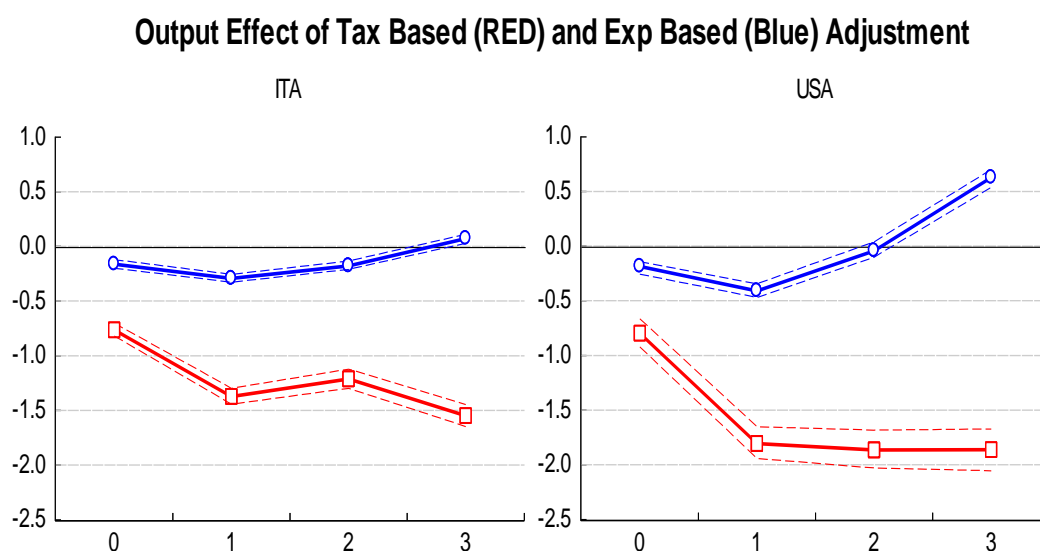
and the future (anticipated) shifts announced upon the introduction of the plan is negative. In other words, fiscal stabilizations are temporary measures: when multi-year fiscal plans are introduced, agents know that at least part of the measures will be undone in the future. We capture the differences between transitory and permanent stabilizations by allowing the fiscal multiplier to depend on the way the adjustment occurs.

We then distinguish between "tax based" (TB) and "expenditure based" (EB) fiscal adjustments. An adjustment is labeled as tax-based (expenditure-based) if the sum of the unexpected and announced tax (expenditure) changes is larger than the sum of the unexpected and announced expenditure (tax) adjustments.

### Different Output Effects of Fiscal Stabilizations

Figure 2 illustrates our main results by reporting the dynamic response of output to a fiscal correction of one per cent of GDP for two representative countries in our sample: Italy and the USA.

**Figure 2: Output Effect of Tax Based (RED) and Expenditure Based (Blue)**



## Adjustment

The multipliers we observe for TB adjustments are therefore definitely larger than one and on average close to two. Instead they are much smaller initially, and become negative after about a year and a half, in the case of EB adjustments. The lowest output cost of EB plans appears for the U.S., where multi-year plans typically introduce permanent fiscal corrections. Italy, on the contrary, where fiscal corrections are transitory actions, pays the highest output cost.

## Policy Implications

In summary the message is clear. In OECD countries the fiscal adjustments that "work" and are less recessionary or not recessionary at all are those with permanent spending cuts which signal a credible change of fiscal policy stance. Tax-based adjustments and stop-and-go policy packages tend instead to be associated with deep recessions.

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## Austerity

*Harris Dellas<sup>1</sup> and Dirk Niepelt<sup>2</sup>*

### Introduction

The recent European debt crisis brought “austerity” to center stage. The public debate contains references to “austerity” as excessive retrenchment; as a self-defeating scheme; or, as a means of gaining credibility. But what kind of phenomena do these words refer to and what do they mean? And do they represent the right framework for thinking about austerity? More generally, what is austerity, what purposes does it serve and what kind of consequences does it have both for the level of macroeconomic activity (the rate of economic growth, the unemployment rate, etc.) and social welfare?

### What is Austerity?

Austerity is a concept that has proved difficult to either define formally or to measure properly. Typically, it refers to a substantial fiscal adjustment either through a reduction in government expenditure, an increase in taxes or a combination of the two. But how much the deficit must decline and under what circumstances in order to be classified as austerity has not been addressed. Alesina and Ardagna define major fiscal adjustments as episodes during which the cyclically adjusted primary fiscal balance improved by at least 1.5% of GDP. The IMF counts as fiscal adjustment deficit-reduction measures of a certain scale even when they do not lead to reductions in the deficit of the size intended. There is no economic justification for either definition. One of the key objectives of our paper is to provide a definition that is based on economic theory.

Roughly speaking, an improvement in the budget deficit is reflected in an improvement in the level of the public debt. One could thus alternatively define austerity as the reduction in government borrowing that is associated with the fiscal adjustment.

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Viewed from the perspective of public debt allows us to study austerity employing the concepts and tools used in the well-developed credit literature, in particular as they pertain to credit rationing. This is important as it can bring much needed clarity to this subject. This literature has stressed the difference between the concepts of the ability to repay and the willingness to repay debt. Lacking ability to pay means that the debtor does not have the resources needed to make the payment. Lacking willingness means that the debtor is not willing to make the required payment in spite of the fact that he has sufficient resources at his disposal. The debate on austerity often mixes and confuses these terms. In order to have a meaningful analysis of austerity it is important to clarify which concept is the more relevant.

Ability to repay does not seem to be an issue as far as debt limits on sovereigns are concerned. Even Greece, which has a public debt to GDP ratio close to 180% seems to have sufficient resources (current and future tax revenue, government assets, public land, other forms of national wealth) to fully repay such and an even a much higher level of debt.<sup>3</sup> To the best of our knowledge, sovereign debt crises have not been associated with inability to pay. They have rather been associated with unwillingness to pay. The government of a country like Greece may be unwilling to repay debt by selling off islands or the Parthenon or by taming corruption and improving tax collections because of political economy considerations. A credit limit must thus reflect calculations on the part of the creditors about the amount of debt that a country will be willing to honor. Applying the term austerity to describe restricted lending that emanates from credit market perceptions of unwillingness to repay is meaningless. If I would like a loan of 100 but I was perceived as unwilling to repay anything in excess of 50 even if my repayment capacity were 100, then it would be silly to argue that I suffered austerity because I could not get the full 100 (which corresponds to my ability to repay) but only 50 (which corresponds to my willingness to repay). That is, restrictions on the size of deficits that a country can run do not necessarily imply something abnormal, questionable or austere.

