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Windfall of Low Interest Payments and Fiscal Sustainability in the Euro Area: Analysis through Panel Fiscal Reaction Functions

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I. INTRODUCTION

Although the European sovereign debt crisis occurred five years ago,[1] the causes remain unclear. There are three explanations for the crisis, which differ with respect to the assessment of pre-crisis fiscal policy in the peripheral countries of the Euro area (i.e., Greece, Ireland, Italy, Portugal, and Spain).

According to the first narrative, the debt crisis was closely linked to the global financial crisis, which pushed the peripheral member states into a particularly deep recession, resulting in a huge fiscal deficit and exploding sovereign debt. This narrative emphasizes that before the outburst of the global financial crisis, fiscal deficits in the peripheral member states were low and sovereign debt levels were rather stable (see, e.g., Bronner et al. 2014).

The second narrative links the sovereign debt crisis to unsustainable fiscal policy, which the peripheral member states were running after joining the Euro area. According to this narrative, these countries could anticipate a bailout by other member states for either political reasons or due to the fear of financial contagion (see, e.g., Baskaran and Hessami 2013).

The third explanation (see, e.g., Aguiar et al. 2015) points to the following mechanism. The prospect of joining the Euro area allowed the peripheral countries to benefit from the higher credibility of the member states. This opportunity weakened the incentive of these governments to spend less to borrow

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[1]The crisis is described in detail, e.g., by Lane (2012) and Shambaugh (2012).

cheaply while leaving their impatience unaltered.[2] Thus, they loosened their fiscal policy. Nevertheless, this policy change was not driven by anticipation of a bailout by the remaining countries (as suggested by the second narrative) but by a windfall of lower interest payments. However, when the global financial crisis spawned fears of Euro area disintegration[3] and the windfall disappeared, the fiscal policy of peripheral countries proved to be unsustainable.

The empirical literature on pre-crisis fiscal sustainability in the Euro area has been increasing rapidly in recent years. Nevertheless, there is no evidence that unequivocally confirms one explanation while rejecting the others. It differs in the assessment of fiscal sustainability in the countries that eventually experienced serious sovereign debt problems (cf., e.g., Daniel and Shiamptanis 2013 vs. Theofilakou and Stournaras 2012), as well as in the comparison of fiscal discipline in those countries to the fiscal discipline in countries less affected (cf., e.g., Baldi and Staehr 2015 vs. Baskaran and Hessami 2013). It is not consistent even in the evaluation of the effects of Maastricht criteria on fiscal discipline (cf., e.g., Afonso and Balhote 2015 vs. Schoder 2014). Thus, further research is needed. However, to overcome the ambiguity in the results so far, more stress should be placed on the possible mechanisms that could alter fiscal sustainability in the Euro area rather than on the Euro area establishment itself, which is the approach in this paper.

We provide empirical evidence in favour of the third narrative, which advances at least three testable hypotheses. First, the perspective of joining followed by membership in the Euro area subdued the importance of domestic factors in the sovereign bond yields of the peripheral countries. These factors regained their importance only after fears of Euro area disintegration had spread. Second, the peripheral countries had been running unsustainable fiscal policies before the global financial crisis. Their policies ceased to be sustainable not after adoption of the Euro, but when their governments started to gain the windfall of a low interest burden. As their impatience remained unaltered, they spent what they gained from low interest payments and more. Third, during the period when peripheral countries were gaining the windfall of a low interest burden, the remaining countries strengthened their fiscal sustainability. They had to spend less to borrow cheaply because, otherwise, their credibility could be weakened by the impatience of the governments from peripheral countries belonging to the currency union.

[2]By the same token, if the credibility of the remaining countries was somewhat weakened by a currency union, the incentive of their governments to spend less to borrow cheaply should have been strengthened.

[3]In November 2011, the probability (implied by prices on the online betting market Intrade) that at least one country would leave the Euro area peaked at over 65% (Shambaugh 2012).

There is ample evidence supporting the first hypothesis;[4] therefore, we focus on the remaining two. However, for the purpose of policy recommendations, our findings should be considered together with the results of studies on the first hypothesis.

