The fiscal mix in the euro-area crisis – dimensions and a model-based assessment of effects

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Abstract

The current paper contributes to the debate about fiscal policy's role in shaping euro-area macroeconomic developments by providing facts: it documents the evolution of the euro area's fiscal mix since 2007 both across countries and across a broad set of fiscal instruments. The paper, then, evaluates the effects of the fiscal mix against one particular counterfactual. Namely, the paper asks: how would the euro-area macroeconomy have evolved if the member states had strictly adhered to the fiscal behavior embedded in pre-crisis fiscal rules? Toward this end, the paper first puts the fiscal mix into the context of New Keynesian business cycle theory, arguably the dominant theory of business cycles to date. The paper, then, builds a two-country model of a currency union to provide a quantitative assessment of how the fiscal mix may have affected the "Core" countries and the "Periphery" of the euro area. The results suggest that fiscal policy in the euro area as a whole and in each of the two blocks separately stimulated economic activity more and that public debt rose more than would have been the case under strict adherence to pre-crisis fiscal behaviour.

Keywords: Fiscal policy mix, consolidation, currency union. risk premium, sovereign risk

JEL-Codes: E32, E62, E52

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1 Introduction

There is a consensus that fiscal policy has shaped euro-area developments since the beginning of the crisis years in 2008. There is much less of a consensus, however, how exactly. One reason for this, we believe, is that the public discussion tends to focus on just one country at a time (for example, Greece alone), on just one instrument at a time (for example, government consumption) or on just one episode at a time (for example, the contraction phase of 2010 to late 2013). Instead, the current paper provides a more comprehensive approach that enables the reader to put the fiscal developments in the euro area into a broader perspective.

This is important. First, because fiscal policy differed starkly across countries. Focus on government consumption as a share of potential GDP, for example. In Greece it fell by about five percentage points during the contraction phase, while in Spain it fell less than half as much, and in France and Germany it kept rising. Second, because one time period may not usefully be viewed independent of another. For example, despite the contraction in 2010-13, Spain's government consumption as a share of potential GDP never fell below the 2007 level. The contraction merely undid the rise during the preceding stimulus phase of 2008/09. Indeed, at the euro-area aggregate level, in spite of a contraction in 2010-13, this instrument remained above pre-crisis levels throughout all the crisis years. Third, because one instrument in isolation may not be representative of the mix of instruments. In most countries, transfers as a share of potential GDP, for example, did not fall during the contraction phase, but kept rising, quite contrary to the evolution of government consumption. Taken together, a look at the data suggests a more nuanced view than the one obtained by focusing on one country, and one instrument, and one episode at a time.

The current paper, first, provides facts about the euro area's fiscal mix. It, then, puts the fiscal mix into the context of economic theory. The theory that the paper focusses on is "New Keynesian," arguably the most widely used theory of business cycles today. Last, the paper attempts to measure the effect that the fiscal mix had on economic activity in the euro area as a whole, and the "Core" and the "Periphery."[1] This measurement requires spelling out a

[1]For the remainder of the paper, the "Periphery" of the euro area consists of Cyprus, Greece, Ireland, Italy, Portugal, and Spain. The "Core" is formed by the remaining countries of the euro area. These labels do not contain judgement of any sort.

model, and a counterfactual against which to compare the fiscal mix.

As a laboratory, the paper uses a New Keynesian two-country model of a currency union with sovereign risk, extending the work of Corsetti et al. (2014). Within this model, the paper, then, focuses on one particular counterfactual. Namely, it asks: how would the euro-area macroeconomy have evolved if the member states had strictly adhered to the fiscal behaviour that they exhibited prior to the crisis years? In order to model pre-crisis fiscal behaviour, we resort to rules for the fiscal instruments that were estimated on pre-crisis data. These rules depict a fiscal behaviour that is not particularly countercyclical, and that adjusts fiscal instruments with a view toward stabilising the public debt. Viewed against this counterfactual, the paper finds that the deviations from pre-crisis fiscal behaviour implied by the euro-area fiscal mix have contributed to supporting both economic activity and inflation throughout the crisis years. Viewed against the counterfactual, the same deviations also have contributed to the sharp run-up in public debt; particularly, the debt of the euro-area "Periphery."

Our finding is that fiscal policy in the euro area appears to have been more supportive of economic activity than strict adherence to pre-crisis fiscal behaviour would have implied. We wish to be clear that we do *not* make the unconditional statement that the fiscal mix *was* supportive of economic activity and *lead* to a run-up in debt. Neither do we claim that the fiscal behaviour in pre-crisis years reflected optimal behaviour. Rather, we compare the effect of the actual fiscal mix to pre-crisis fiscal rules. The point of departure is important for the comparison. Some readers may, instead, have in mind a different point of comparison, say, a counterfactual in which the fiscal mix would have been more countercyclical than it was. Compared to this, the euro-area fiscal mix of recent years might no longer look supportive of economic activity.

Other readers may consider the pre-crisis counterfactual reasonable, but have in mind the experience of one specific country, say, Greece, and then wonder how the results come to pass. We wish to highlight here that we do not assess the fiscal mix of each and every country. Rather, the model-based exercise focuses on the Core and Periphery blocks as aggregates. Individual countries make up a fraction of these blocks only (Greece, for example, accounts

for about ten percent of the model's Periphery). We hope that the data that accompany the current paper will enable future research to look in more detail at the country level, and the heterogeneity found therein.

More in detail, the paper proceeds as follows. Starting from 2007, we compute individual spending instruments (government consumption, government investment, and public transfers as shares of potential GDP), together with a breakdown of effective average tax rates by economic function (consumption, labour income and capital income taxes). The stimulus phase was common to Core and Periphery, and characterised by a mix of tax cuts and spending increases. The contraction phase, instead, saw fiscal policies diverge sharply. The Periphery embarked on a path that involved higher taxes and lower spending, with the notable exception of transfers. The Core, instead, never withdrew the spending stimulus provided in the early phase of the crisis.

Next, we put the fiscal mix into the context of "New Keynesian" economic theory. Designed originally for monetary policy analysis, it gives a strong role to monetary fiscal interaction. The theory also emphasizes spillovers across countries. The paper discusses strengths and weaknesses of this class of theories. The literature finds that, first, the fiscal *mix* is of central importance for the business cycle; second, the macro-economic impact of that mix heavily depends, in particular, on the monetary stance and on the (perceived) fiscal sustainability risks. In particular, theory highlights that spending multipliers tend to be large when monetary policy is constrained (Christiano et al. 2011). Monetary policy in the euro area appears to have become constrained from around mid 2012 onward (compare Swanson and Williams (2014)), that is, well after the stimulus phase ended. The conditions for large fiscal multipliers, therefore, may not to have been in place in the early phase of the crisis, meaning that the early stimulus was likely fiscally costly, explaining why (compared to past behaviour) we find that this fiscal mix may have contributed to the rise in debt.

There is an extensive literature concerned with fiscal policy transmission. Among the papers that have examined fiscal policy in the euro area specifically, the paper closest to ours is Alesina et al. (2014). It provides an empirical assessment of the deficit reduction plans of 2009-14 for eight euro-area countries (including Portugal, Spain, Ireland and Italy) based

on the narrative approach developed in Alesina et al. (2015). The authors conclude that fiscal austerity in the crisis was not the main driver of weak economic activity as long as austerity was primarily spending-based. By and large, we share their main conclusion: the fiscal mix in the euro area remained expansionary throughout the crisis years when compared to what strict adherence to pre-crisis fiscal behaviour would have implied. Our study differs from theirs in three dimensions. First, we provide fiscal developments for all countries in the euro area (EA18) and examine the area-wide fiscal mix jointly. Second, our analysis builds on disaggregated data at the instrument level. Third, we resort to a full-fledged business cycle model for the counterfactual analysis. Similar to us, Coenen et al. (2013), Cwik and Wieland (2011), and in 't Veld (2013) also propose DSGE model based evaluations of fiscal policy developments in the euro area. They focus, however, either only on the stimulus or the contraction phase, but not on the overall mix. A central tenet of the current paper, instead, is that developments later in the crisis may best be discussed in light of the decisions made earlier.

The rest of the paper proceeds as follows. Next, we document the euro-area fiscal mix since the onset of the crisis. Section 3 puts this mix into the context of the macroeconomic developments in the euro area at that time and the New Keynesian literature on fiscal policy transmission. Section 4 presents the quantitative results from model-based counterfactuals and a discussion of the limitations of the analysis. A final section concludes.

2 The fiscal mix in the crisis

This section discusses the fiscal mix in the euro area since 2007. Economic theory (reviewed in Section 3) suggests that the fiscal mix is of central importance for the business cycle. In what follows, the development of the fiscal mix throughout the crisis is presented through the use of six fiscal instruments: on the revenue side, we look at ex-post estimates of effective labour tax rates, indirect tax rates and tax rates on capital income; on the spending side, we decompose spending net of interest (primary spending) into government consumption, public transfers and government investment. Spending items are expressed as shares of potential

GDP.[2] In the exposition, we will largely confine ourselves to a discussion of the euro area as a whole and the Core and Periphery. Toward the end of this section, we will give the reader a glimpse at the heterogeneity within the blocks. The accompanying data set allows to explore the breakdown by country in detail.

Figure 1 shows the euro-area fiscal mix as a black solid line. For comparison, the figure also shows the evolution of the fiscal mix for the US general government (red dashed line). Since levels may differ starkly, in Figure 1 the axes on the right are reserved for the US series.

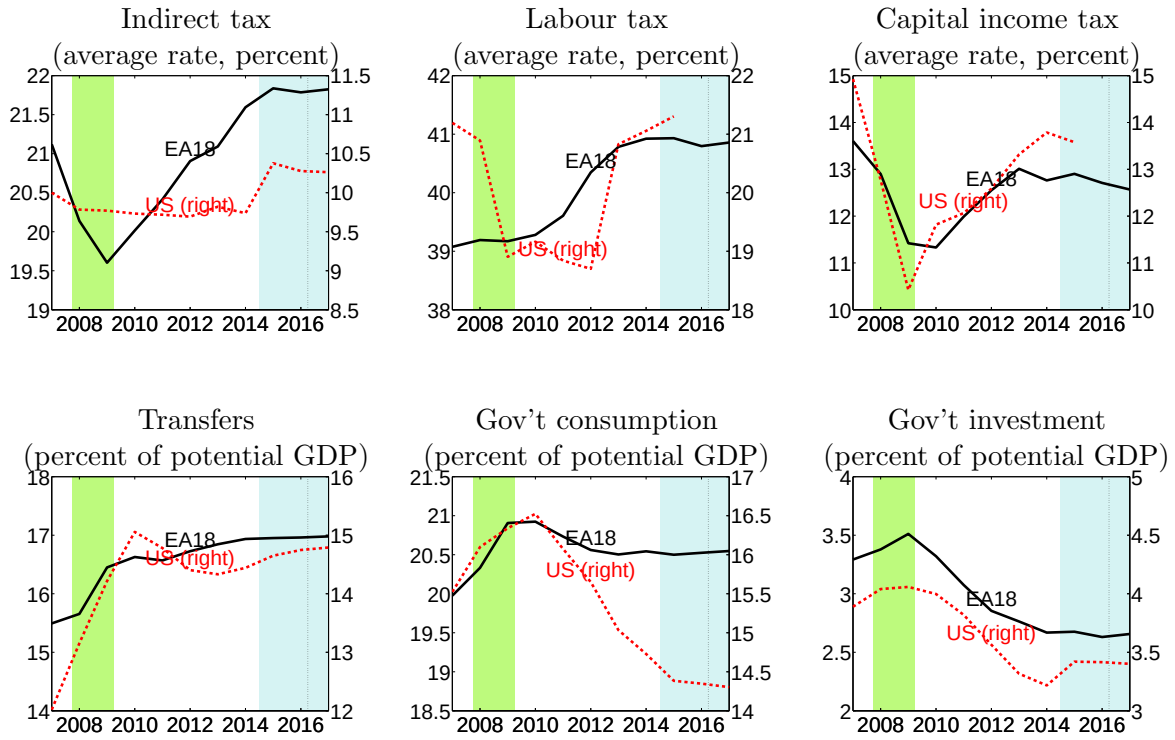

Figure 1: **Fiscal instruments in the euro area (EA18, solid line) and US (red dashed line).** The data are for the general government. Based on EC AMECO database, Spring 2016, and OECD. A vertical dotted line at that point marks the EC forecast date. For the US, the data used to calculate the labour tax rate and the capital tax rate are not available for 2015 and 2016. The appendix describes how the data were constructed.

Figure 2, thereafter, provides the split into euro-area core and periphery countries.

Three phases

[2]Note that, throughout the paper, we will use the terms "effective tax rates" and "taxes" synonymously. Whenever we refer to the revenue generated by a tax instrument, we explicitly refer to the associated "revenue".