But what if the country were both able and willing to repay 100 and only got 50? That is, if she were “forced” by the markets to run a deficit that were smaller than the one that she found both feasible and preferable? We think that the discrepancy between what the country is willing (and able) to repay and the loan that she actually gets is a meaningful definition of

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<sup>3</sup> Note that in Latin America, debt crises have taken place at much lower debt/GDP ratios, namely less than 70%.

austerity because, if it were possible to eliminate it, the borrower would be made better off without any adverse consequences for the creditors. We also argue that the most appropriate definition of austerity ought to involve a national consumption rather than a debt gap (discrepancy). These two are identical in the absence of investment. But as we will explain later, large loans accompanied with investment (or reform) requirements may make austerity more rather than less severe, so the debt gap is not always an accurate measure of austerity suffered. Hence, we define austerity as the shortfall of consumption from the level desired by a country and supported by its repayment capacity.

### What Purposes Does it Serve?

Austerity measures are not imposed without a reason and at a random time. And there exists no government that would choose to implement austerity if she were not "forced" to do so by either private (Italy) or official creditors (Greece). Austerity follows debt crises (or, it is used to preempt future ones) which in turn arise in countries with large and increasing levels of debt to GDP ratios, typically when they are also experiencing a period of anemic economic growth. For instance, when Greece suffered a debt crisis its debt to GDP ratio was 130%, its budget deficit was 15% and its most recent rate of economic growth -3.1% (all these are 2009 values).

The standard justification for austerity is that it is needed in order for the country to restrict growth in public debt. In its absence, the argument goes, the country would have to pay large risk (default) premia or even be completely shut out from the credit markets. For a country running a budget deficit that could prove very costly.

A related argument is that it represents a strategy for building a reputation of creditworthiness: by taking tough and unpopular austerity measures, a government signals that it will be similarly prepared to honor its future debt obligations by making costly debt repayments, lowering thus the cost of its current borrowing. This argument is reminiscent of the arguments used in the literature on monetary policy credibility developed in the 80s. The monetary policy literature stressed that a central bank that chose to keep inflation low even in the face of a recession would establish its inflation fighting credentials, thereby lowering



inflationary expectations and creating a more favourable inflation-output trade-off (a flatter Phillips curve).

Implicit in the above argument is that there are different types of governments, with different levels of commitment to enjoying a creditworthy reputation. The existence of different types of debtors represents the key ingredient of our model: Debtors differ with regard to their—unobserved to creditors—willingness to honour debt commitments, reflecting type specific costs that are suffered in the case of default.<sup>4</sup> In our view, such unobserved willingness (or political ability) to repay external debt represents a key dimension of uncertainty faced by creditors, and it is a dimension that has repeatedly been emphasized by policymakers and academic commentators alike. If a government's decision to implement austerity is an indicator of its willingness to repay debt, then austerity may help creditors to screen governments seeking fresh funds. Such an outcome may be advantageous for low default risk (high default costs) types, allowing them to borrow more (or, at more favourable rates) relative to types with high default costs.

It is worth noting here that a meaningful justification of austerity does not exist in the standard sovereign debt model because of lack of government heterogeneity. This model implies the existence of an endogenous debt and consumption ceiling that matches exactly the borrower's willingness to repay. As such, it predicts austerity to equal zero because there is no reason in this model to justify restricting funds below that ceiling. Moreover, in the standard model, the relationship between austerity and growth is unambiguous: Austerity lowers investment and impacts negatively on growth. Consequently, the standard sovereign model cannot make sense of either austerity or of the arguments surrounding the extant debates.

### **What are its Consequences?**

The debate on the consequences of austerity has centered on its implications for economic growth. The empirical literature has been pre-occupied with short term effects, while the

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<sup>4</sup> In terms of an aggregate measurable quantity such as GDP losses the actual costs of defaulting may be the same across countries. But the trade-off shaping the default decision may still differ across governments if the incidence of the default costs is asymmetric across groups and different governments weigh the welfare of these groups differently.

policy debates have involved both short and long term effects. The best known empirical studies are by Alesina and Ardagna and by a group of IMF economists. They produced conflicting results. Alesina and Ardagna study fiscal adjustments in rich countries and find that that belt-tightening that relied on reductions in government spending could actually increase growth, even in the very short term. In contrast, the IMF study finds that such adjustments are contractionary: a fiscal consolidation equivalent to 1% of GDP leads on average to a 0.5% decline in GDP after two years, and to an increase of 0.3 percentage points in the unemployment rate. It also finds that spending cuts are less contractionary than tax hikes.

In the policy debate there are two camps. The pro-austerity camp claims—as discussed above—that the main function of “austerity” is to help establish—signal—a government’s level of creditworthiness and thus, suppress sovereign debt default premia and increase the flow of fresh funds. Consequently, such confidence-inspiring policies increase investment and thus foster rather than hamper economic performance even in the short run. They have an even stronger positive effect on medium-long term growth. The opponents of austerity, on the other hand, while recognizing its direct contribution to credibility argue that this effect may be overwhelmed by negative macroeconomic implications. Austerity is thought to depress economic activity through standard spending (Keynesian) multiplier effects and thus to lower a country’s debt repayment ability. Consequently, in their view severe austerity could actually reduce the flow of fresh funds by making default more rather than less likely.

Our theory produces several results. First, in line with the pro-austerity camp, it establishes that austerity makes it possible to identify and extend more funds to creditworthy governments. In particular, a high creditworthiness country accepts austerity and lets current consumption suffer by honoring its current debt obligations while a low type defaults. The revelation of type makes it possible to reward the good types with larger fresh loans. Second, it highlights the role that can be played by adding investment requirements to the loan package. This additional instrument assists the separation of government types and also increases the welfare of a creditworthy government even when the proceeds from the investment *cannot* serve as collateral. Interestingly, the optimal package requires *over-investment* relative to the case where the government can freely choose the investment level. Moreover, this over-investment takes a special form. For any fresh funds offered above a certain level, not only must all these funds be invested but investment must also be co-

financed by the borrower. That is, investment increases by more than one-to-one with such funds. These results are both novel and unexpected from the point of view of the extant sovereign debt literature. In this literature, the only reason for over-investment is to provide more collateral and thus make it possible to obtain a larger loan. Moreover, the extra funds received through (over-)investment's enhancement of the collateral are split between investment and consumption. In our model, by contrast, over-investment need not contribute to higher collateral and the effect on consumption of the marginal unit of debt made possible by over-investment is negative. That is, beyond some level, more debt implies greater austerity. The fact that the optimal level of debt is found in the greater austerity region implies that a low credit risk borrower is better off with more rather than with less austerity.