Our approach to the study of fiscal sustainability builds on the framework of fiscal reaction functions proposed by Bohn (1998) and developed by many others, in particular de Mello (2008) and Mendoza and Ostry (2008). Being founded on government intertemporal budget constraints, it avoids discretion in defining fiscal sustainability. It also avoids discretionary assumptions on the discount factor. However, it has weaknesses of its own (otherwise acknowledged by Bohn 2007). On the one hand, the responsiveness of primary balance to sovereign debt may evolve over time. Fiscal sustainability in a given period indicates hardly anything about future fiscal decisions (Greiner et al. 2007). However, this is a weakness of any test of fiscal sustainability and not only of the fiscal reaction function, as all such tests rely on historical data. On the other hand, the framework does not take into account that there is a limit to the primary surplus that a country can raise. This limit is related to an upper bound of taxes (recall the Laffer curve), as well as to political will (Daniel and Shiamptanis 2013). It is mirrored in abrupt spikes in sovereign bond yields, which precede sovereign debt crises.

We use the framework in a form that controls for the possibility of spurious correlation. With growing awareness of the problem, such a form becomes more and more frequent.[5] Following Favero and Marcellino (2005) and, in particular, Burger and Marinkov (2012), we apply a reaction function not only to the fiscal stance indicators but also to major categories of government revenue and expenditure.[6] This allows us to conclude whether possible changes in fiscal sustainability were more related to taxation or government expenditure. Note that such an extension of the framework is still rare.

[4]See, e.g., Afonso et al. (2012), Afonso et al. (2015), Arghyrou and Kontonikas (2012), Aßmann and Boysen-Hogrefe (2012), Attinasi et al. (2010), Bernoth and Erdogan (2012), Borgy et al. (2012), De Grauwe and Ji (2012a, 2012b), De Santis (2012), Gibson et al. (2012), Gerlach et al. (2010), von Hagen et al. (2011) or Haugh et al. (2009). Interestingly, the first hypothesis is also supported by studies on other fiscal federations. For example, Heppke-Falk and Wolff (2008) find that risk premia in the German sub-national bond market decline in response to an increase in interest payments to revenue ratio after this ratio was considered by the German constitutional court a proxy for extreme financial distress that justifies the entitlement of local government to a bail-out. By contrast, Bayoumi et al. (1995) and Capeci (1994), among many others, show that in the US, where investors do not expect local governments to be bailed out, risk premia in the sub-federal bond market strongly depend on local fiscal variables (or local factors in general), resulting in access to credit being even withheld at very high levels of local government debt.

[5]Cf. Afonso (2008), Afonso and Jalles (2011), Legrenzi and Milas (2013), Medeiros (2012) and Schoder (2014).

[6]Note that unlike this paper, Favero and Marcellino (2005) study the reactions of total revenue and expenditure only, whereas Burger and Marinkov (2012) analyse South Africa (and not the Euro area).

We estimate fiscal reaction functions on a sample of 12 early member states of the Euro area in the period 1970-2013. Unlike other studies on the topic, we focus on the windfall from the sovereign bond yield convergence related to the establishment of the Euro area instead of the Euro area establishment itself. On theoretical grounds, the choice of focus is motivated by Aguiar et al. (2015), as discussed above. On empirical grounds, the choice is prompted by Theofilakou and Stournaras (2012), who provide evidence of increased sensitivity of the fiscal stance in the Euro area to changes in sovereign bond yields.

The focus is reflected in the division of the countries into two groups, core and periphery, based on the scale of benefits from sovereign bond yield convergence.[7] Core countries include Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands, while Greece, Ireland, Italy, Portugal and Spain are periphery countries. The benefits from sovereign bond yield convergence also account for the division of the analysed period into two sub-periods: the time of the windfall for the peripheral member states (covering the years 1996-2007) and the remaining years (covering the years 1970-1995 and 2008-2013). By basing the division of the sample on the benefits from sovereign bond yield convergence, we verify whether those benefits represent a mechanism that could alter fiscal sustainability in the Euro area. Other studies on the topic either do not specify any such mechanism or simply assume it (usually by vague reference to moral hazard).

Our main findings are as follows. First, in the countries where sovereign bond yields decreased sharply in the years 1996-2007, fiscal stance ceased to respond to sovereign debt accumulation. This was due to the lack of sufficient adjustment in government current expenditures and direct taxes. In contrast, in the member states that did not benefit from yield convergence related to the Euro area establishment, responsiveness of the fiscal stance to sovereign debt increased during the period of 1996-2007. This was achieved mainly through the pronounced adjustments of government current expenditures. The findings are robust to changes in the estimation method, measures of fiscal stance, the composition of the sample, country groupings, and the period's split, as well as to sample division based on the values of the interest rate-growth differential (IRGD).