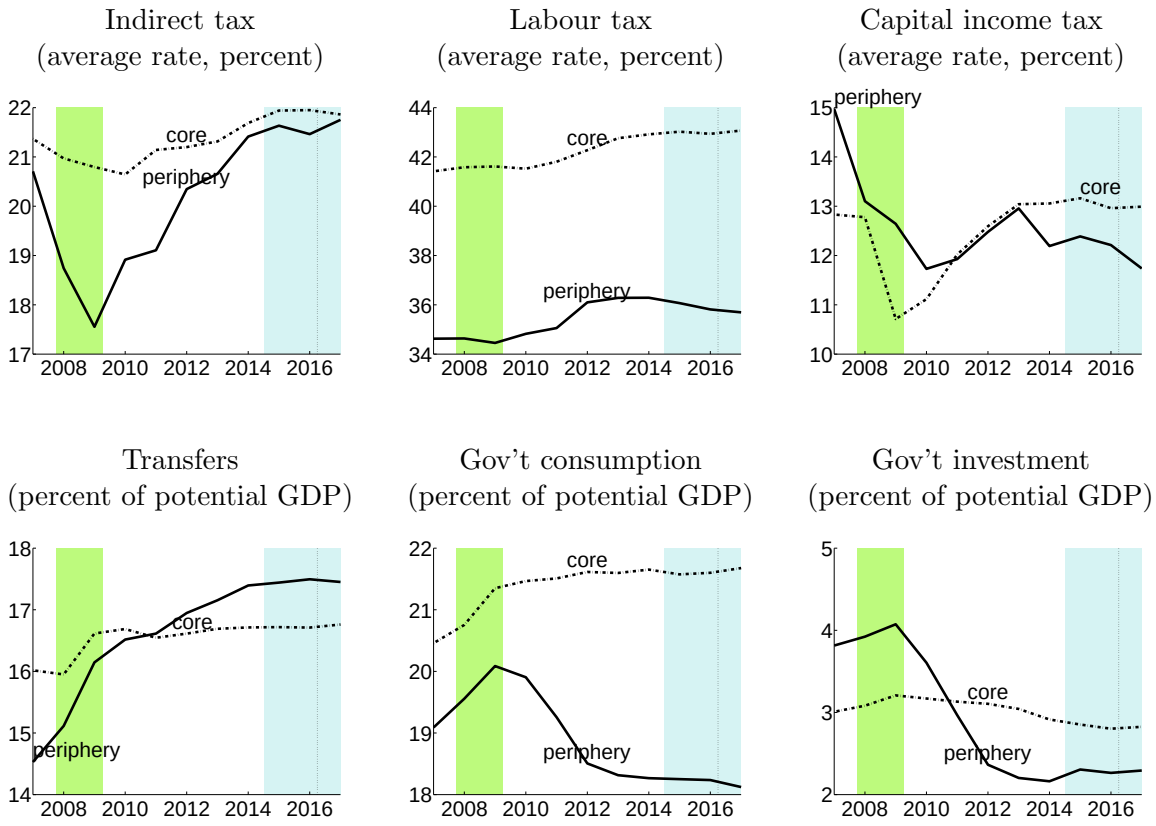

Figure 2: **Fiscal instruments in the Core (dash-dot line) and Periphery (solid line)**. The data are for the general government. Based on EC AMECO, Spring 2016. A vertical dotted line at that point marks the start of out-of-sample forecasts.

The financial crisis that started in 2008 marked a deep break in the way fiscal policy was managed in all developed countries, and the euro area makes no exception.[3] Figure 1 suggests that over the crisis years the euro-ares fiscal mix evolved in three phases. The *stimulus phase* (marked by green shading) in the early part of the financial crisis was characterised by the adoption of the European Economic Recovery Plan (EERP) at the end of 2008: all effective tax rates (top row of the figure) fell and spending (bottom row of the figure) increased. This phase gave way to a fiscal *contraction phase* that started in late 2010 (no shading). In that phase, taxes rose and spending fell, though from the base established in the stimulus phase. An exception to the contraction in spending are transfers, which continued to rise throughout the contraction phase (bottom row, left panel of Figure 1). Only from 2014 onward a *stabilisation*

[3]Section 4 will show this more formally.

phase set in, in which taxes and spending no longer showed marked changes (blue shading), but rather remained at the levels established at the end of the contraction phase.

We will next discuss the fiscal mix in more detail, separately for the revenue side and the expenditure side. Doing so, we will also make the comparison with the US.

Revenues

The following four elements mark the crisis' euro-area, core, and periphery tax policy mix: First, indirect taxes at the area-wide level (top left panel of Figure 1) fell early on in the crisis. Only by around late 2012 they reached again and later exceeded their pre-crisis level. The Periphery accounts for the largest share of these developments (solid line in the top left panel of Figure 2). At the end of the stabilisation phase, indirect taxes in the euro area are projected to be about half a percentage point above their 2007 pre-crisis levels. Indirect taxes in the US, instead, were rather stable through 2014.

Second, labour taxes in the euro area have been stable throughout the stimulus phase, to rise by about one and a half percentage points throughout the fiscal contraction phase. Then they stabilised at this higher level from 2014 onward. This rise affected both labour taxes in the Core and the Periphery (central panel, top row of Figure 2). The similarity in patterns, however, fits into very different starting conditions in the two regions, with labour taxes in the Periphery in 2007 being about seven percentage points lower than in the Core. What is also noteworthy is that the euro-area developments contrast strongly with the evolution of US labour taxes. US effective labour tax rates fell sharply in the stimulus phase (red dashed line, center top panel of Figure 1) and did not rise above the pre-crisis levels thereafter.

Third, euro-area effective capital income tax rates (top right panel of Figure 1) fell sharply in the stimulus phase, recovering to almost pre-crisis levels by the end of the contraction phase. While capital income taxes show similar drops in both regions initially, the subsequent rise of the area-wide capital tax rate is almost entirely due to the Core. Capital taxes in the Periphery remained well below pre-crisis levels during the stabilisation phase (solid line, top right panel of Figure 2). The area-wide drop in effective capital income tax rates in the stimulus phase and the subsequent rebound were somewhat weaker than what was observed

in the US.

Fourth, changes in effective tax rates can be the result of discretionary changes in legislation (changes in effective tax rates due to "policy factors") or they can be the result of changes in the state of the economy (due to progressivity or tax evasion, or loss carry-forward, for example; changes due to "non-policy factors"). Figure 3 shows how much of a given change in effective current tax rates (calculated summing revenues and bases of indirect, labor, and capital income taxes) mechanically can be attributed to policy factors and to non-policy factors. From 2010 onwards, the AMECO database reports discretionary measures on current

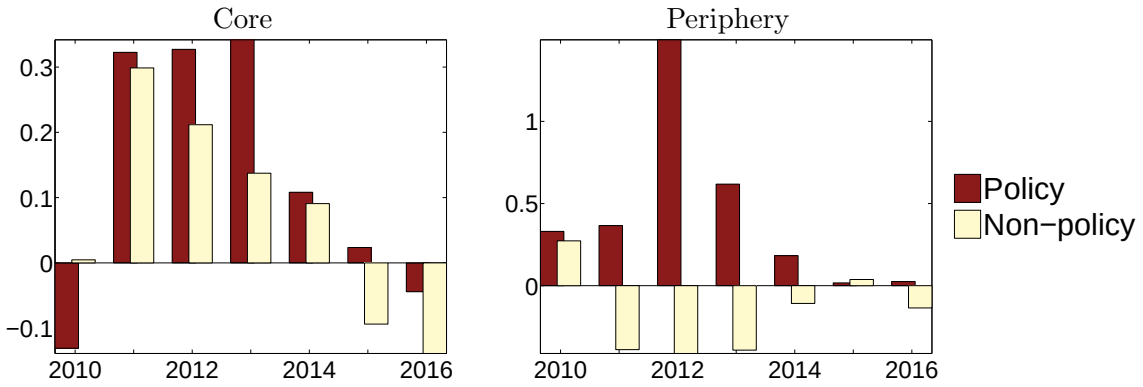

Figure 3: **Evolution of the effective current tax rate, decomposition in policy and non-policy factors.** Revenue as a percent of GDP - Source: AMECO and authors' calculations.

revenues, in revenue units. For the figure, any change in effective tax rates attributable to this (keeping the base fixed) is labelled a change due to policy-factors (shown as a red bars). The residual is labeled a change due to non-policy factors (yellow bars). The results are striking. First, the revenue-generating discretionary changes to effective current tax rates were larger in the Periphery (and much larger in 2012) than in the Core. Second, the non-policy factors supported effective tax rates in the Core countries, while they subtracted from effective tax rates in the Periphery. Commission (2014) discusses the role of tax evasion.

We wish to be very clear that, up to this point and in the current section more generally, we have only aimed at presenting facts. Interpretations of the facts, instead, will have to rely on a counterfactual. This is most apparent when having the state of the macro-economy in mind. In particular, a discretionary change in policy as defined above may well represent a

systematic reaction of policy makers to the level of public debt or economic activity. This is why, in Section 4 we will use a model and fiscal rules that allow for such systematic responses to disentangle the extent to which these changes in tax rates are a reflection of the state of the economy or are "unusual" when seen in the light of pre-crisis fiscal behaviour. Anticipating the findings, Section 4 suggests that in spite of the contractionary discretionary changes documented here, effective tax rates in the Periphery remained lower than pre-crisis fiscal behaviour would have suggested.

Expenditures

Next, we turn to the evolution of the public sector's expenditures (see the bottom rows of Figures 1 and 2). These showed substantial differences across the Core and the Periphery. The following three observations emerge: First, euro-area government consumption expenditure (as share of potential GDP) rose in the stimulus phase, namely by a full percentage point. The rise was equally strong in the Core and the Periphery (center panel, bottom row of Figure 2). The fiscal contraction phase, instead, saw government consumption expenditures in the Core and Periphery diverge. In the Periphery, government consumption contracted sharply. By 2012, it ranged about half a percentage point of potential GDP below the pre-crisis level (solid line). In the Core instead, one cannot witness any contraction (see the dashed line, central panel, bottom row of Figure 2). For the euro-area as a whole, and relative to the end of the stimulus phase, government consumption, therefore, fell during the contraction phase. It remained above *pre-crisis* levels throughout, however. The comparison to the US is informative as well (red dashed line, center panel, bottom row of Figure 1). Namely, during the years of the stimulus phase the US expansion in government consumption resembles the euro area's. At the time of the onset of euro-area fiscal policy's contraction phase, instead, US government consumption contracts much more sharply than in the euro area as a whole. Indeed, the magnitude of the contraction in government spending in the US resembles the sharp contraction witnessed in the Periphery only.

Second, government investment spending evolved remarkably similar in the euro-area as a whole (solid line, bottom right panel of Figure 1) and the US (red dashed line, same figure).

Namely, after an expansion by a few tenths of a percentage point of potential GDP during the stimulus phase, euro-area government investment contracted to levels somewhat below pre-crisis levels, stabilising there. The euro-area developments mask substantial differences across regions. Namely, the Periphery accounts for the lion's share in the contraction in government investment during the contraction phase (solid line, bottom right panel of Figure 2). The Periphery governments' investment activity by 2014 was more than 1.5 percentage points of potential GDP lower than pre-crisis.

Third, while euro-area government consumption and investment fell during the contraction phase, transfers continued to rise (solid line, bottom left panel of Figure 1). By the onset of the stabilisation phase, transfers in the euro area stood 1.5 percentage points of potential GDP higher than before the crisis. These developments are largely accounted for by the evolution of transfers in the Periphery (solid line, bottom left panel of Figure 2). There, transfers rose by a full percentage point of GDP during the stimulus phase. Transfers continued to rise further in the fiscal contraction phase (that saw other expenditures fall sharply). With the onset of the stabilisation phase, transfers in the Periphery stood about three percentage points of potential GDP higher than prior to the crisis. In terms of magnitude, transfers in the Periphery rose about as much as they did in the US in recent years.

The role of the mix

We wish to be very clear that so far we have only presented facts. We argue that having these facts, across time, across instruments, and across countries is important for understanding the role that the euro area's fiscal mix has played in recent years. The counterfactuals that we will present in Section 4 suggest that the fiscal mix overall remained more supportive of economic activity in both the Core and the Periphery than it would have under pre-crisis fiscal behavior. One key for understanding this result is to bear in mind that we examine the overall fiscal *mix*.

By way of example, consider the contraction in government consumption in the Periphery after 2009 (that is, in the contraction phase). This is one element of the fiscal mix. Focusing on this one element only, however, may give a quite misleading impression of euro-area fiscal

policy. On the one hand, this contraction of government consumption has to be viewed in light of the earlier expansion during the stimulus phase. The contraction in government consumption in the contraction phase is only half as large when viewed relative to pre-crisis levels rather than the levels in the stimulus phase. This is the time dimension of the fiscal mix. Next, there is the country dimension. As the above showed, the Core's government consumption expenditures did not reverse at all, staying about one percentage point above the pre-crisis level through the end of the sample. Last, there is the instrument dimension. Namely, while the Periphery's government consumption expenditures contracted sharply during the consolidation phase, *transfers* in the Periphery kept increasing. As Section 3 makes clear, such an increase in transfers may offset (some or all of) the contractionary effect of a spending consolidation.