The key to understanding this result lies in the fact that low credit risk borrowers have a higher propensity to invest because they are more committed to repaying and thus need more funds in the future. Consequently, increasing investment beyond the conditionally optimal level hurts more a less creditworthy type who tries to mimic than a high type. The over-investment requirement then represents a costly signal that the high type can employ in order to distinguish himself from a mimicking low type, paving the way for obtaining more funds. While these additional funds cannot be used to increase consumption and close the consumption gap, they are still valuable because they help close the investment gap (which is due to the fact that a debt constrained sovereign also under-invests relative to the first best).

The role of investment as a sorting device has several implications. First, it makes austerity a non-monotone function of the quantity of new loans: As the amount of new loans increases from some low level, austerity initially decreases. But beyond a certain level of new debt, it starts to increase. As mentioned above, the optimal level of austerity is found in the increasing portion of this function and consequently, more austerity is associated with higher welfare for creditworthy borrowers. Second, it gives rise to an ambiguous relationship between the severity of austerity and economic growth. The same level of austerity may be associated with different rates of growth. But at the level of austerity that maximizes the welfare of creditworthy countries, austerity is more severe but investment and growth are higher than in situations in which the investment instrument cannot be used in the loan package. And third, it drives a discrepancy between debt based (credit rationing) and consumption based (austerity) gaps. In particular, with forced investment, credit rationing—the distance between

actual debt and the level under complete information (the natural borrowing ceiling)—decreases with the amount of fresh funds while austerity becomes harsher. That is, the debt gap could be indicating an amelioration of credit rationing while the consumption gap would at the same time be indicating more severe austerity.

We also consider extensions of the model that help shed light on costly signalling other than through over-investment and on the inclusion of reform requirements in loan packages. We argue that having the borrower undertake costly—in the short term—reforms can increase the flow of funds. But unlike popular thinking, reforms accompanied by the relaxation of fiscal stance do not necessarily prevent the loss of current consumption. There is simply no clear relationship between the size of new funding and austerity.

### **Is there a Right Amount of Austerity?**

Our analysis establishes that there is a bounded size for optimal (welfare maximizing) austerity. Austerity can be neither too light nor too severe. It cannot be too light because in such a case low creditworthiness governments will opt to implement the light austerity measures in order to masquerade themselves as creditworthy types, obtain sizeable fresh funds and then default in the future. When the creditors correctly perceive this incentive they will restrict funds to all possible types, hurting the low risk governments. On the other hand, austerity cannot be too harsh because it would make it too onerous for a low risk government to accept such low level of consumption, pushing it to default and thus foregoing the opportunity to reveal its type. We also show –consistent with the opponents of severe austerity– that under some circumstances, large Keynesian multipliers do indeed reduce the optimal size of—but do not eliminate the need for– austerity.

## Do Financial Markets Reward Austerity?

*Benjamin Born, Gernot Müller and Johannes Pfeifer<sup>5</sup>*

### Austerity: Controversial in Many Respects

In the years following the global financial crisis, many European governments have been implementing sizeable austerity measures. These measures include both spending cuts and tax increases and are implemented in order to confront mounting concerns about rising levels of public debt or outright solvency issues. Indeed, in a number of euro area countries sovereign yield spreads relative to Germany started to take off by 2010, arguably leaving policy makers with no alternative course of action.

Still, austerity policies have been accompanied by heated controversies, political unrest and, at times, the resignation of governments. This is because first and foremost, fiscal consolidation measures have strong distributional consequences. In particular the composition of austerity, that is, whether budget deficits should be reduced mainly through higher taxes or lower expenditures and on whom the burden should fall is hotly debated. Second, austerity might hurt growth and more strongly so during deep recessions when economic slack is pervasive. As a consequence, the timing of austerity is also widely discussed. Some commentators have been arguing for delaying austerity until after the slump, while others have been arguing for frontloading consolidation because of spiraling financing costs.

Against this background we address a narrow, but particularly pertinent question. Namely, we ask whether financial markets, at least, do reward austerity. Given that austerity remains controversial in many respects, but is frequently implemented in response to financial market pressures, one should think that austerity is surely rewarded by financial markets and pays off in terms of reduced sovereign yield spreads. And yet, it has been suggested that “financial investors are schizophrenic about fiscal consolidation and growth.” First, so the argument goes, “they react positively to news of fiscal consolidation, but then react negatively later, when consolidation leads to lower growth – which it often does.” (Blanchard 2011) The

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question thus warrants a more systematic investigation which, in turn, requires the construction of a new data set as well as an appropriate empirical strategy. In what follows we summarize our ongoing research on the issue (Born et al. 2014).

### **Financial Markets' Assessment: Sovereign Yield Spreads**

Bond prices fall and yields rise as sovereign default becomes more likely. Hence, in order to measure how financial markets assess the health of public finances we rely on sovereign yield spreads: the difference of interest rates on government debt relative to those offered by a reference bond issued by a country for which default can be ruled out for all practical purposes. Importantly, we only consider interest rates on bonds denominated in the same currency in order to eliminate the confounding effects of inflation and depreciation expectations and to isolate market expectations of an outright default.

Sovereign yield spreads are particularly informative about the state of public finances and in some respect more so than the “fundamental” determinants which govern the actual health of government finances. While fiscal indicators such as, for instance, the level of sovereign debt provide important information in this regard, they generally do not provide a sufficient statistic for assessing the sustainability of debt. For the willingness and the ability of governments to honor a given level of debt obligations depends on a number of country-specific, partly unobserved factors, such as the ability to raise taxes. The same level of debt may thus have very different implications for debt sustainability in different countries. Sovereign yield spreads, instead, provide a more comprehensive picture, both because they reflect a broader assessment of market participants and because of the immediate budgetary consequences of higher interest rates. We also find that that our spread measure moves in close sync with credit default swap (CDS) spreads. These correspond to the premium of an insurance contract against a default event. However CDS premia are only available for parts of our sample.