The remainder of the paper is organized in the following manner. Section II presents the related literature. Section III provides a bird's eye view of the windfall in the peripheral economies resulting from sovereign bond yield convergence related to the establishment of the Euro area and how it was used. Section IV presents our estimation strategy. Section V provides estimation results of various fiscal reaction functions (V.1), as well as their robustness tests (V.2). Section VI discusses policy implications and concludes. Tables with panel unit root tests and robustness checks are provided in an online appendix.

[7]Other reasons for such a division are specified in section III.

II. RELATED LITERATURE

This paper relates to the rapidly growing literature on fiscal reaction functions in the Euro area. As mentioned in the introduction, the findings in this strand of the literature have been very ambiguous so far, calling for further research. For example, Afonso and Balhote (2015) find that the Maastricht Treaty, the Stability and Growth Pact and the introduction of the euro were all followed by a worsening in the primary balance in the EU. However, the primary balance remained responsive to growing sovereign debt. Among the Euro area countries, this responsiveness was absent in Finland, France, Greece and Netherlands or in France and Spain, depending on the model specification. Schoder (2014) finds that the Maastricht Criteria contributed to the sustainability of sovereign debt in the Euro area if compared with non-EMU countries, although not in those member countries where the primary balance was not responsive to sovereign debt. The latter group included Greece, Portugal and France (but not Italy or Spain). Baldi and Staehr (2015) do not find different fiscal reaction functions for the pre-crisis period in the countries that eventually experienced serious sovereign debt problems compared to the ones less affected. In contrast, Baskaran and Hessami (2013) find some evidence that the introduction of the Euro and, in particular, suspension of the Stability and Growth Pact in the late 2003 encouraged borrowing in countries that had traditionally run large fiscal deficits. In turn, Daniel and Shiamptanis (2013) find that the responsiveness of the primary balance to inherited sovereign debt in the Euro area was strong enough to eliminate the explosive behaviour of debt and the primary balance. If anything, the responsiveness was stronger in 1999-2011 than in 1970-1998. The authors conclude that the European sovereign debt crisis was a consequence of bad luck or insolvent future promises. Greiner et al. (2007) study fiscal sustainability in Euro area members that were either heavily indebted (Italy) or had fiscal deficits in excess of 3% of GDP (France, Germany, and Portugal) in the early 2000s. They conclude that these countries were correcting the primary balance in response to growing sovereign debt. Legrenzi and Milas (2013) prove that the fiscal policy in peripheral countries was sustainable. However, the authors find that those countries adjusted their primary balance only when their sovereign debt was high enough. The exact sovereign debt threshold above which corrective actions were undertaken was lowered by financial turmoil in the external environment. In contrast, Theofilakou and Stournaras (2012) find that debt stabilization efforts were strong only in countries with low sovereign debt (below 60% of GDP), while in countries with high sovereign debt, such efforts were absent. However, even in the former group of countries, the effort disappeared in the years 1998-2009. Weichenrieder and Zimmer (2014) find that Euro area membership has weakened the responsiveness of fiscal policy to the level of sovereign debt compared to the period between the signing of the Maastricht Treaty and euro adoption, but it has strengthened responsiveness if

compared to the period before the Maastricht Treaty. However, they view their results as not robust enough to draw firm conclusions.

This paper contributes to the literature mainly by redirecting the focus from the establishment of the Euro area to the effects of the windfall gains in the peripheral countries from sovereign bond yield convergence. To the best of our knowledge, none of the previous studies on this topic pay as much attention as this paper does to the role of the windfall (and this in spite of evidence of increased sensitivity of the fiscal stance in the Euro area to changes in sovereign bond yields – cf. Theofilakou and Stournaras 2012). Consequently, previous studies imply that fiscal tensions in peripheral countries have been either unrelated to establishment of the Euro area or, conversely, inherent to the euro, albeit for unspecified reasons. In contrast, our findings suggest that to make fiscal policy sustainable in peripheral countries, changes in the Euro area are both required and possible. Namely, any policies and institutional arrangements that subdue the importance of domestic factors in sovereign bond yields should be abandoned (or avoided).

Having such a focus, this paper also contributes to the relatively underdeveloped literature on the effects of windfall gains in advanced economies. Although the literature on windfall gains is broad and diverse, its focus is on developing countries. It has focused on natural resources (see, e.g., Mehlum et al. 2006), foreign aid (see, e.g., Svensson 2000), and foreign borrowing (see, e.g., Vamvakidis 2007). These sources of windfall are of no importance to the vast majority of advanced economies. Exceptions include, e.g., resource abundant countries like Norway, which have made good use of such windfalls (see, e.g., Gylafson 2011). Obviously, this paper is not the first to address the effects of windfalls on the peripheral countries of the Euro area. It follows, e.g., Fernández-Villaverde et al. (2013), although only in very general terms. These authors, on the one hand, associate the windfall with the global financial bubble rather than with sovereign bond yield convergence related to the Euro area establishment. On the other hand, they study the general reform process in the peripheral economies rather than fiscal policy.