Heterogeneity within the blocks

So far, we have discussed the dynamics of the fiscal mix for two broader blocks of countries (Core and Periphery) and highlighted considerable heterogeneity across the blocks. In this section, we therefore highlight that there is heterogeneity within the blocks. We do so for two reasons. On the one hand, we wish to encourage the reader to explore the country-level fiscal mix in more detail, something that is beyond the scope of the current paper. The data that accompany the paper have the country-level information readily available.

On the other hand it seems important to us to put the numbers that we have reported above into context. In particular, the reader may question why the Periphery's fiscal mix shown in Figure 2 does not show a stronger contraction still. And similarly for the Core. One reason for this may be that the experience of specific countries subject to very strong fiscal adjustment (notably, Greece) may have shaped public perception about the Periphery's fiscal mix, or the euro area's as a whole.

Therefore, in Figure 4, we first plot the evolution of three of the fiscal instruments (government consumption, labour taxes, and transfers) for two countries in the peripheral block: Greece and Spain. In the consolidation phase, Greece has seen large cuts in government consumption (by more than five percent of potential GDP) and a steep increase in labor

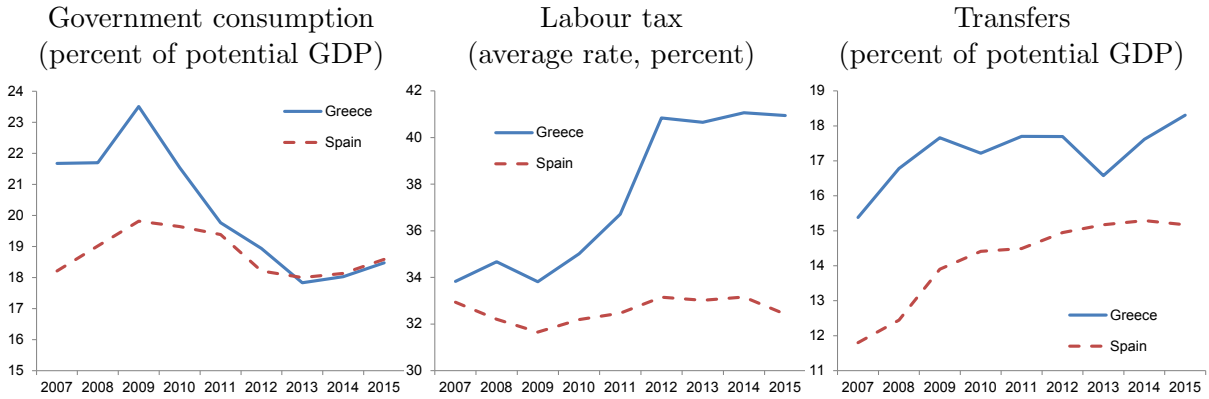

Figure 4: **Development of fiscal instruments in Greece (solid line) and Spain (dashed line).** Based on EC AMECO database, Spring 2016.

tax rates by about 7 percentage points (see the solid line in Figure 4). This fiscal mix in Greece differed substantially from the less volatile dynamics of fiscal instruments registered in other countries of the Periphery. The figures focus on one such case, Spain (red dashed lines). Spain, similar to Greece, experienced cuts in government consumption in the contraction phase. These cuts, however, not only were smaller than in Greece. They also did not reduce government consumption as a share of potential GDP to below the level witnessed in 2007, just prior to stimulus phase. Thus, whereas Greece has cut government spending below pre-crisis levels, Spain has not. Similarly, Spain did not follow Greece's path in raising labor taxes. What we will argue below is that the Periphery's fiscal mix overall was not as contractionary as pre-crisis fiscal rules would have implied.

Within the countries of the Core developments are more similar. Figure 5 shows a comparison between France (blue solid line) and Germany (red dashed line) for the same selected fiscal instruments. The common element is that both countries have increased government consumption in 2009, and did not retrench afterward. The experience in the contraction phased diverges, however, with France showing a significant increase in the labour tax rate amid a rise in transfers, a dynamics not visible in Germany. Again, these figures suggest that it is not straightforward to assess the effect of the fiscal mix without the use of theory, a model, and a clear counterfactual. We turn to these next.

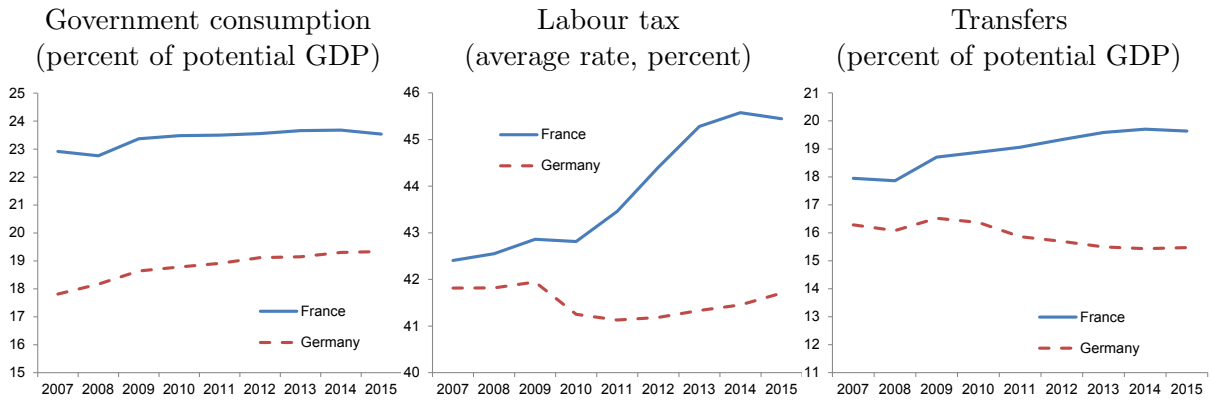

Figure 5: **Development of fiscal instruments in Germany (solid line) and France (dashed line).** Based on EC AMECO database, Spring 2016.

3 The fiscal mix in light of macroeconomic developments and economic theory

This section puts the euro-area fiscal mix into the context of macroeconomic developments in the euro area and economic theory. Throughout, we will focus on giving an overview of the findings in a subset of the literature, namely, the literature concerned with New Keynesian business cycle theory. We do so for two reasons. First, because today this arguably is the most-widely used theory of business cycles. Second, because in Section 4 we will provide a quantitative assessment of the macroeconomic effects of the fiscal mix in the euro area using a rather complex business-cycle model from this class of theories that incorporates the considerations discussed in the current section. The theory, of course, is not without shortcomings. One should, therefore, bear in mind that the discussion below and the quantitative results presented thereafter are conditional on a specific class of theory.[4]

New Keynesian theory suggests that in order to assess how fiscal policy has shaped the euro-area macroeconomy one needs an integrated assessment of *all* the dimensions of the fiscal mix, and of the macroeconomic environment at the time. The theory suggests two things, in particular: that the fiscal *mix* is of central importance for the business cycle and that the macro-economic impact of that mix heavily depends on two dimensions that have changed

[4]Section 4.6 presents a discussion and a number of caveats in this regard.

in the euro area over the course of the crisis: the monetary stance and the (perceived) fiscal sustainability risks in the euro area's periphery.

Next, we document these two dimensions of the macroeconomic environment. Thereafter, we present the theory. A short summary of the discussion in the current section can be found in Table 1. Readers who are familiar with the literature or are interested primarily in the quantitative results should feel free to read the next section and then jump directly to Section 4.

3.1 The euro area macro-economy since 2007

This section gives a brief overview of euro-area macroeconomic developments. In the figures shown below, the green shading corresponds to the stimulus phase identified in Section 2 and the blue shading corresponds to the stabilisation phase, with the contraction phase in between. Unless noted otherwise, a solid black line refers to the euro area as a whole (EA18), a blue dashed line to the Core, and a red dotted line to the Periphery.

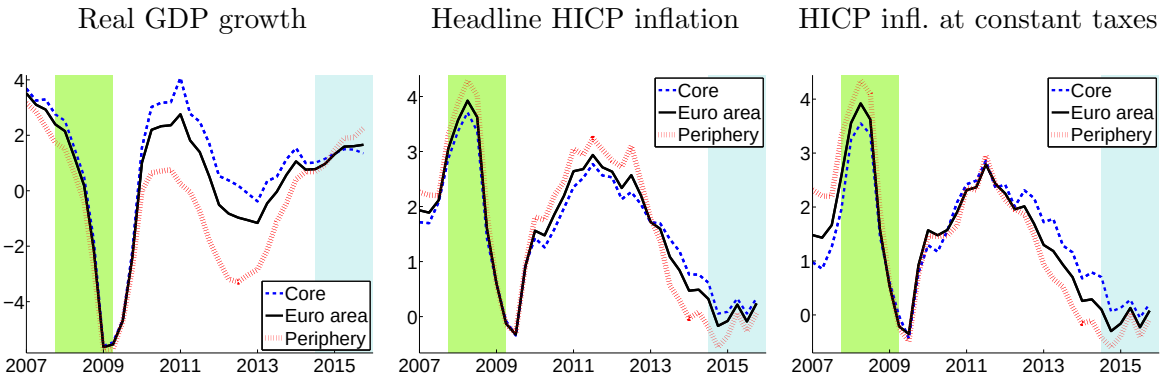

Figure 6: Year-on-year growth rates. Source: Eurostat - National accounts and ECB.

The euro area has gone through a deep recession (see the GDP growth rate in the left panel of Figure 6). Initially, the recessionary developments were rather synchronised across the Core and Periphery. In 2010, though, economic developments in the Periphery started to lag substantially behind the recovery in the Core. Only from mid-2013 we observe a third phase of gradual convergence. The euro-area crisis was marked by a precipitous fall in private investment (not shown here, see Figure 12). This fall was particularly severe in the Periphery,

Table 1: **Summary table – the fiscal mix in the context of theory**

	Stylised facts from Section 2		Theory discussed in Section 3:
	euro area	Core and Periphery	likely macroeconomic implications
Revenue side	Drop in **indirect effective tax rates** during the stimulus, fully offset during contraction phase (offset correctly anticipated).	Most of these developments took place in the Periphery. There, strong increase in statutory VAT rate in the contraction phase.	Stimulus expansionary but higher debt; expectations of trajectory of indirect taxes supported consumption in stimulus phase, *at cost of stronger contraction in contraction phase*.
	Steady rise in **labour taxes** above pre-crisis levels.	Both in Core and Periphery.	Recessionary. Periphery's rise runs counter to fiscal devaluation, as labour taxes *rose* in the middle of a rise in indirect taxes.
	Strong drop in **effective capital taxes**. Mostly driven by non-policy factors (negative profits), but also cuts to top rates.	Particularly strong in Periphery.	Similar impact as reduction in indirect taxes, supporting investment.
Expenditure side	**Government consumption** rises in stimulus phase. Half of this increase consolidated thereafter.	Core and Periphery provide stimulus. Permanent in Core. Euro-area contraction, thus, due only to Periphery, which consolidates to levels below pre-crisis.	Expansionary in the stimulus phase (not self-financing ⇒ *increase in debt* ⇒ sovereign risk?). Contraction phase contractionary for Periphery; sovereign risk renders recessionary impact smaller. After 2012 (at the ZLB), Core's continued stimulus supports activity in the Periphery.
	Government investment contracts sharply in contraction phase.	Contraction centered on Periphery. There, contraction of two percent of potential GDP. Much smaller, trend-like fall in Core.	Similar to contraction in gov't consumption. Potentially long-lasting contractionary effect. Contraction means no demand stimulus exactly when multipliers high (in ZLB part of contraction phase since late 2012).
	Transfers increase.	Mostly in Periphery. Transfers stable in Core after stimulus phase. which saw a continuing increase during the contraction phase.	Expansionary effect, especially in the Periphery. Likely not self-financing prior to ZLB phase. Ensuing rise in debt reduces expansionary impact due to need for later distortionary financing.

with an overall contraction from the 2007 level of about 7 percentage points of GDP, more than three times the maximum drop observed in core countries. The center panel of Figure 6 shows headline HICP inflation rates and the right panel the same headline rates adjusted for the mechanical effects of tax measures. The direct effect of tax measures has supported headline inflation in the Periphery over the years 2010 to 13. Still, from 2011 onward there is persistent disinflation (see Figure 12 for HICP inflation rates excluding food and energy).