To conduct our analysis we collect data and construct a new data set for sovereign yield spreads. Our sample comprises quarterly data for 26 emerging and advanced economies from 1993 to 2013. A number of basic facts are worth mentioning. First, yield spreads vary considerably across time and countries. In some instances they are slightly below zero, in

others they are as high as 70 percentage points. A total of about 1500 observations also allows us to compute the empirical density function. It increases sharply at low levels of spreads, as the number of observations for which spreads are high is limited. Second, yield spreads co-move negatively with economic activity. The correlation of yield spreads and current output growth is negative in all countries of our sample, but Sweden. Third, there is no systematic correlation pattern of spreads and government consumption.

### **Identification: Cuts to Exhaustive Government Spending**

Sovereign yields move for a variety of reasons, some of which may coincide with austerity, either by chance or systematically. The challenge, therefore, is to identify a possible causal effect of austerity on sovereign yield spreads. In order to do so, we focus on a limited set of fiscal policy measures, namely the quarter-by-quarter variations in exhaustive government consumption. We do not consider changes in transfers or taxes, because these vary simultaneously with economic activity, which is also a prime determinant of sovereign yield spreads.

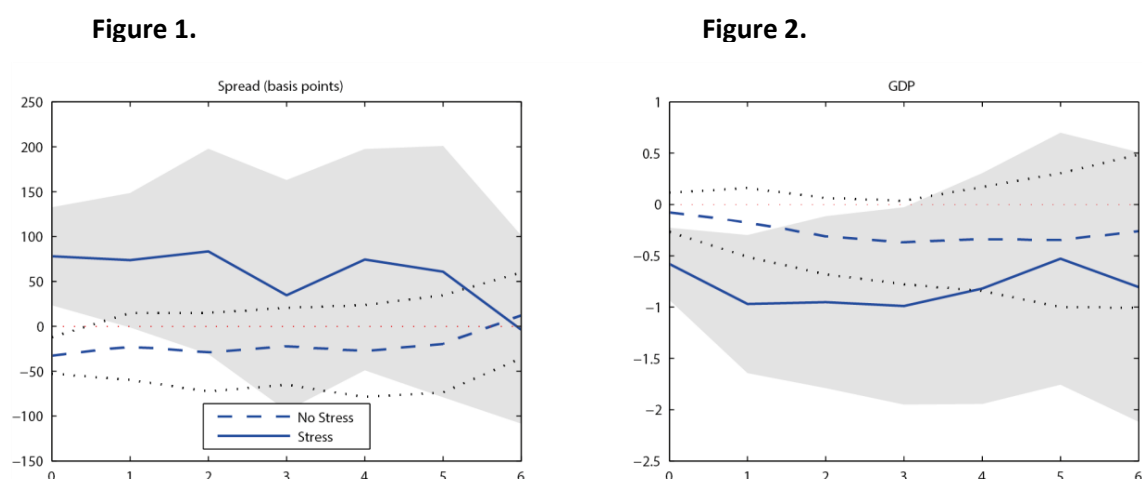
As we limit our analysis to exhaustive government consumption we are able to identify a causal effect of fiscal consolidation by exploiting a particular institutional constraint. Specifically, following earlier work by Blanchard and Perotti (2002), we rely on the fact that government consumption is typically predetermined, because policymakers are unable to respond systematically to the state of the economy within a given quarter due to legislative constraints. It may appear that during crisis periods in particular, policy makers are able to respond more swiftly to contemporaneous developments in the economy. Still, a close reading of various policy documents published during the recent crisis suggests otherwise (see Born et al. 2014). That said, we acknowledge that identification strategies are necessarily controversial and we discuss a number of caveats and possible remedies in the paper.

### **Results: Financial Markets Reward Austerity – But not in Times of Fiscal Stress**

How do sovereign yield spreads respond to austerity or, more specifically, to a cut of exhaustive government spending? To answer this question we estimate a number of econometric models. A key aspect of our analysis is that we permit the response of yield

spreads to differ depending on whether the economy experiences fiscal stress or not. Thereby we control for the possibility that the economic environment is systematically different during austerity times – be it because of strain in the financial sector or because of extensive slack in the economy. We control for fiscal stress in our estimation by weighting observations according to the relative size of sovereign yield spreads (relying on the empirical density function within a smooth transition regression framework). Our large sample, which contains observations from various crises as well as more benign periods, is particularly suited for this purpose.

**Figures 1 and 2: Dynamic Response of Sovereign Yield Spreads (1) and Output (2) to a Cut in Government Consumption of one Percent of GDP**



The above figure shows the dynamic response of sovereign yield spreads (left) and output (right) to a cut in government consumption equal to one percent of GDP. The horizontal axis measures time in quarters, the vertical axis measures the percentage deviation from the pre-shock path, measured in percent in case of GDP and in basis points in case of sovereign yield spreads. The solid lines show the responses during fiscal stress, with shaded areas indicating 90 percent confidence bounds. The dashed lines instead display the responses during benign times. In this case, confidence bounds are captured by the dotted lines.

Results are rather stark: the dynamic adjustment of the economy under fiscal stress differs considerably from that during benign times. A cut of government consumption raises spreads



during times of fiscal stress. The effect is quantitatively non-negligible: a cut of government consumption by one percent of GDP raises spreads by about 80 basis points. Moreover, the effect is quite persistent, lasting for about a year. If instead government consumption is cut during benign times spreads decline by about 20 basis points. The effect is also persistent in this case.

To rationalize these findings it is useful to consider how austerity impacts output (right panel). We find that cuts of government consumption hardly affect output during benign times. Instead, in times of fiscal stress, cuts reduce output by about one percentage point for an extended period, implying a fiscal multiplier of about unity. Hence, fiscal consolidation exerts a significant negative effect on growth during times of fiscal stress. This finding goes some way towards accounting for the rise in spreads in response to spending cuts, because output growth is an important factor contributing to sovereign default decisions.

We also assess how spending cuts impact sovereign yield spreads in the long run. In this regard we find a significant decline after about 6 quarters. Moreover, we find that results are robust in various dimensions. For instance, we find our results unchanged, once we control for forecasts of government spending growth in order to exclude the possibility that our results are driven by anticipated fiscal policy measures. We also find that results hold for specific subsamples, that is, they are not driven by the observations for the recent crisis or a specific subset of countries.

### **Restore Public Finances, Before it is Too Late**

Our findings suggest that austerity fails to bring about a reduction in yield spreads, provided that it impacts economic activity adversely. This proviso appears to be met precisely during times of fiscal stress. In other words, financial investors do not reward austerity during those times when their call for austerity is apparently most urgent. Are investors schizophrenic? Not necessarily. Rather, spreads simply may reflect the probability of default. Austerity, in turn, raises this probability in the short run if fiscal stress is high. As a result, spreads rise in response to austerity.