Finally, this paper relates to the literature on links between fiscal adjustment composition and fiscal sustainability. Research on these links has intensified following the sovereign debt crisis in the Euro area.[8] However, differences in the conclusions drawn from before the crisis have remained. While most studies convincingly argue that expenditure-based adjustments are more likely to be sustained (see, e.g., Alesina and Ardagna 2013), some papers prove the opposite (and are also persuasive). In particular, Schaltegger and Weder (2015) find that the probability of sovereign default is not lowered by fiscal adjustments unless they are revenue-based. In turn, Kaplanoglou et al. (2015) show that if one takes into

[8]See, e.g., Afonso and Jalles (2012), Alesina and Ardagna (2013), Heylen et al. (2013), Kaplanoglou et al. (2015), Molnár (2013) and Schaltegger and Weder (2014 and 2015).

account 'fairness' variables, fiscal adjustment composition ceases to matter for their sustainability.[9] Hence, in the case of this strand of literature, more research is also needed. It is worth emphasizing that most papers approach the topic from different angles than the one that fiscal reaction functions allow for. Recall that the main advantage of our approach, based on fiscal reaction functions, is the avoidance of discretion in defining the notion of fiscal sustainability.[10]

III. A BIRD'S EYE VIEW OF THE EFFECTS OF WINDFALL FROM SOVEREIGN BOND YIELD CONVERGENCE IN THE EURO AREA

When the establishment of the Euro area was formally decided in the Maastricht Treaty in 1992, there was a clear division across the EU with regard to sovereign bond yields. While in most EU countries they were very close to each other, the spread against 10 year German bunds ranged from 4 to 6 percentage points in Italy, Portugal and Spain. In Greece, it even exceeded 16 percentage points.

We label these 4 countries as peripheral. Ireland, with a spread in excess of 1 percentage point, hardly fits this group; however, taking into account the yield path in the aftermath of the crisis, we included it among the peripheral countries (as most other studies do – see, e.g., Corsetti et al. 2014; Lane 2012 or Shambaugh 2012).[11,12]

The spreads in the peripheral countries started to narrow after December 1995, when the details of Euro adoption were agreed upon. During the subsequent 3 years, spreads dropped to approximately 20 basis points, except for in Greece, where yield convergence took an additional 2 years. Therefore, financial markets treated the peripheral countries like the most economically stable core countries. The changes in spreads are shown in Figure 1.

Yield convergence contributed to a deep decline in interest payments on sovereign debt in the peripheral countries. In 1996-1999, the decline ranged from 1.7% of GDP in Spain to 4.9% of GDP in Italy. By comparison, in the core countries, it ranged from 0.1% of GDP in Luxembourg to 1.6% of GDP in Belgium. Gains in terms of lower interest payments due to yield convergence were

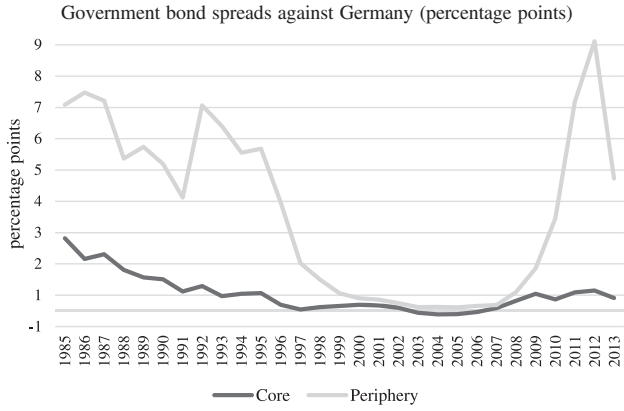
[9]These 'fairness' variables include the targeting of social transfers and their effectiveness in terms of poverty alleviation, government expenditure on training and active labour market policies, social transfers directed to the poor (such as social housing), and VAT rates on necessities.

[10]This is not an advantage over Schaltegger and Weder (2015), who study episodes of sovereign defaults. In their paper, there is no discretion in defining fiscal sustainability either. As they draw opposite conclusions to those of most other studies on links between fiscal adjustment composition and fiscal sustainability, it is important to cross-check whether this difference in conclusions relates to a lack of discretion in defining fiscal sustainability.