Public debt and sovereign risk

A distinguishing feature of the euro-area crisis is the emergence of sovereign risk. CDS spreads are a market-based measure of risk premiums. Figure 7 (taken from Corsetti et al. (2014)) documents that sovereign CDS spreads rose markedly from 2010 onward, and particularly so in the Periphery (see the blue solid line in the right panel). Importantly, not only did sovereign spreads rise but also non-financial corporate spreads (red dashed line). Spreads rose to a lesser extent in the Core (left panel). The rise in spreads subsided only after the

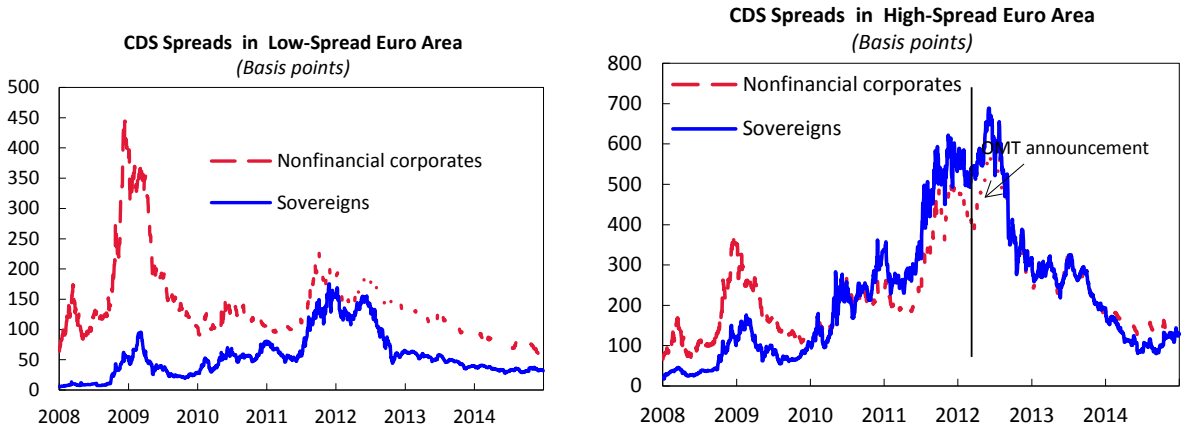

Figure 7: 5-year CDS spreads in low-spread and high-spread euro area countries, as well as for nonfinancial corporations headquartered there. Low-spread euro area includes Austria (number of firms in our sample: 1), Finland (4), France (29), Germany (21), and Netherlands (8). High-spread euro area includes Italy (4), Portugal (2), and Spain (6). The same relative weights are adopted for the sovereign and corporate index series. For example, of the 63 firms in the low-spread euro area sample, 29 are headquartered in France. As a result, in the sovereign low-spread euro area series, France has a weight of 29/63. Follows Corsetti et al. (2014). Raw data: Bloomberg.

European Central Bank's announcement of outright monetary transactions (OMT).

The level of public debt increased substantially throughout the crisis, with the public debt

rising by about 50% of GDP in the Periphery, to a level above 120 percent. In core countries, debt rose by about 20 percent of GDP (data not shown, see right panels of Figure 12). Figure 8 decomposes this increase in public debt mechanically into different factors: the primary balance (green bars), the differential between interest rates and nominal GDP growth

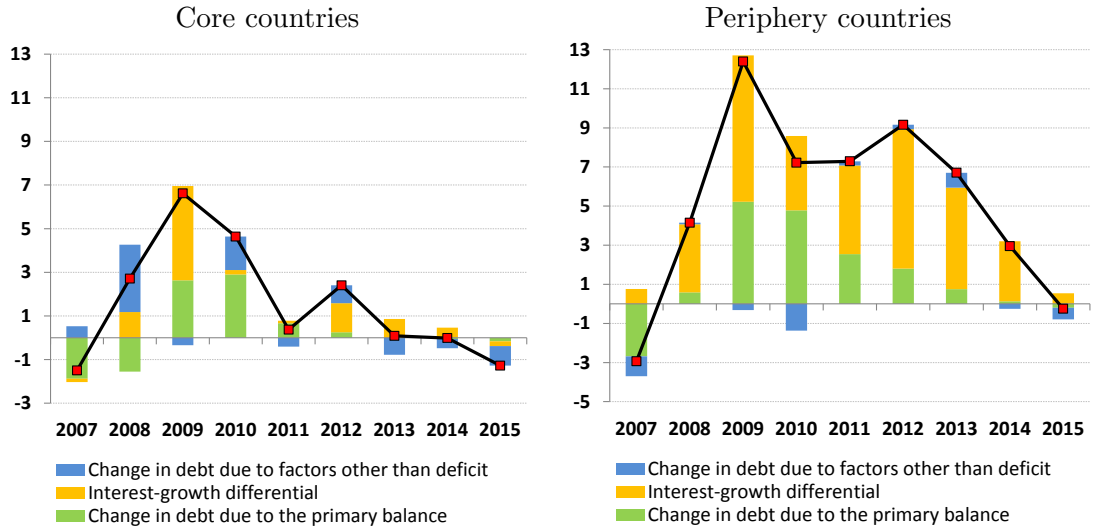

Figure 8: **Decomposition of debt increase**. Source: AMECO. All data are in terms of nominal GDP.

rates (yellow bars) and the other factors not included in the deficit (blue bars). The latter mostly refers to transfers to the financial system (and in some cases positive privatisation receipts). Different from the common view, such transfers to the financial system explain a bigger share of debt accumulation in core rather than periphery countries, mostly due to bank capital injections in Germany in 2008-09 and in Belgium in 2013-14. In any case, Figure 8 shows that the lion's share of the run-up in debt did not result mechanically from bank bailouts. In periphery countries, debt increased mostly on account of sustained primary deficits and interest payments, the latter due to higher debt and the increased risk premia.

Monetary Policy

Fiscal and monetary policy interact. On the one hand, the monetary transmission mechanism can be affected by fiscal imbalances. On the other, and as the review of the theory below will make clear, the transmission of fiscal policy measures may depend heavily on the monetary

reaction to those measures. What is important for the purpose of the current paper is that the monetary stance has changed over the course of the crisis. Going into the financial crisis, the

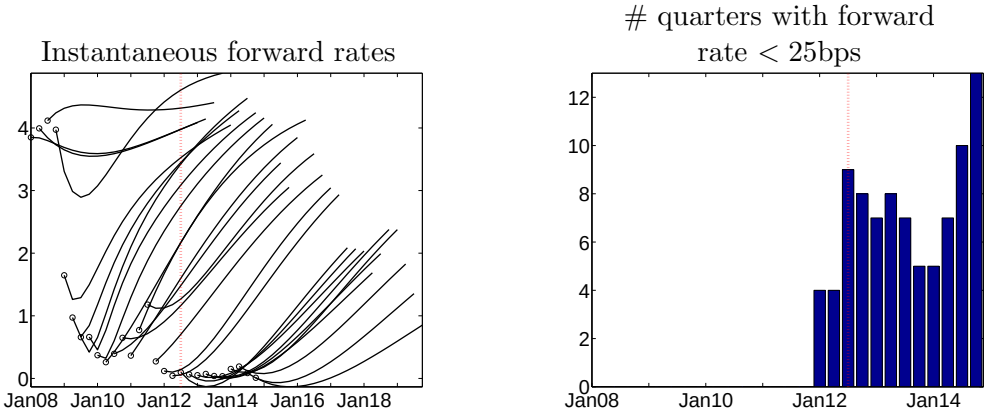

Figure 9: **Forward rates on AAA government paper.** Based on estimates of Svensson-type model of the yield curve for AAA-rated government paper. Plotted is the observation closest to the middle of the first month of a given quarter. The vertical dotted line marks the date of ECB president Draghi's July 26, 2012 "whatever-it-takes" speech. Panel on the left: forward rate curves, maximum maturity 5 years. Panel on the right: number of quarters (including current quarter) for which the instantaneous forward rate is smaller or equal to 25 basis points annualised. Source: ECB Statistical data warehouse.

European Central Bank implemented a number of "non-standard" monetary policy measures. Instead of reporting on these in detail, Figure 9 shows the resulting forward rates as implied by a Svensson-type model of the yield curve. The figure shows a gradual downward movement of the forward curve. We take the resulting curves as a rough indication of monetary policy expectations, having in mind all the due caveats. In the early years of the crisis, the estimated forward curves not only do not touch values close to zero, but they also remain rather steep. One interpretation of this is that markets expected monetary policy to react to shocks and not to hold rates fixed for some time. Only at the beginning of 2012 do the forward curves fall below 25 basis points (a rough measure of the central bank policy rate nearing the ZLB), and then only for four quarters initially (that is, the current quarter and the next three). It takes until ECB president Draghi's July 2012 "whatever-it-takes" speech whereafter the spot rate reaches zero and the forward curve flattens for an extended period. From mid 2012 onward, the policy rates were expected to stay below 25 bps (annualised) for around 7 quarters on average. In sum, monetary policy in the euro area appears to have become constrained only

from around mid 2012 onward (compare also Swanson and Williams (2014)), that is, well after the stimulus phase ended.

3.2 Theory

For the exposition of selected channels, we now resort to a textbook version of the New Keynesian business-cycle model, an exposition of which can be found, for example, in Galí (2008). This model forms the backbone of the (much larger) model of Section 4. The key property of New Keynesian models is that due to nominal rigidities economic activity is demand-determined. The textbook model consists of a closed economy. Households consume, work in the labour market and save into nominal bonds, the rate of return on which (R_t in the following) the central bank controls. For the exposition in this section, we simplify the fiscal sector such that there are only four fiscal instruments: a distortionary labour tax, T_t^L, a distortionary consumption tax T_t^C, a lump-sum tax T_t^g that is used to stabilise the debt level, and government consumption expenditures g_t. Taxes and spending can vary over time. Production uses labour only. That is, we abstract in particular from physical capital as well as private or government investment. GDP, y_t, therefore will be given by the sum of private and government consumption only.

Letting E_t mark expectations, and after imposing goods-market clearing, the households' consumption-saving problem gives rise to the following so-called *intertemporal IS equation*

$$\underbrace{y_t - g_t = E_t[y_{t+1} - g_{t+1}]}_{\text{consumption smoothing}} + \underbrace{E_t[T_{t+1}^C - T_t^C]}_{\text{path of consumption taxes}} - \underbrace{[(R_t + \Delta_t) - E_t[\pi_{t+1}]]}_{\text{ex-ante real rate of interest}}. \tag{1}$$

The first term reflects the households' desire to smooth consumption over time. The second term reflects that consumption taxes change the effective cost of consuming at different points in time. For example, all else equal, if the household expects consumption taxes to be higher in the future than today, the household will want to consume more today than tomorrow. The final term is the ex-ante real rate of interest that the household faces (π_t is the inflation rate). The higher that real rate is, the more the household will want to save today rather than consume. The higher the real rate, the lower, therefore, is aggregate demand. This makes

the real rate a central element in the transmission of fiscal policy. Δ_t is an interest-rate spread that can arise, for example, if sovereign risk spills over to private-sector interest rates, giving rise to the sovereign-risk channel of Corsetti et al. (2013). Note that through setting the nominal interest rate accordingly, in principle, the central bank can absorb the effect of sovereign risk on the macroeconomy.

The second equation is the so-called *New Keynesian Phillips curve*:[5]

$$\pi_t = E_t[\pi_{t+1}] + \kappa \cdot \underbrace{[\nu y_t + T_t^c + T_t^L]}_{\text{marginal production cost}} \quad , \ \kappa > 0, \nu > 1. \tag{2}$$

It reflects the firms' pricing decisions. Firms will raise their prices (thus creating inflation), whenever their marginal costs of production rise today, or are expected to rise in the future (as reflected in higher future inflation). In the textbook version of the model, marginal costs of production are given by the wage that firms pay. This wage, in turn, will be affected both by economic activity (the higher employment is, the higher the wage) and by taxes. The reason for the latter is the following. The higher the labour tax rate is the lower the worker's take-home pay. That is, the less the worker will be inclined to work and the higher a wage the firm has to pay. The marginal costs for the firms will, thus, rise with the labour tax. Similarly, the marginal costs for the firms will rise with the consumption tax.

3.3 Area-wide fiscal policy

Let us focus first on the transmission of area-wide fiscal policy. In "normal times," one would expect the central bank to counter inflationary developments. That is, as inflation rises, the central bank would be expected to raise the nominal rate of interest, R_t, sufficiently strongly to raise the real rate of interest $R_t - E_t\pi_{t+1}$. This, in turn, will lead households to save more, cutting back consumption. This causes aggregate demand to fall, thus dampening inflationary pressures.

In the textbook model, reductions in consumption taxes or labour taxes are disinflationary.

[5] Government spending g_t will typically also have a further indirect effect on costs through the wealth effect. This effect tends to be quantitatively small, however, so we neglect it in the exposition here. For the exposition, we also abstract from discounting in the Phillips curve.

If the central bank reacts as in "normal times," it will cut interest rates, leading to a rise in aggregate demand. In other words, theory suggests that such tax cuts are expansionary in normal times. In this light a fall in taxes in the stimulus phase (when monetary policy was unconstrained) would have been expansionary, in line with the quantitative findings we show in Section 4.

An increase in government spending is expansionary as well. At the same time, the additional demand of the government leads to higher inflation and, thus, to higher real rates which *crowd out* private consumption. In normal times, the spending multiplier, therefore, is positive, but less than one, see Woodford (2011). Theory suggests that such expansions in normal times (due to the multiplier being less than one) are not self-financing. For the euro area, this means that likely the fiscal developments in the stimulus phase were expansionary, but have raised the government debt level.[6] Indeed, in Section 4 we find quantitatively that compared to fiscal behaviour under a certain set of pre-crisis fiscal rules, the fiscal mix in that time has contributed to rising public debt levels.