Hence, our results caution against interpreting high sovereign yield spreads as a call for austerity by investors. Still, we note that policy makers face a quandary during times of fiscal

stress. Austerity is of little help, as it depresses economic activity and pushes yields further up. A fiscal expansion, on the other hand, may boost economic activity in the short run, but will adversely affect yield spreads in the long run. Under these circumstances, the least bad option may be to avoid a sharp shift in the fiscal stance.

Admittedly, this strategy risks, given protracted deficits under fiscal stress, that the stock of public debt and, eventually, yield spreads rise further. Alternative policy measures may, however, provide sufficient stimulus to economic activity for fiscal strain to ease even in the absence of a strong fiscal correction. Of course, the fact that fiscal stress exposes the economy to grave risks cannot be denied. Whenever feasible, policy makers should therefore aim at restoring public finances during benign times, that is to say, before it is too late.

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## The Time for Austerity: Estimating the Average Treatment Effect of Fiscal Policy

*Òscar Jordà and Alan M. Taylor*

Research on the effects of austerity on output has been dismissed by some policymakers as unhelpful, but continues anyway despite the difficulty of identifying multipliers from observational data. Our new paper reconciles disparate estimates of fiscal multipliers in the literature. Common identification assumptions appear problematic. Matching methods based on propensity scores show how contractionary austerity really is, especially in economies operating below potential.

### Macroeconomics on Trial?

In 1809, on a battlefield in Portugal, the first recognizable medical trial evaluated bloodletting on a sample of 366 soldiers allocated into treatment and control groups. The cure was shown to be bogus. It was the beginning of the end of premodern medicine. Yet problems of allocation bias— i.e., “insufficient randomization”—pervaded poor experimental designs until the landmark British Medical Research Council trials of patulin and streptomycin in the 1940s. Since then the randomized controlled trial (RCT) has been the foundation of evidence-based medicine.

Is a similar evidence-based macroeconomics possible and what can it learn from this noble tradition? We explore the idea in the context of the foremost academic and policy dispute of the day—the effects of austerity on output (see Alesina and Ardagna 2010; Guajardo et al. 2011). This might seem like a natural and helpful line of debate. Natural, since experimental techniques drawn from medicine have been fruitfully incorporated in other fields of economics. Helpful, for some, since more clarity on fiscal impacts might be welcome, given the uproar over European and UK austerity programs.

Ironically, the policy debate is sprinkled with medical metaphors. In 2011 German Finance Minister Wolfgang Schäuble wrote that “austerity is the only cure for the Eurozone”; while Paul Krugman likened it to “economic bloodletting”. In the FT, Martin Wolf, cautioned that

“the idea that treatment is right irrespective of what happens to the patient falls into the realm of witch-doctoring, not science” while Martin Taylor, former head of Barclays, put it quite bluntly: “Countries are being enrolled, like it or not, in the economic equivalent of clinical trials.”<sup>6</sup>

In a new paper (Jordà and Taylor 2013) we exploit a treatment-control design using statistical techniques designed for situations, experimental or otherwise, where underlying allocation bias may prevail. This turns out to be a serious problem here, as in many other macroeconomic contexts where endogenous policy actions epitomize the “insufficient randomization” problem.

### Confronting the Great Austerity Debate

For consistency we use the very same OECD annual panel dataset (17 economies; 1978–2009) common to two high-profile yet contradictory studies. The influential “expansionary austerity” idea came to be associated with Alesina and Ardagna (2010; AA); but an IMF study reached the opposite conclusion of “contractionary austerity” (Guajardo et al. 2011; GLP).

For minimal parameterization, we use local projection (LP) methods (Jordà 2005) to estimate output impacts of fiscal policy up to 4 years out. These flexible methods permit us to compare different identification strategies and easily allow for possibly nonlinear, or state-dependent responses. Indeed we find that responses are very different in booms and slumps, as emphasized by Keynes in the 1930s.

#### *Step 1: Replicating Expansionary Austerity: LP-OLS Results versus AA*

The simplest identification of the causal effect of a fiscal policy intervention relies on a weak form of the selection-on-observables assumption: conditional on a set of controls, variation in policy interventions is supposedly largely random. However, if policy interventions conditional on controls are systematically determined by an unobserved variable that is correlated with the outcome then the method fails.

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<sup>6</sup> The quotes are from ft.com, nytimes.com, ft.com and ft.com, respectively.

As a first step we estimate LP-OLS impacts of fiscal policy using the AA measure of policy, the change in the cyclically-adjusted primary balance (CAPB) from year 0 to year 1.<sup>7</sup> These first estimates suggest, consistent with AA, that austerity is expansionary: the significant coefficients here have a positive sign. In Table 1 we stratify the results by the state of the cycle (2 bins, boom and slump, based on the sign of HP-filtered log output,  $y^c$ ) at time 0; we see that the result is entirely driven by what happens in booms. It is only in booms that we find a significant response of real GDP to fiscal tightening, with a coefficient or multiplier of about +0.2\* in years 1 and 2 (+  $p < 0.10$ , \*  $p < 0.05$ ). The effects seem to taper off in years 3 and 4. But in slumps, the policy response is not statistically significant and is typically negative.

**Table 1: LP-OLS Estimates of the Impact of 1% of GDP Fiscal Consolidation, by State of the Economy**

	Log real GDP (rel. to Year 0, $\times 100$ )				
	Year 1	Year 2	Year 3	Year 4	Sum
Fisc multiplier, $y^c > 0$ , boom	0.21*	0.24*	0.05	-0.17	0.23
	(0.06)	(0.07)	(0.05)	(0.10)	(0.16)
Observations	222	205	192	180	180
Fisc multiplier, $y^c \leq 0$ , slump	-0.03	-0.07	-0.17	-0.23+	-0.55+
	(0.03)	(0.06)	(0.10)	(0.12)	(0.27)
Observations	235	235	231	226	226

Standard errors (clustered by country) in parentheses. +  $p < 0.10$ , \*  $p < 0.05$ .

$y^c$  is the cyclical component of log  $y$  (log real GDP), from HP filter with  $\lambda = 100$ .

Additional controls: cyclical component of  $y$ , 2 lags of change in  $y$ , country fixed effects.

### *Step 2: Replicating Contractionary Austerity: LP-IV Results versus IMF*

Alternative identification is possible if valid instrumental variables (IVs) are available. This method assumes that if there is correlation between the IV and the control, then one has a source of exogenous variation in policy interventions with which to calculate the causal effect (e.g. Auerbach and Gorodnichecko 2013; Owyang, Ramey and Zubairy 2013).