[11]The first study applies sovereign CDS spread above 150 basis points as a formal criterion for delineation between the peripheral and core countries. The remaining two studies do not specify criteria, but they also seem to base their division of the Euro area on the yield paths in the aftermath of the crisis.

[12]In the econometric analysis developed in Section V.2, we check the robustness of the results with the exclusion of Ireland from the peripheral economies.

Figure 1



Note: German long-term government bond yields have been subtracted from values for every single country and then averaged. Further information on the source and computation method are given in Table 2.

magnified in the peripheral countries by larger sovereign debt levels compared to the core countries. Although in 1996 the country with the largest net debt was Belgium, the next five most indebted EU countries were the peripheral countries.

In 1999-2007, interest payments declined further. In both groups of countries, the decline was similar and ranged from 0.1% to 3.0% of GDP. While in the peripheral countries it was primarily due to the rollover of maturing debt at lower yields, in the majority of core economies, it was caused largely by a fall in the sovereign debt level.

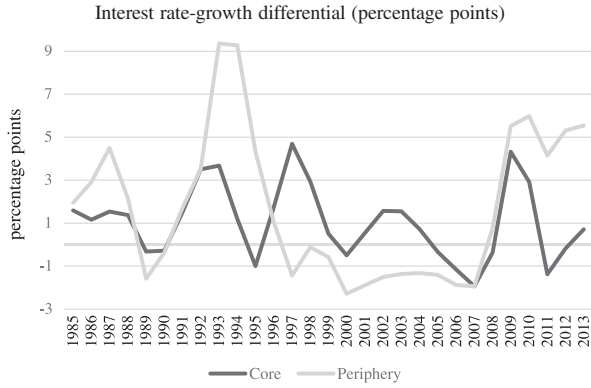
Described yield convergence in the peripheral countries resulted in a negative IRGD, which is the difference between the interest rate paid to service sovereign debt and the growth rate of the economy. While IRGD in the core countries became clearly negative only in 2006-2007, i.e., at the peak of the pre-crisis boom and during the early phase of subsequent flight-from-risk and flight-to-quality,[13] yields in the peripheral countries fell below the nominal GDP growth rate in 1996 and remained clearly below that rate until 2007 (see Figure 2).[14]

Negative IRGD implies that larger spending today does not require lower future spending (see, e.g., Fischer and Easterly 1990). In the case of fiscal policy, this

[13]Flight-from-risk and flight-to-quality are provided as an explanation of the negative IRGD in the core countries by, e.g., Caporale and Girardi (2013).

[14]In this group, only Italy, which was struggling with slow GDP growth, did not benefit from negative IRGD. Lack of large external imbalances was another Italian peculiarity. Due to this peculiarity, Italy is not included in peripheral countries in some studies (see, e.g., Kang and Shambaugh 2014). In the econometric analysis, we check the robustness of our results to the change in Italy's classification (i.e., shifting from peripheral to core countries).

Figure 2



Note: Interest rate growth differential is defined as the differential between the cost of debt and growth rate of nominal GDP. Effective interest rate on sovereign debt is approximated by the ratio of government interest payments to sovereign debt. The same approximation is used, e.g. by Favero and Monacelli (2005). Further information on the source and computation method are given in Table 2.

means that, in theory, permanently negative IRGD prevents the sovereign debt to GDP ratio from exploding notwithstanding the primary deficit. Even if government incurs debt to repay the whole interest on debt previously incurred, sovereign debt grows slower than the economy (cf. equation (2) in section IV).[15] There were at least two reasons why negative IRGD in the peripheral countries should be considered a windfall rather than a permanent phenomenon. First, one might expect interest rates to stay permanently below the growth rate of an economy if the economy over-saved, i.e., kept savings above capital remuneration. However, this was not the case for the peripheral economies, as their domestic saving rates remained much lower than the capital share of GDP. Second, there is plenty of empirical evidence confirming that country-specific credit and liquidity risk factors in the yields of the peripheral countries were dominated by the international factor. Therefore, the former factors were mispriced in the years preceding the global financial crisis.[16] After its outburst, when these factors started regaining their importance, the yields of the peripheral countries soared.[17]

[15]However, Ball et al. (1998) argue that attempts to roll over sovereign debt forever would fail in the case of a negative shock to output growth. Such a shock would force government to impose higher taxation on generations already burdened by slow output growth. This is what apparently happened in the peripheral countries in the aftermath of the global financial crisis.