All of this contrasts sharply with a situation in which the monetary authority does not react as in "normal times." Imagine, for example, that the central bank were to keep interest rates constant amid the fiscal impulse; for example, because it is constrained by a lower bound on interest rates. We will call this the zero lower-bound (ZLB) scenario. For government spending, Christiano et al. (2011) and Woodford (2011) stress that government spending multipliers can then be much larger than in "normal times." If interest rates (R_t) remain fixed, the inflationary impact of government spending *reduces* the real rate of interest ($R_t - E_t\pi_{t+1}$ falls if inflation expectations rise but interest rates do not). Rather than crowding out private-sector consumption more fiscal spending *crowds in* private consumption in such a situation.

For the transmission of tax changes as well, the monetary stance is of central importance. Eggertsson (2011), for example, stresses that in a ZLB scenario, changes in tax rates may have the exact opposite effect on economic activity than in normal times. Tax increases are inflationary. In normal times, the monetary response crowds out demand. If interest rates

[6] If a considerable share of households were liquidity-constrained, instead, spending multipliers could be larger than unity (Gali et al., 2007). Still, they would need to be unrealistically large to make spending increases self-financing in normal times.

remain fixed, however, the increase in inflation is *expansionary*, for it *reduces* the real rate of interest.

Figure 1 documents that government consumption and investment expenditures combined rose in the euro area during the stimulus phase, but then started falling somewhat. The theory suggests that the spending impulse may not have been timed to have the largest possible multiplier. Indeed, Figure 9 shows that up until July 2012 the ECB's main refinancing rate (one measure of the monetary stance) remained at above the lower bound and so did interest rate expectations. In line with this, Swanson and Williams (2014) show that medium-term risk-free yields in the euro area, as measured by yields on German bunds continued to react to news until late 2012 and so were essentially unconstrained. Thus, the expansion in spending may have happened when multipliers were small, with commensurate effects on the government debt level, while lesss spending stimulus was forthcoming when multipliers could have been expected to be larger and the associated fiscal costs smaller.

This matters, for an increase in debt can raise fiscal sustainability risks (the Δ_t term in equation 1). In normal times, the central bank can absorb sovereign risk spreads. At the ZLB it cannot as easily. Fiscal sustainability risks then change the fiscal calculus, as is stressed by Corsetti et al. (2013). Namely, they show that once higher debt levels induce sovereign risk spreads to rise and if government spending is not self-financing, spending cuts are less recessionary. Spending cuts reduce the deficit, which in turn causes risk spreads (the Δ_t) faced by the government and the private sector to fall, *crowding in* private-sector demand.

It is also important to note that "unconventional fiscal policy" can ensure that the lower-bound constraint on monetary policy is undone; see Correia et al. (2013). For this to work, the fiscal mix across instruments and time matters. This can be seen in the IS equation (equation (1)): A path of consumption taxes that rises over time ($[E_t T^C_{t+1} - T^C_t] > 0$) has the same effect on economic activity through the intertemporal IS equation, equation (1), as a reduction in real interest rates ($R_t - E_t[\pi_{t+1}] < 0$). Any effect on inflation can, then, be curbed by a movement of labour taxes in the opposite direction, see equation (2). While, indeed, fiscal forecasts for indirect taxes projected an increasing path from the end of the stimulus phase onward (not shown), the mix does not conform with the unconventional fiscal

policy: labour taxes rose in the middle of what was a phase of rising indirect taxes.

The textbook model shown above does not have a role for transfers. In practice, as a share of potential GDP these continued to rise over the euro-area crisis years. The literature holds that transfers are expansionary if some households are liquidity-constrained, see Oh and Reis (2012), and again particularly so when monetary policy is constrained, see Giambattista and Pennings (2012). The reason is that an increase in transfers typically moves resources from households with a lower marginal propensity to spend out of income to households that have a higher marginal propensity to spend. Of course, the downside of such increases in transfers, as with any of the fiscal measures discussed so far is that they may not be self-financing, thus contributing to rising government debt levels, which would increase the need for contractionary fiscal policy in future years. Drautzburg and Uhlig (2015) stress that fiscal multipliers can be affected adversely in a quite dramatic fashion by the need for later distortionary financing of the ensuing deficits.

3.4 Fiscal policy in each block

The discussion so far has largely abstracted from the core-periphery dimension. Section 3.1 and Figure 2 have highlighted, however, that both the state of the economy and fiscal policies started to diverge across Core and Periphery with the onset of the contraction phase. The key element in a currency union is the assessment of spill-over effects across the blocks.

On the tax side, foremost to mention is the concept of a "fiscal devaluation" in a currency union. This entails raising competitiveness by cutting labour taxes and financing these cuts by raising value-added taxes (thus curtailing domestic demand but raising exports), compare Farhi et al. (2014). *Prima facie*, however, a fiscal devaluation in the Periphery in the contraction phase does not receive much support from the numbers we showed in Figure 2. Rather, the opposite movement seems to have been in place. Labour taxes in the Periphery did not fall (either in absolute terms or relative to the Core). And, while indirect tax rates in the Periphery have risen in the contraction phase they did so only from their atypically low levels reached at the end of the stimulus phase. The theory, thus, suggests that this element of the fiscal mix may not have helped to stimulate economic activity in the Periphery.

The international dimension matters as much on the spending side; see Corsetti et al. (2014) or Blanchard et al. (2016). Domestic government spending generates domestic demand and so tends to be inflationary at home. Spending in one block of the currency union thus tends to cause a rise in area-wide inflation. In normal times (when the currency union's monetary authority is unconstrained), this triggers a higher real rate of interest in the union as a whole (through the monetary response), which in turn causes negative demand spillovers to the other block of the union. The literature has pointed out, though, that matters can differ sharply in a ZLB phase, especially if that phase is persistent. Then, higher inflation crowds *in* the spending block's private consumption demand. The trade channel will mean that some of that increased demand falls on the block that did not increase spending. In other words, in a ZLB scenario spending spillovers may switch from being negative (beggar-thy-neighbour) to positive. In Section 4 we find that the Core's expenditures remained higher after mid 2012 than pre-crisis fiscal behaviour would have suggested. The theory suggests that this element of the fiscal mix may have stimulated economic activity not only in the core, but also in the periphery of the euro area.

Corsetti et al. (2014) refine this argument further. In a model that forms the basis for the one used in Section 4, they argue that the country-distribution of government spending is particularly important in a ZLB phase when one region of the union is fiscally stressed, while the other is not. They show that a cut in government spending in fiscally stressed countries of a currency union (which reduces the sovereign risk-premium there) and a simultaneous fiscal expansion in countries with fiscal space can be expansionary for the area as a whole. This is important for the euro-area context because the fiscal contraction in the Periphery occurred precisely in such an environment of heightened sovereign risk premiums (recall Figure 7) and in an environment in which the Core did not retrench (compare Figure 2).

4 Quantifying the implications of the euro-area fiscal mix

This section resorts to a larger New Keynesian model of the business cycle in order to quantify the macroeconomic implications of the euro-area fiscal mix. The model economy

is an extended version of Corsetti et al. (2014). It consists of a currency union with two blocks, the Core and the Periphery, and features the channels of fiscal policy transmission and the state dependence discussed in the previous section. Readers who are interested to learn more about the structure of the model may consult the box below. For the other readers, it suffices to explain the fiscal sector of the economy, to which we turn next.

Description of the model. Figure 10 provides a flow-chart presentation of the monetary union model. It is comprised of two blocks, HOME and FOREIGN, later associated with the Core and the Periphery. The flowchart zooms in on one of the blocks (HOME). The blocks differ in terms of size, macroeconomic and fiscal shocks, but otherwise are identical. The union-wide central bank sets the risk-free rate of interest at which savers in HOME and FOREIGN can deposit funds with a union-wide financial intermediary. In doing this, the central bank responds to area-wide inflation, the area-wide output gap, and the area-wide credit spread (with a view to absorbing the effect of rising spreads if possible); compare Cúrdia and Woodford (2010) for why this is good central bank policy. The central bank, though, can become constrained by the zero lower bound on interest rates, in which case it can no longer absorb the risk spread.

The model features three types of households in each block: savers, borrowers, and liquidity-constrained households. Savers deposit funds with union-wide financial intermediaries and buy government bonds. Borrowers borrow funds from the intermediaries, at a borrowing cost that is subject to a country-specific spread. This spread on private-sector lending, in turn, is linked to the borrowing costs of the sovereign. This is the *sovereign risk channel* of Corsetti et al. (2013). Sovereign risk is assumed to increase in the level of sovereign debt. Through the sovereign risk channel, higher government debt has the potential to reduce consumption demand. Saver and borrower households participate in financial markets. The third type of household, instead, is liquidity constrained and lives pay-check to pay-check. Liquidity-constrained households always consume their entire labour earnings plus any lump-sum transfers that they receive. For them, Ricardian equivalence does not apply – fiscal transfers matter directly for their consumption demand.

All households have preferences for bundles of differentiated goods from HOME and FOREIGN, but they exhibit home bias. Physical capital once produced is not mobile internationally. The production of domestic fixed investment uses both domestic and foreign goods as inputs, but is biased towards using the domestic ones. Labour is not internationally mobile. Prices of individual goods are rigid, so that output is demand-determined. Wages are rigid as well.

Fiscal policy is country-specific. The governments in HOME and FOREIGN conduct fiscal policy according to the set of fiscal rules described in Section 4.1.

The appendix to the paper contains a detailed exposition of the model and discusses the parameter choices that we make.

4.1 Fiscal rules

In the absence of shocks, we wish the fiscal sector to normally react to macroeconomic developments in a way that is consistent with pre-crisis fiscal behavior in the euro area. Toward this end, and as is customary in the literature, we model fiscal policy as a set of fiscal rules. The form and parameterisation of the rules is identical in HOME and FOREIGN. Nevertheless, fiscal policy is country-specific because the fiscal instruments can deviate from the rule, and they react to country-level developments. The fiscal rules take the form

$$x_t = \rho_x x_{t-1} + \theta_{x,B^b} \widehat{b}^g_{t-1} + \theta_{x,Y} \widehat{y}_t + \epsilon^x_t.$$

Here, $x_t \in \{\tau^c_t, \tau^L_t, \tau^K_t, \widehat{g}_t, \widehat{i}^g_t, \widehat{T^g_t/P_t}\}$ is one of six fiscal instruments, namely, the tax rate on consumption (indirect tax), tax rate on labor income, the tax rate on capital income, real government consumption, real government investment, and government transfers. Hats over a variable mark log deviations from the balanced growth path. The tax rates are expressed in terms of deviation from the steady state, which is taken to be the euro-area average of 2007. The spending instruments are expressed in terms of the percent deviation from the balanced growth path. The instruments are persistent through parameter ρ_x, and they respond to deviations of real debt b^g_t from the Maastricht treaty target level and deviations of output y_t from the balanced growth path. Next to the systematic behavior embedded in the rules, there can be unanticipated "fiscal shocks," ϵ^x_t. These correspond to the unsystematic component of fiscal policy that is not anticipated by economic agents. The rules for different instruments x will have different parameters ρ_x, θ_{x,B^b}, and $\theta_{x,Y}$.

It is beyond the scope of the current paper to estimate fiscal rules in the context of the current model. Rather, we rely on estimates in the literature to parameterise these rules. Our main point of reference is Coenen et al. (2013), from which we take the functional forms of the rules and the parametrisation of all but one. Their estimates are for the euro area as a whole, derived from estimating the ECB's New-Area-Wide-Model with a fiscal sector on a sample