As a next step we therefore replace the LP-OLS estimator with an LP-IV estimator. The change in CAPB is instrumented by the IMF set of potential “narrative” instruments: indicators of dates of fiscal consolidations that, through a reading of the historical record, might be

<sup>7</sup> We can consider all such shocks, or restrict attention to “large” shocks (larger in magnitude than 1.5% of GDP), a cutoff value used by AA and proposed earlier by Alesina and Perotti (1995), but the results are robust to these changes.

reasonably considered to be exogenous.<sup>8</sup> Here the findings are very much consistent with the IMF results in Table 2.

Austerity appears contractionary: the significant coefficients here have a negative sign. However, stratification shows that this result is now largely driven by what happens in slumps. The effects in a boom are imprecisely estimated but negative. In a slump we find significant negative responses of real GDP to fiscal tightening from year 1 all the way out to year 4. Over 4 years the sum of these effects is  $-2.68^*$ , so the average *loss* for a 1% of GDP fiscal consolidation is a depressed output level of about to 0.7% per year over this horizon.

**Table 2: LP-IV Estimates of the Impact of 1% of GDP of Fiscal Consolidation, by State of the Economy**

	Log real GDP (rel. to Year 0, $\times 100$ )				
	Year 1	Year 2	Year 3	Year 4	Sum
Fisc multiplier, $y^C > 0$ , boom	-0.34 (0.30)	-0.32 (0.46)	-0.13 (0.47)	-0.59 (0.47)	-0.87 (1.36)
Observations	222	205	192	180	180
Fisc multiplier, $y^C < 0$ , slump	-0.25+ (0.14)	-0.76* (0.23)	-0.95* (0.29)	-0.79* (0.31)	-2.68* (0.84)
Observations	235	235	231	226	226

Standard errors (clustered by country) in parentheses.  $+p < 0.10$ ,  $*p < 0.05$ .  
d.CAPB instrumented by IMF fiscal action variable in binary 0-1 form (treatment).  
 $y^C$  is the cyclical component of log  $y$  (log real GDP), from HP filter with  $\lambda = 100$ .  
Additional controls: cyclical component of  $y$ , 2 lags of change in  $y$ , country fixed effects.

### Endogenous Austerity: The Fiscal Treatment is not Randomly Allocated

Naturally, a key question is: are these instruments really exogenous? In fact, no: the IMF's fiscal consolidation episodes can be predicted using predetermined macroeconomic controls. They may not be valid instruments. Thus, even with this IV, which might alleviate the most glaring issues of endogeneity and measurement bias in OLS, some endogeneity remains in the treatment variable.

We find evidence here from multiple criteria, including exogeneity tests and balance checks. Table 3 presents probit models of the IMF treatment variable (a consolidation from year 0 to year 1). In column 1 we see that governments pursue austerity when debt is elevated. In

<sup>8</sup> This is "narrative-based identification" (see e.g., Romer and Romer 1989).

column 2, when output is further below potential or growing more slowly, there is an increase in the likelihood of treatment. Finally, columns 3 and 4 add the lag of treatment. Being in treatment today is a good predictor of being in treatment tomorrow: austerity programs persist.

**Table 3: Austerity Treatment Episodes are a Non-Random Allocation**

	Probability of Treatment (t+1)			
	(1)	(2)	(3)	(4)
Public debt/GDP (t)	0.32* (0.07)	0.27* (0.07)	0.11+ (0.06)	0.11+ (0.06)
Cyclical component of log $y$ (t) ( $y^C$ )		-0.02* (0.01)	-0.01 (0.01)	
Growth rate of output (t)		-0.03* (0.01)		-0.02* (0.01)
Treatment (t)			0.42* (0.02)	0.42* (0.02)
Observations	459	459	459	459
Predictive ability test, AUC	0.61 (0.03)	0.65 (0.03)	0.81 (0.02)	0.82 (0.02)

Standard errors in parentheses. <sup>+</sup>  $p < 0.10$ ; \*  $p < 0.05$

### *Step 3: Estimates of the Average Effect of Fiscal Consolidations*

We offer a new take in a third and final step. If the IMF's austerity treatment variable has a significant forecastable component this could induce allocation bias in estimated responses. To address this we use local projections again, but with an inverse probability weight regression-adjustment method to calculate average treatment effects (ATEs).<sup>9</sup>

The inverse probability weight regression-adjustment estimator (LP-IPWRA) uses a saturated first-stage probit model to predict treatment probability based on observables, getting as close as possible to a quasi-randomized experiment. This first stage prediction is called the *policy propensity score*. The second stage LP outcome regression then corrects for the allocation bias in situations where the outcome also depends on observables, but is *in every other respect* exactly the same specification used in the OLS and IV specifications. The

<sup>9</sup> On the IPW estimator in economics see Hirano, Imbens, and Ridder (2003); for an application to macroeconomics with policy propensity scores, see Angrist, Jorda and Kuersteiner (2013). On the IPWRA estimator and the “doubly robust” property see Robins et al. (1994) and Lunceford and Davidian (2004). A survey of these and related estimators is found in Imbens (2004).

consistency of this estimator is “doubly robust” (unlike IPW or regression adjustment alone) and guards against incorrect model specification in either the treatment regression or the outcome regression.

Using the LP-IPWRA estimator, Table 4 shows that austerity has a mostly negative effect, all years, in both bins. It has larger and more statistically significant negative effects in the slump. In booms, which one could view as the “full employment” case, we find smaller (and mostly statistically insignificant) impacts of fiscal consolidation on output. Summed over 4 years, the LP-IPWRA estimates of the ATEs are -1.13+ in booms but -2.48\* in slumps.

**Table 4: LP-IPWRA Estimates of the Impact of Fiscal “Treatment”, by State of the Economy**

Log real GDP (rel. to Year 0, $\times 100$ ). Truncated weights for robustness.					
	Year 1	Year 2	Year 3	Year 4	Sum
Fiscal ATE, $y^C > 0$ , boom	-0.15 (0.14)	-0.42+ (0.22)	-0.20 (0.25)	-0.63* (0.28)	-1.13+ (0.69)
Fiscal ATE, $y^C < 0$ , slump	-0.19 (0.14)	-0.69* (0.17)	-0.89* (0.19)	-0.60* (0.25)	-2.48* (0.58)
Observations	457	440	423	406	406

Robust standard errors in parentheses. + $p < 0.10$ , \* $p < 0.05$ .

Additional controls: cyclical component of  $y$ , 2 lags of change in  $y$ , country fixed effects.

$y^C$  is the cyclical component of  $\log y$  (log real GDP), from HP filter with  $\lambda = 100$ .

Doubly robust IPWRA estimation. Inverse weights truncated at 10. First-stage uses a saturated probit.

### Three Views of Austerity: The Good, the Bad and the Ugly

Our results contrast with the expansionary austerity view of AA, and even amplify the opposing view of the IMF. For comparisons we have to adjust for the scale of the treatments by the average treatment size, the mean of the IMF measured consolidation (in % of GDP). There is little variation in treatment size across the bins, so the average treatment effects are in fact comparable to multipliers because the average treatment, coincidentally and conveniently, is close to one.

In recent times austerity has been systematically applied in weak economic conditions: *plus ça change*. But in a bad current state the economy is more likely to grow faster than trend going forward. By failing to allow for the endogeneity of treatment we could end up with a far



too rosy view of the aftermath of fiscal consolidations: a dead cat bounces, regardless of whether it jumped or was pushed.

Using OLS estimation we would walk away believing in expansionary austerity, or no effect when the economy is weak. Using “narrative” IV we might believe in contractionary austerity except when the economy is strong, but the estimates are possibly biased as the instruments may not be valid: allocation into treatment is not random. Using IPWRA to deal with allocation bias, we find stronger evidence of contractionary austerity in the weak economy with much more precise estimates. These results suggest that only a strong economy can bear a fiscal consolidation without significant output losses.

However, a major caveat suggests that we likely have a biased underestimate of the effects of current austerity policies in many countries. This caveat is the zero lower bound (ZLB), when fiscal multipliers are known to be much larger in both theory and evidence. Recent and current conditions in the US, Japan, UK, and Eurozone all correspond to a ZLB “liquidity trap” environment, but our in-sample data overwhelmingly do not.<sup>10</sup> Thus our estimate of austerity’s damaging effects is probably conservative.

## Summary

Few economic policy issues generate as much controversy as the ongoing austerity argument, and, as Europe and the UK endure double-dip stagnation, the debate is probably far from over.

Fiscal consolidations are not exogenous events, even those identified by the narrative approach. By reweighting observational data to approximate an experiment where treatment is “as if” at random, we estimate policy responses in a way that corrects for allocation bias.

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<sup>10</sup> Our estimates are based on a sample from 1978 to 2007, when the ZLB was virtually absent from any country-year observations in the dataset (the only exceptions being 7 country-year observations, out of a total of 173 consolidation episodes, all of these relating to Japan in the 1990–2007 period). As is well known in theory (Christiano et al. 2011; Eggertsson and Krugman 2012; Rendahl 2012) and also from historical evidence from the Great Depression (Almunia et al. 2010), fiscal multipliers are much larger in ZLB conditions than in normal times when monetary policy is away from this constraint. But in the post-2008 forecast period for the U.K. the ZLB was a binding constraint, which would tend to make even our already large estimated fiscal impacts an underestimate of the true impacts.

Our estimates confirm adverse impacts as in the IMF study. But we also find that this is a “bad times” result: fiscal contraction prolongs the pain when the state of the economy is weak, much less so when the economy is strong.

Keynes is still right, after all: “The boom, not the slump, is the right time for austerity at the Treasury.”

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## European Integration as a Constraint to Fiscal Policy of EU-Member States

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### Background of Research Project

The world's advanced economies face a severe public debt crisis. Even before the onset of the Great Recession in 2008, public debt in half of the countries in the euro zone exceeded the Maastricht ceiling of 60 percent of GDP. During the recession, the slowing of economic activity combined with increased transfer payments, financial system bailouts, and fiscal stimulus programs resulted in a ballooning of public debt. In the countries at the center of the European debt crisis (Greece, Ireland, Italy, Spain, and Portugal, or GIIPS) gross public debt as a share of GDP rose 30 percentage points since 2008 to a staggering 105 percent of GDP by 2011. The ten largest remaining euro-zone members (EU10) also experienced large debt increases, albeit not as large as in the GIIPS, by nearly 18 percentage points of GDP, reaching a ratio of 0.79 in 2011. Surges of public debt on such a global scale are rare, and over the previous century occurred only during major wars and the Great Depression.

The European debt crisis raises serious concerns about fiscal solvency and has changed the nature of fiscal policy discussions in Europe. Until recently, the dominant issue in tax policy discussions was the harmonization of national tax rates and measures to limit tax competition. Once the debt crisis started, however, the focus shifted toward the implementation of country-specific fiscal austerity programs to address fiscal imbalances and bring debt under control. A number of countries, including Portugal, Greece, Italy, Ireland and Spain, and to a lesser extent France and the Netherlands, adopted austerity packages that feature both expenditure cuts and increases in tax rates.

While much ink has been spilled in both the financial and academic press on the pros and cons of austerity measures in response to the debt crisis, there has been surprisingly little discussion of the constraints imposed on fiscal policy by the fact that euro-zone countries are highly integrated. Estimates of the sustainability of public debt and the impact of austerity programs tend to treat countries as isolated economic units, setting aside the potential for significant erosion of tax bases across countries due to factor mobility, or for spillover effects

on the budgets and welfare of other member countries. In addition, standard closed-economy models underestimate the elasticity of capital tax revenues and tend to overestimate the ability of the government to raise tax revenue. Taking these effects into consideration is critical because the implications of fiscal austerity for macroeconomic aggregates and welfare depend on the particular fiscal policy that countries decide to follow, the degree of integration of capital and goods markets, and the elasticity of tax revenue.