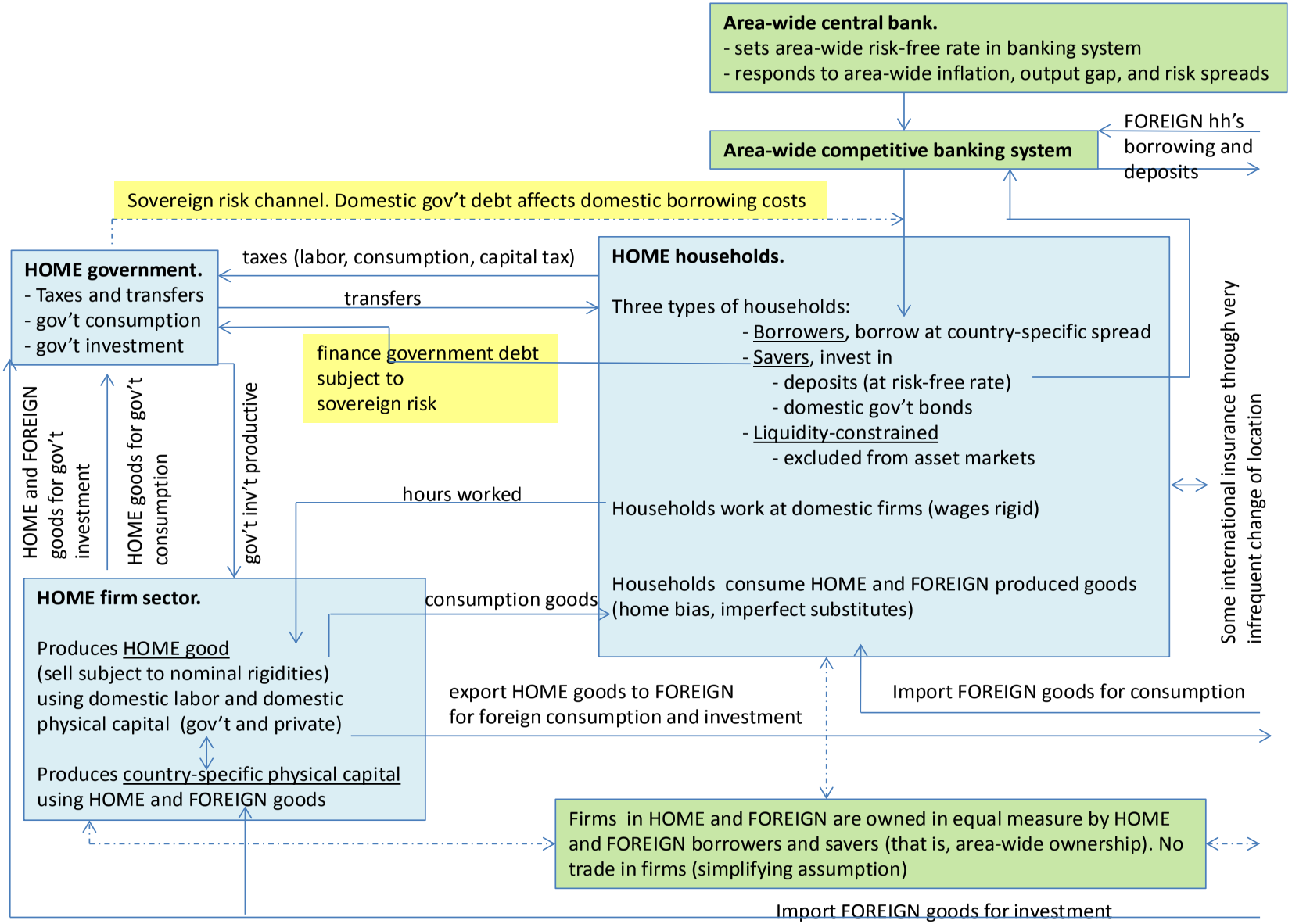

Figure 10: **Flowchart.** Illustrates the structure of the model. Green squares: area-wide elements. Blue squares: country-specific elements. Yellow squares: sovereign risk channel. The model is symmetric. The same country-specific elements and sovereign risk channel pertain to FOREIGN as well (though depending on the FOREIGN state of the economy, of course).

from 1985Q1-10Q2. Their estimates are, thus, largely based on "normal times" and ignore the euro area's fiscal contraction phase, in particular. In any case, their estimates appear quite similar to those reported by Forni et al. (2009), whose sample runs to 2005Q4, and so is firmly pre-crisis. The rules are parameterised as shown in Table 2.

Table 2: **Parameterisation of the fiscal rules**

	Parameter values			
Instrument	ρ_x	θ_{x,B^g}	$\theta_{x,Y}$	Source
Revenues				
Consumption tax rate[(1)], τ_t^C	0.91	0	0	Coenen et al. (2013)
Labor tax rate[(2)], τ_t^L	0.75	0.02	-0.01	Coenen et al. (2013)
Capital tax rate[(3)], τ_t^K	0.97	0.003	-0.003	Forni et al. (2009)
Expenditures				
Government consumption[(4)], $\widehat{g}_t$	0.77	-.02	0.06	Coenen et al. (2013)
Government investment[(5)], $\widehat{i}_t^g$	0.7	-.18	.55	Coenen et al. (2013)
Lump-sum transfers[(6)], $\widehat{T_t^g/P_t}$	0.7	-.14	0.1	Coenen et al. (2013)

Notes: Parameters of the fiscal rules. [(1)]: The estimates by Forni et al. (2009) are very similar ($\rho_{\tau^c} = 0.96$, $\theta_{\tau^c,B^g} = 0.003$ after imposing $\theta_{\tau^c,Y} = 0$). [(2)]: Coenen et al. (2013) model separately taxes on wages, and worker's and employer's social security contributions . We account only for one class of labor-income taxes. Our parametrization is an average of their groups' responses. Forni et al. (2009), estimate $\rho_{\tau^L} = 0.91$, $\theta_{\tau^L,B^g} = 0.01$ and *impose* $\theta_{\tau^L,Y} = 0$. [(3)]: Coenen et al. (2013) *assume* that capital taxes remain fixed throughout, which seems unreasonable to us. Hence we use the Forni et al. estimates. [(4)]: roughly consistent with the estimates in Forni et al. (2009), who abstract from feedback and set $\theta_{G,B} = 0$, $\theta_{G,Y} = 0$. [(5)]: We treat government investment as a perfect substitute to private-sector investment. This follows Coenen et al. (2013), who report little evidence of complementarities. [(6)]: Coenen et al. (2013) distinguish lump-sum transfers from lump-sum taxes. We only have one lump-sum tax/transfer instrument. Our parametrisation uses their estimates for transfers.

The set of parameterised pre-crisis rules combined is debt-stabilising. For all expenditure items, the fiscal rules incorporate a contribution to debt consolidation (negative parameters θ_{x,B^g}). The expenditure items react to output, as well. Government consumption and investment expenditures are cut if output falls short of trend. Transfers, instead, increase. On the revenue side, only labor taxes contribute notably to debt stabilisation. The labor and capital tax rules are mildly pro-cyclical: tax rates rise in recessions. The consumption tax rate is acyclical. In sum, the fiscal rules depict a fiscal behaviour that is not particularly countercyclical. This is important to bear in mind, for the behaviour embedded in the rules will be our point of comparison in the remaining section.

4.2 Constructing the baseline

Next, we describe how we construct the evolution of the baseline economy. Thereafter, we describe counterfactuals. In these, we take from the baseline economy the evolution of non-fiscal shocks and of monetary policy (shocks and ZLB episodes), as well as the form and parametrisation of the fiscal rules, but change the shocks that affect the fiscal instruments.

The results presented in this section rely on numerical simulations. The simulations are obtained through an iterated perfect foresight solution of the non-linear model. We solve the model under perfect foresight. Then, we move two quarters ahead, taking the previous two simulation quarters (this quarter and next) as given. We allow for economic shocks and unanticipated changes in the fiscal instruments and simulate anew. Again, we move two quarters forward, until we reach 2015Q4.

To construct the baseline we proceed as follows. For the first two quarters of each simulation run, we set the fiscal instrument to the value prescribed by the *ex-post* data for that year. For the taxes, these are the tax rates. For the expenditure items, we target expenditures relative to trend output. We do this by appropriately calibrating the unexpected shocks in the fiscal rules specified in the previous section. For all fiscal series we match deviations from the steady state (or the balanced growth path) in the model to deviations of the data from the country-specific 2006-07 levels.[7] The simulations start in 2008Q1 having imposed the 2007 debt levels as initial conditions (Core: 62% of GDP, Periphery: 75% of GDP).

For the model, a choice has to be made as to how deep the recession is (whether it is driven by cyclical factors or a change in the trend, for example). Compared to a pre-crisis area-wide trend, euro-area output falls more than 10 percent short of the trend (see Figure 11). We set up our baseline to roughly replicate this behaviour of output. This view provides scope for fiscal stabilization policy and debt stabilisation concerns.

The evolution of economic activity will add to determining tax revenue, and thereby affect the evolution of government debt. The latter affects the short-run tax and spending elasticities (compare Corsetti et al. 2014). Reproducing roughly the evolution of the euro-area

[7] It is well-understood that, thereby, we do not necessarily introduce the same sequence of shocks relative to the rules for different counterfactuals (since y_t and b_t^g) change. For a general audience, we find it more useful, however, to think of policy counterfactuals in terms of levels than in terms of shocks.

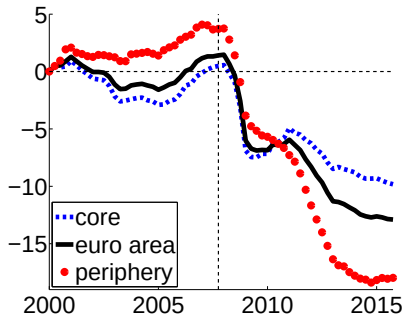

Figure 11: **GDP in the Core and Periphery detrended at pre-crisis EA trend.** Real GDP in the EA, its Core and Periphery. Linearly detrended log series. Percent deviation from trend. Trend estimated on sample 2000Q1-07Q4.

economy, thus, matters. This has the elements discussed in Section 3.1: a sharp contraction in output and investment and diverging developments in later years. Toward mimicking this, we manually introduce a sequence of unanticipated shocks to the time discount-factor, to country-specific productivity, to markups, to monetary policy and to the marginal efficiency of investment (the latter being roughly interpretable as a measure of financial frictions). As regards monetary policy, we assume that starting with the fall of 2012 monetary policy sets its target interest rate to the zero bound, which we understand as a level of 25 basis points annualised. We assume that the interest rate is expected to remain there for seven quarters (recall Figure 9). With each simulation, the lower bound episode is extended. In the simulation, sovereign spreads are assumed to be very low at the beginning (as agents perceive no default risk), but then from early 2010 to early 2011 increase to the level indicated by the CDS spreads for a specific debt level given in Corsetti et al. (2014) at the height of the crisis. In the simulation, by assumption they stay at that level throughout mid 2012 and then are reduced by half, roughly reproducing the evolution of spreads after ECB President Mario Draghi's "whatever-it-takes" remarks. It is beyond the scope of the current paper to explore the mechanism through which this cut in spreads comes to pass. Corsetti et al. (2014), for example, explore one such mechanism: a (contingent) pooling of debt. Other proposed mechanisms build on multiple equilibria.

4.3 Does the baseline fit the euro-area developments?

Figure 12 shows the evolution of selected aspects of the baseline economy as black solid lines. The first row focuses on the Periphery, the second row on the Core. From left to right the panels show real GDP (in deviation from trend) in percent, the private sector investment-GDP ratio in percentage points, the inflation rate net of the direct effect of tax changes in annualised percentage points, and the public debt-GDP ratio in percentage points. All entries are in deviation from the steady state. The final row shows the evolution of the policy rate. The blue dashed lines mark the actual data (in deviation from trend or the 2006-07 average level). It bears noting that, necessarily, the baseline does not match the evolution shown in the data in all dimensions. Nevertheless, the baseline captures, we would argue, some of the most important characteristics of the euro-area crisis years: a deep, protracted recession that is deeper in the Periphery than the Core (left-most panels), a collapse in investment particularly in the Periphery, inflation below target, and a sharp run-up in sovereign debt.

4.4 The effect of the euro area's fiscal stance as a whole

This section asks: how would the euro-area macroeconomy have evolved if both blocks had strictly adhered to the fiscal behaviour that is envisaged in the fiscal rules? This counterfactual feeds in the same sequence of recessionary non-fiscal shocks as above. It also keeps the timing of the lower-bound episode for monetary policy. It differs from the baseline, however, in that in both the Core and the Periphery there no longer are discretionary changes to fiscal policy. Rather, in *all quarters* the fiscal instruments are now assumed to follow the pre-crisis fiscal behaviour as embedded in the fiscal rules (with $\epsilon_t^x = 0$ for all periods in time and instruments in both blocks of the currency union).

Figure 13 shows how much higher output, inflation, and public debt would have been if the fiscal rules had been followed strictly throughout the crisis. The figure shows deviations from the baseline evolution, that is, from the model baseline the evolution of which was targeted in Section 4.2 and the results for which were shown in Figure 12. A negative number in Figure 13 means that the value of the respective variable in the counterfactual is smaller than the value in the baseline.

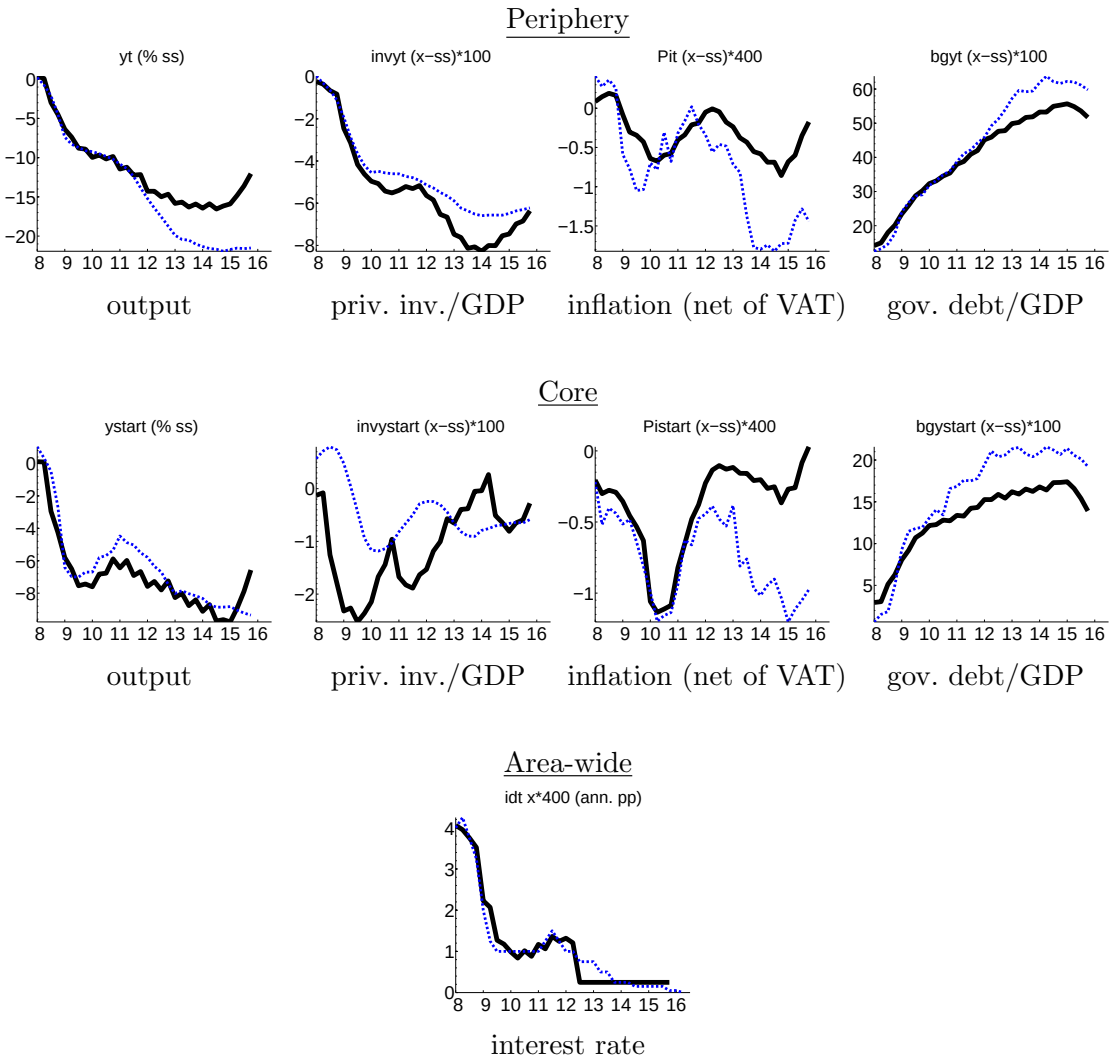

Figure 12: **Model baseline: output, investment, inflation, and debt.** Evolution of output, private investment to GDP, inflation, government debt, and the policy rate in the baseline model (black solid) and the data (blue dashed line). The last date targeted is 2015 Fall. Negative numbers in the figures here mean that the value of the respective variable is smaller than the steady-state value. Top row: Periphery, second row: Core. Left-most panels: output expressed in percent deviation from the balanced growth path. Second to left: private investment in percent of GDP. Second to right: annualised inflation rate (net of changes in VAT) in deviation from steady state for the model, HICP inflation excl. food and energy for the data. Right-most panel: government debt as a percent of GDP in deviation from steady state. Last row: central bank policy rate (annualised percentage points, in levels).

Most of the numbers are negative. The main result, therefore, is the following: the simulations suggest that if the euro-area countries would have followed the pre-crisis fiscal rules throughout, overall output and inflation would have been lower. Compared with this counterfactual,

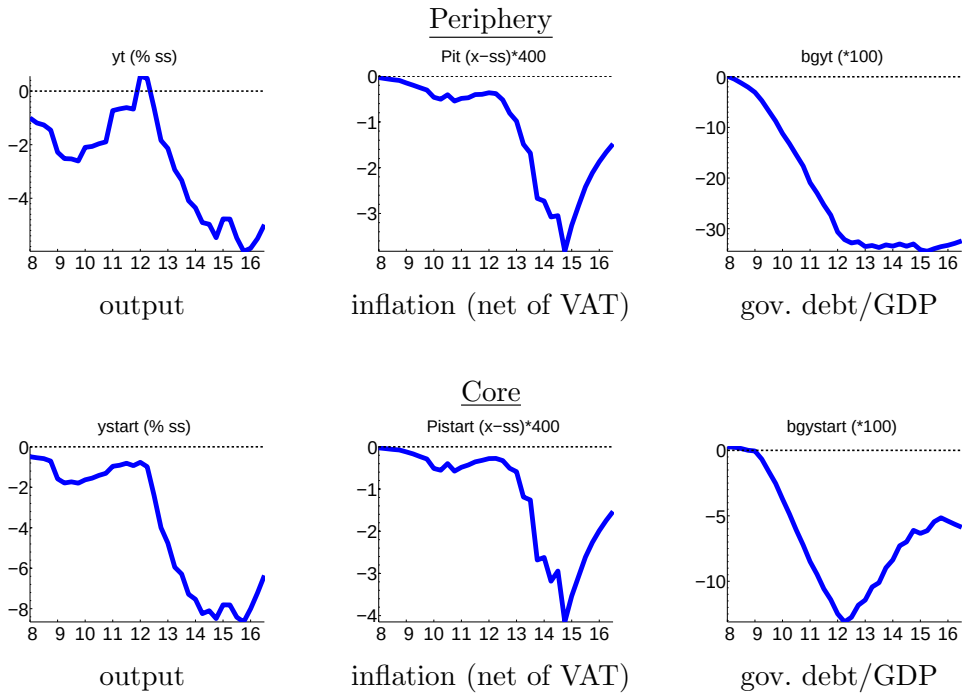

Figure 13: **Counterfactual: rule-based policy. Output, inflation, and sovereign debt.** Evolution of output, inflation and government debt in the counterfactual with rule-based policy. The last date targeted is 2015 Fall. Negative numbers in the figures mean that the value of the respective variable in the counterfactual is smaller than the value in the baseline. Variables are scaled as in Figure 12.

the fiscal mix in the euro area has stabilised output in both the Core and the Periphery (output in the counterfactual being lower than in the baseline). That stabilisation was substantial in 2009-10, when it accounted for output of almost 2 percentage points of GDP and about half a percentage point in the inflation rate. The stabilisation was stronger still in the years after monetary policy became constrained by the ZLB. The simulations suggest that output would have been much lower if fiscal policy had followed the pre-crisis rules throughout. This is so in both the Periphery (by 6 percent) and the Core (by 8 percent). Similarly, the simulations suggest that inflation would have fallen almost 4 percentage points below target. This gain in economic stabilisation, at the same time, could have meant that the countries accumulated more public debt than they would have under a strict implementation of the pre-crisis fiscal rules. Focusing on the right-most panel of Figure 13 it becomes apparent that the rules are much more successful in stabilising the debt level (debt being lower in the counterfactual than

the baseline). Indeed, under the rule-based counterfactual, the governments stabilise their debt levels (relative to GDP) almost entirely, with a commensurate reduction in the spreads (not shown). The simulations, thus, suggest that the change in the way fiscal policy has been conducted since the beginning of the crisis (deviating from pre-crisis fiscal rules) may have raised the debt to GDP level by over 30 percent of GDP in the Periphery, and by over 10 percent in the Core. Interestingly, all of the run-up in debt occurs before mid 2012, that is, before monetary policy becomes constrained. That is, when compared with pre-crisis fiscal behaviour, not only did the fiscal mix remain supportive of output throughout the years, but also has it become fiscally less burdensome (as measured by the effect on debt) in the period after monetary policy became constrained. This has to do both with the consolidation efforts in the Periphery and the fact that the remaining demand stimulus was more cost-effective (in terms of debt), not least due to larger positive spillovers from the Core (recall the discussion in Section 3) on the Periphery once euro-area monetary policy became constrained.

Figure 14 shows the differences in fiscal instruments in the Core and the Periphery under the counterfactual. A positive value means that the instrument takes on a higher value in the rules-based counterfactual than in the baseline. For the Periphery, the differences in instrument values across the two scenarios are large. Under rules-based policy, labour taxes would have been 2 to 4 percentage points higher throughout, with similar developments for consumption taxes and capital taxes (positive numbers in row 1). On the spending side, during the stimulus phase the counterfactual would have seen about a full percentage point of GDP less of government consumption and investment than in the baseline (negative numbers in row 2, left-most panel). Initially, transfers would have been higher still in the counterfactual, though. All this reverses, so that the counterfactual would have foreseen higher government spending and investment toward the end of the contraction phase, but also transfers in the Periphery that would have been about three percentage points of GDP lower than in the baseline (see row 2). For the Core, the main difference appears to be on the spending side, where government consumption, government investment, and government transfers most of the time would all have been lower under rules-based policy than in the baseline (by roughly a percentage point of GDP each, negative numbers in row 4). The ensuing drop in demand

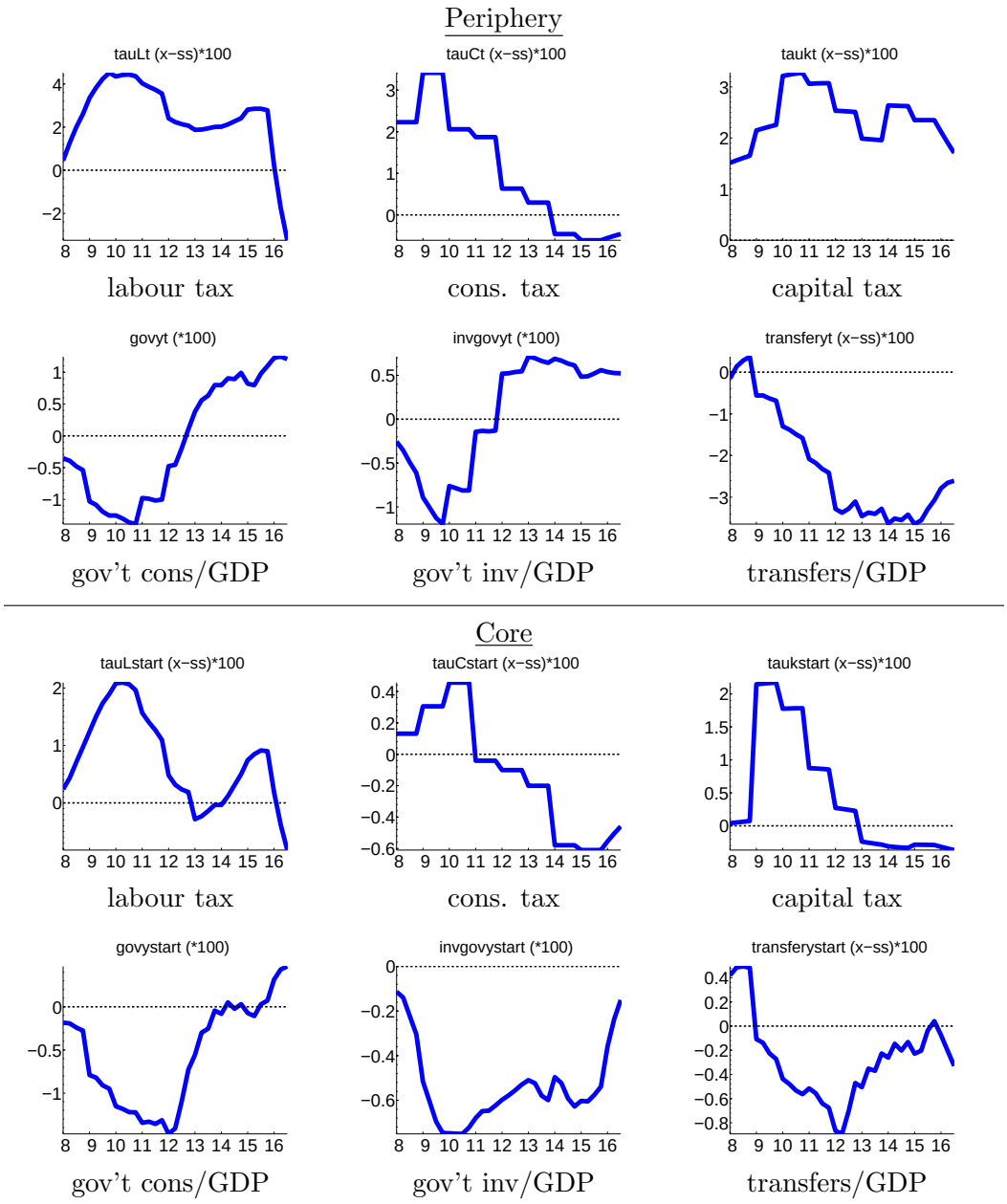

Figure 14: **Counterfactual: rule-based policy. Fiscal instruments.** Evolution of the fiscal instruments in the counterfactual with rule-based policy. Negative numbers in the figures mean that the value of the respective variable in the counterfactual is smaller than the value in the baseline. Top two rows: Periphery, bottom two rows: Core. Tax rates are in levels ("-1" on the vertical axis means the tax rate is one percentage point lower in the counterfactual than the baseline). Government consumption, government investment, and transfers are expressed in percent of GDP (a "-1" on the vertical axis meaning, for example, that the government consumption would be one percentage point of GDP lower in the counterfactual than the baseline).

by the government and of liquidity-constrained households under the counterfactual would have reduced euro-area demand at a time when the economy was constrained by the ZLB, explaining part of the large output losses under the counterfactual that Figure 13 documents. A remaining part stems from reduced monetary accommodation. Throughout, we assume that the central bank reduces the policy rate by about 50 basis points for every 100 basis point increase in private-sector spreads. Since the latter rises with sovereign risk in the simulations after mid 2012 and debt is persistent, implicitly, lowering sovereign debt also removes some monetary stimulus. In particular, under the counterfactual the Periphery has much lower sovereign debt, which in turn translates into lower spreads and thus less monetary accommodation for the Core (as most of the rise in spreads occurred in the Periphery). For the Periphery, instead, the effect that lower debt has on spreads brings less crowding out of consumption and a lower tax burden.