### Research Questions and Methods

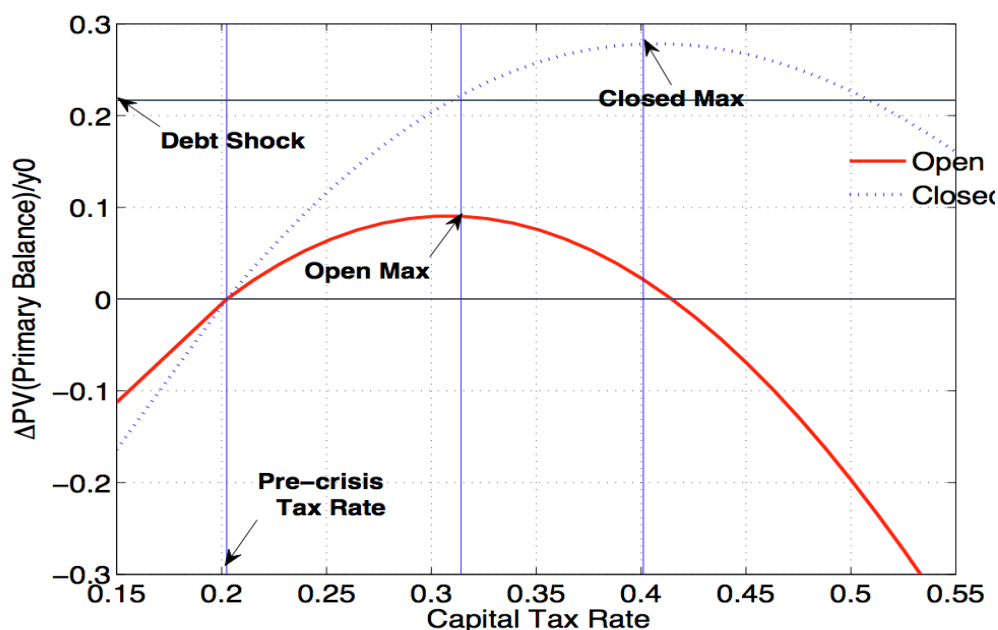
If, in the presence of the observed large debt shocks, defaults are to be averted (i.e. fiscal solvency maintained) and the euro-zone countries are to remain fully integrated in goods and asset markets, three key questions arise. First, is tax-driven fiscal adjustment feasible (i.e. can it yield increases in the present value of the primary fiscal balances that match the higher debt ratios)? Second, how do different tax-adjustment policies using capital or labor taxes differ in terms of revenue, macroeconomic dynamics, cross-country externalities, and welfare costs? Third, what are the implications of strategic interaction, and the benefits of coordination, as integrated economies adjust rates of taxation?

The workhorse neoclassical model widely used for quantifying the effects of tax policies in the literature is poorly suited for answering these questions, because it underestimates the elasticity of the capital tax base to changes in capital taxes. In those models the capital stock is pre-determined at any given date and adjusts slowly over the long run. In addition standard neoclassical models assume that there is a full tax allowance for capital depreciation, which is at odd with actual tax codes. As a result, models of this class overestimate the effectiveness of capital tax hikes for raising tax revenues and underestimate the significance of cross-country externalities. Our analysis incorporates endogenous utilization of capital, which allows agents to adjust taxable capital income much quicker in response to capital tax changes. We also introduce a limited depreciation tax allowance in line with the actual treatment of capital in tax codes. These two features make capital income taxes more distortionary than in the neoclassical model, and also lower the ability of the government to raise capital income tax revenues so that our model can match empirical estimates of the elasticity of capital tax revenues.

We calibrate our model to euro-zone data to study the international dimensions of fiscal adjustment and to examine the positive and normative effects of tax increases that restore solvency. We feed the debt shocks observed in the euro zone since 2008 into the model and compute the short- and long-run effects on equilibrium allocations, prices and welfare that result from responding to those shocks with capital or labor taxes. To study the role of international externalities, we divide the euro zone into two asymmetric regions representing the GIIPS countries and the EU10. We then examine the effects of unilateral tax adjustments, where the balance of the euro zone adjusts labor taxes to maintain revenue neutrality, and then examine tax adjustments when there is strategic interaction between the two regions.

### Research Findings

The quantitative results produce important insights into the potential effects of fiscal austerity options facing Europe. The first result is that a unilateral increase in the capital tax rate is not a feasible strategy for restoring fiscal solvency in response to the observed debt shocks. The dynamic Laffer curve of the capital tax peaks far below the required increment to revenue. Labor taxes can raise revenue to match the debt shock, but the tax hikes entail large welfare costs. Capital tax adjustments induce large cross-country externalities, which favor the countries with less pressure to raise capital taxes (i.e. the EU10). In addition, in both the labor- and the capital-tax increase scenarios, GIIPS countries can raise more revenue at a lower welfare cost under autarky than as an integrated economy. This suggests that these countries have a strong incentive to impose capital controls or default on their debt.



We next examine Nash solutions to one-shot tax competition games in which both regions choose the optimal pairs of capital and labor taxes to restore fiscal solvency in response to the observed debt shocks. The Nash game produces the well-known race to the bottom in capital tax rates, with offsetting higher labor taxes. Welfare, using the standard measure of lifetime compensating variations in consumption, declines relative to the pre-crisis equilibrium by 1.66 percent. The race ends with small positive capital taxes and higher labor taxes relative to pre-crisis rates, but the former are too low and the latter too high because countries do not internalize the international externalities of their tax policies. Cooperation internalizes these externalities, and thus moderates the size of the cut in capital taxes and the hike in labor taxes. This makes fiscal adjustment slightly less costly, but even in this case the welfare cost of the tax adjustments that restore fiscal solvency remains large.

The costs of adjusting to the debt shocks are lower when regions or countries are assumed to be able to choose the best mix of their own capital and labor taxes acting unilaterally and assuming the other countries remain passive. These results are not sustainable, however, because they negate the strong incentives for strategic interaction. Moreover, the costs of implementing the best tax mix to restore fiscal solvency are lower under autarky than those of the Nash and Cooperative games for the GIIPS region, but higher for the EU10 region. Hence, the GIIPS region is left with an incentive to move away from full economic integration.

## Policy implications

Despite the fact that European nations have closely integrated goods and financial markets, policy discussions have proceeded largely without taking into account international ramifications of domestic tax policy adjustments. Ignoring international spillovers is dangerous, however, because it produces overly optimistic projections for revenue, and it ignores the implicit transfers that take place between economies with asymmetric revenue needs and asymmetric tax systems. Economists have pointed out a number of factors that could give highly-indebted European countries incentives to exit the euro zone; a depreciation of the currency could produce an export boom and reduce unit labor costs, removal of the Maastricht debt and deficit targets could enable countries to adopt more expansive monetary and fiscal policies, and default on external debt could relax (at least temporarily) the country's budget constraint. This paper identifies another factor that can undermine incentives to remain in the euro zone: the fiscal externalities from tax austerity that work against the GIIPS region. These factors deserve careful consideration in discussions of fiscal austerity and fiscal sustainability.

## Open Questions?

The analysis conducted in this paper assumes that changes in tax rates do not affect long-run growth rates, that there is full employment and that governments do not have the option of adjusting expenditures. These factors will yield other dimensions over which countries can choose to beggar-thy-neighbor, or cooperate by internalizing the impact of domestic policy choices on other countries.