In sum, we have run a very specific counterfactual. Namely, we have compared the evolution in the model baseline (that incorporates the actual fiscal mix) with a counterfactual under which the two blocks would have permanently followed pre-crisis fiscal behaviour as embedded in the set of pre-crisis fiscal rules that we discussed above. This set of rules was not particularly countercyclical and put emphasis on debt stabilisation. The results suggests that the fiscal mix in the euro area as a whole stabilised economic activity in the crisis years by more than pre-crisis fiscal behaviour would have done, and particularly so more recently. At the same time, the results also suggest that this has come with a steep rise of sovereign indebtedness, which the pre-crisis fiscal behaviour would have contained.

4.5 The effect of the Periphery's fiscal stance alone

The previous section suggests that the evolution of debt in the Periphery would have been starkly different had the pre-crisis fiscal rules been applied throughout in both the Core and the Periphery. What this section seeks to do is isolate the contribution of the Periphery in recent years. The counterfactual that we present asks: what would the evolution in the euro area have looked like if the Periphery had resumed strict pre-crisis fiscal behaviour from 2013 onward, that is, after the strong increase in the public debt/GDP ratio in the early years of

the crisis? More in detail, we let the Core implement the same level of the fiscal instruments as in the baseline (the actual fiscal mix in the Core). Until the end of 2012 the Periphery implements the actual fiscal mix as well. This means, in particular, that government debt rises by 30 percent of GDP, as in the baseline. From 2013Q1 onward, however, the Periphery now is assumed to strictly follow the pre-crisis fiscal rules, with $\epsilon_t^x = 0$ for all instruments and periods. This means that from 2013 onward in the counterfactual the Periphery embarks on a fiscal consolidation as envisaged in the rules.

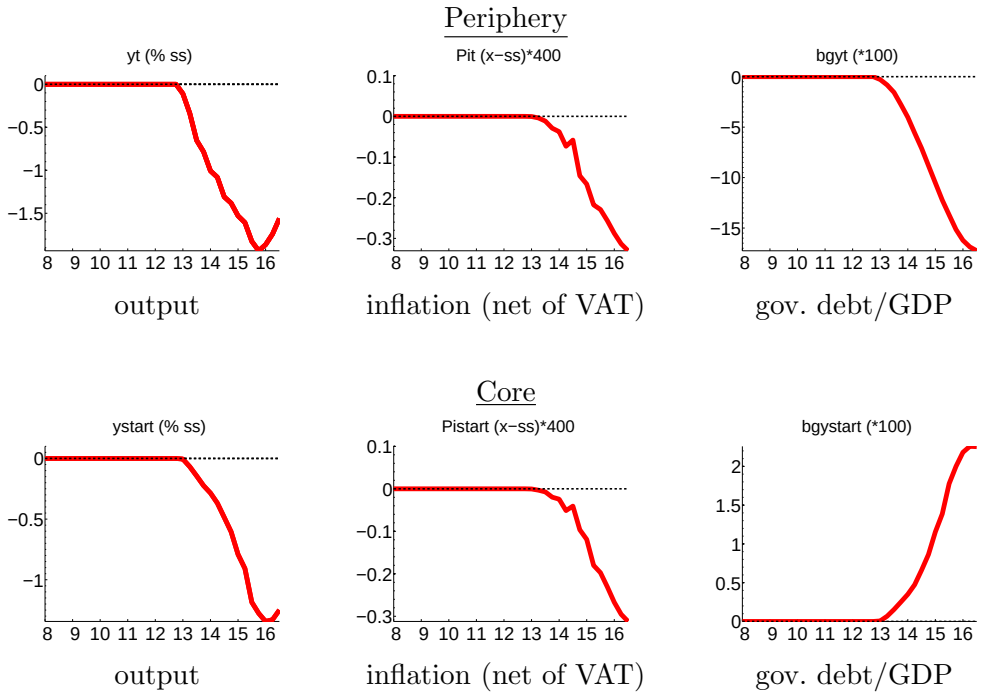

Figure 15: **Counterfactual: rule-based policy in the Periphery only (starting in 2013). Output, inflation, and sovereign debt.** Evolution of output, inflation and government debt in the counterfactual with rule-based policy in the Periphery only. Negative numbers in the figures mean that the value of the respective variable in the counterfactual is smaller than the value in the baseline.

Figure 15 shows the effect of this counterfactual on output, inflation, and the public debt level in both the Core and the Periphery. The entries for output and inflation for the years from 2013 onward are negative.[8] The counterfactual thus suggests the following: if the Periphery had followed the rules-based fiscal policy from 2013 onward, output and inflation would have

[8]Up to the end of 2012, this counterfactual does not deviate from the baseline. Therefore, the early entries in Figure 15 are zero by construction.

been lower in both the Periphery and the Core than they actually were. The reason is that the pre-crisis fiscal rules would have emphasized debt stabilisation to a larger extent than the actual fiscal mix. In other words, if the Periphery would have implemented pre-crisis fiscal behaviour from 2013 onward, the model simulations suggest that we would have witnessed a sharper fiscal contraction in the Periphery than we actually have observed. The counterfactual, thus, suggests a conclusion that appears to qualify a commonly-established view: the Periphery as a whole may have contracted fiscal policy by less than pre-crisis fiscal behavior would have suggested. This lack of a stronger contraction in turn has contributed *positively* to stabilising output in the Periphery relative to what would have been observed under the pre-crisis fiscal rules. Due to positive demand spillovers when monetary policy is constrained, it also has stabilised output in the Core. Indeed, the Core's debt would have been somewhat higher if the Periphery had contracted according to the fiscal rules.

4.6 Caveats

This section has sought to make the point that the fiscal mix in the euro area mattered, for the individual block of countries and for the area as a whole. The simulations that we showed suggested that in the recent years, after interest rates hit their lower bound, both the Periphery's fiscal mix and the Core's have been more expansionary for the area as a whole and for the respective other block than a strict implementation of pre-crisis fiscal rules would have implied.

At this point, several caveats and remarks are in order. In particular, we see the exercise above and the data that we provide as a starting point for a more model-based discussion of the effects of the *fiscal mix* on euro-area economic activity. Our paper is a first step, and it is important to highlight possible limitations. These concern both technical dimensions and the interpretation of results.

Turning to the technical dimensions first, there are caveats that regard the class of model used. The New Keynesian class of models was built, first and foremost, to analyze monetary policy. Nominal (price or wage) rigidities are a central ingredient, the invariance of which to sizable changes in fiscal policy may appear questionable. At the same time, assuming such invariance

may become tenable as a means to an end, namely, if one is willing to interpret the model more loosely as capturing coordination frictions in the private sector. Even then, however, another concern remains: is this a useful model for analyzing *fiscal* policy? There is ample precedent for doing so, accounting (as we do) for some form of liquidity-constrained consumers (Gali et al. 2007, for example) in order to match evidence on household spending in response to demand stimulus or fiscal multipliers. Nevertheless, these constraints are introduced in an *ad hoc* way here and heterogeneity is much more limited than in the data. For example, even wealthy households may be liquidity-constrained at times, see Kaplan and Violante (2014). An active literature assesses the implications of fiscal policy in models that account for liquidity or borrowing constraints in a more profound way and allow for household risk at the same time. Accounting for equilibrium unemployment amid borrowing constraints could be important, for example, because unemployment brings households closer to the borrowing constraint. Transfers in recessions, then, could be more expansionary than our modeling accounts for. Similarly, unemployment increases idiosyncratic risk and households may, therefore, desire to hold more precautionary savings. This, in turn, may induce deflationary spirals and deep recessions, as in den Haan et al. (2015). Government spending or transfers could mitigate the rise in idiosyncratic risk and, thereby, greatly help stabilise the economy. Clearly, these are mechanisms that the current paper abstracts from.

Several caveats concern the modeling choices that we make within the New Keynesian class of models. In particular, we have used a reasonably standard two-country New-Keynesian business cycle model. The model featured two blocks of countries that were calibrated to be identical apart from their initial debt levels and the fiscal and non-fiscal shocks that they were subjected to. Accounting for the heterogeneity across the euro area, in terms of fiscal institutions, or other, and rigidities may have a bearing on our conclusions. We leave this for future exploration. Similar caveats regard the modeling of financial and sovereign risk. We abstract from modeling financial-sector risk or housing as collateral. We also abstract from the forced deleveraging of firms or households (in the model, borrowers do delever in a recession, but do so voluntarily) that Eggertsson and Krugman (2012) stress. Next, the model used here allows for an effect of sovereign risk on economic activity through borrowing costs

for households. We have not modelled in any way the interaction of fiscal policy, sovereign risk, and the funding costs of firms. This seems an important avenue for further exploration. The sequence of macroeconomic shocks that we used to initialise our baseline simulation, in particular featured sizable shocks to the marginal efficiency of investment (investment shocks). The effect of the shocks is to depress investment. This makes model and data reasonably consistent in an important dimension. To the extent, however, that such shocks represent financial frictions and thus the funding costs of firms, one may reasonably argue that these frictions should be endogenous to fiscal policy (and sovereign risk). We, instead, have assumed that they are exogenous to policy. The direction in which this biases the results ex ante may not be clear. An example may suffice: if a firm's borrowing costs depend on the sovereign spread, which in turn depends on the debt level, fiscal consolidation in the Periphery may have been less harmful to GDP than shown here. On the other hand, if government demand provides demand at a time when there is little other demand, thus stabilising firm's cashflow, this will go in the opposite direction, and we would understate the adverse effects of fiscal consolidation. Last, we also abstract from fiscal uncertainty which may itself have sizable adverse effects on aggregate activity, see Fernández-Villaverde et al. (2015).

We also wish to stress that none of the results presented in Section 4 have a normative flavour. All we did is to compare the evolution of the model economy under the actual fiscal mix to the evolution under one specific set of counterfactual. Under the counterfactual, fiscal policy would not have been particularly countercyclical and would, rather, have put more emphasis on stabilising the public debt.

5 Conclusions

The paper has described fiscal developments in the euro area since 2007 and sought to quantify their effect through the lens of New Keynesian business cycle theory and model simulations. The paper documented the fiscal mix across time, for both the "Core" and "Periphery" regions, for six fiscal instruments. We assessed the evolution of these two aggregate sub-regions, without going through each and every individual country.

The fiscal data suggest distinguishing three phases: An initial stimulus phase in 2009-10, followed by a phase of contractionary fiscal policy in 2011-13, and a stabilisation phase that set in thereafter. For the euro area as a whole, the contractionary phase was characterised by reductions in government consumption and investment spending, and rising taxes. We document that the Periphery accounted for much of this. Fiscal policy in core countries overall does not appear to have contracted. In any case, transfer spending continued to rise in the Periphery even in the contraction phase. Looking at the evolution of the fiscal instruments over time, relative to the pre-crisis level of the instruments, part of the fiscal contraction in the Periphery could be read as a reversal of the earlier stimulus, the lack of a contraction in the Core as maintained stimulus. A detailed look at the country, instrument, and time dimension of the fiscal mix, thus, appears to matter in interpreting recent euro-area fiscal policy.

A clean assessment needs a model and a counterfactual. The counterfactual that we build is based on the fiscal behavior as embedded in pre-crisis fiscal instrument rules. These pre-crisis fiscal rules are not particularly countercyclical and emphasise stabilising the public debt. Our model-based simulation results suggest that a strict adherence to the pre-crisis fiscal rules in the counterfactual would have led to lower aggregate demand and inflation than observed under the actual fiscal mix, particularly after monetary policy became constrained by the zero lower bound in mid 2012. At the same time, the public debt to GDP would have been notably lower as well if the pre-crisis rules had been followed strictly, namely, by 30 percentage points in the Periphery and about 10 percentage points in the Core. Interestingly, the simulations attribute this divergence in debt mostly to deviations of the fiscal mix from pre-crisis rules in the time *before* 2012.

The current paper did not address normative questions. While pre-crisis fiscal rules are a natural point of departure for a positive analysis, another point of departure would be the (welfare-maximising) "optimal" fiscal mix. In particular, a fiscal mix may be expansionary relative to pre-crisis fiscal behavior, but not sufficiently (or, as well, too much) so when compared to the optimal mix. A comparison with the optimal fiscal mix would also help put into perspective to what extent the rise in sovereign debt in the crisis was a price worth

accepting for demand stabilisation. We leave this for future research.

Building on the database that accompanies this paper, future research hopefully will also conduct a more country-specific (rather than "block-specific") assessment of the fiscal mix. The Excel files that accompany the current paper have the country-dimension readily available for the reader and for future research. So, while our results are indicative of the role of the fiscal mix in the euro-area crisis, they will hopefully not remain the last word in an important discussion.

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