[16]See, e.g. Afonso et al. (2012), Barrios et al. (2009), Bernoth and Erdogan (2012), De Grauwe and Ji (2012a, 2012b), Haugh et al. (2009) or Laubach (2011).

[17]See, e.g., Afonso et al. (2012), Afonso et al. (2015), Arghyrou and Kontonikas (2012), Aßmann and Boysen-Hogrefe (2012), Attinasi et al. (2010), Bernoth and Erdogan (2012), Borgy et al. (2012), De Grauwe and Ji (2012a, 2012b), De Santis (2012), Gerlach et al. (2010), Gibson et al. (2012), von Hagen et al. (2011) and Haugh et al. (2009).

Despite the arguments mentioned above, fiscal policy in the peripheral countries had been administered as if IRGD was to be permanently negative. We present a justification of this thesis in the following paragraphs.

The period prior to introducing the Euro is commonly hailed as one of successful fiscal consolidations, which even resulted in "consolidation fatigue" after the Euro area establishment (see, e.g., Briotti 2004 or Fernández-Villaverde et al. 2013). In 1996-1999, fiscal balance indeed improved considerably. However, in the peripheral countries, almost 80% of this improvement was due to a decline in interest payments,[18] and the remaining part was due to cyclical factors. This was accompanied by increases in non-interest spending (sometimes very large, e.g., Greece and Portugal), but their impact on fiscal stance was muted or even offset by tax increases. In the core countries in 1996-1999, fiscal balance improved much less than in the peripheral countries. In contrast to the fiscal balance in the peripheral countries, the improvement did not result exclusively from the decline in interest payments, nor from cyclical factors, but also from cuts in non-interest spending. Changes in the main fiscal categories in the peripheral and core countries in 1996-1999 are compared in Figure 3.

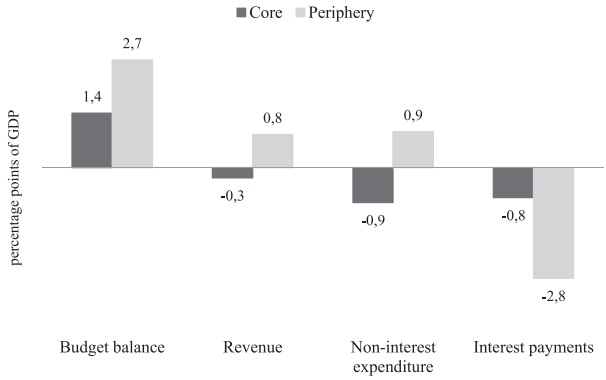
In 1999-2007, fiscal policy was expansionary in the peripheral as well as core countries. However, both groups of countries substantially differed in terms of the size and composition of fiscal expansion. In the peripheral countries, the fiscal balance worsened in spite of the decline in interest payments and booming economy. This worsening resulted from the very large increases in non-interest spending. In every peripheral country, they exceeded 2% of GDP in cyclically adjusted terms (and even 5% of GDP in Greece and Ireland). Unlike in 1996-1999, their impact on the fiscal stance was not seriously alleviated by tax increases, except in Portugal and Spain. In the core countries, the worsening of the cyclically adjusted primary balance was not large enough to outweigh the decline in interest payments and the positive effects of automatic stabilizers on the fiscal balance. Moreover, it resulted from tax reductions (sometimes very large, in particular in Austria, Germany and Luxembourg), while non-interest spending was usually cut. It is also worth noting that the worsening reflected the introduction of a countercyclical fiscal stimulus after the bursting of the dotcom bubble, which was largely withdrawn in subsequent years. That said, fiscal profligacy in the large core economies early after the Euro area establishment led to the suspension of the Stability and Growth Pact in 2003, followed by a watered-down version in 2005. Changes in the main fiscal categories in the peripheral and core countries in the period 1999-2007 are shown in Figure 4.

As the majority of the peripheral countries increased their non-interest spending in 1996-2007 by more than they gained from the decline in interest payments,

[18]This is probably why Briotti (2004), for example, finds that the more indebted the country was, the deeper was the fiscal consolidation it undertook before Euro adoption.

Figure 3

Change in main fiscal categories. EU-12 core and peripheral countries from 1996 to 1999 (percentage points of GDP)



Note: 1996 values have been subtracted from 1999. All variables are cyclically adjusted based on potential GDP. Appraisal of fiscal policy in the EU-12 core and periphery does not change when analysis is based on values cyclically adjusted with trend GDP or without any cyclical adjustment.

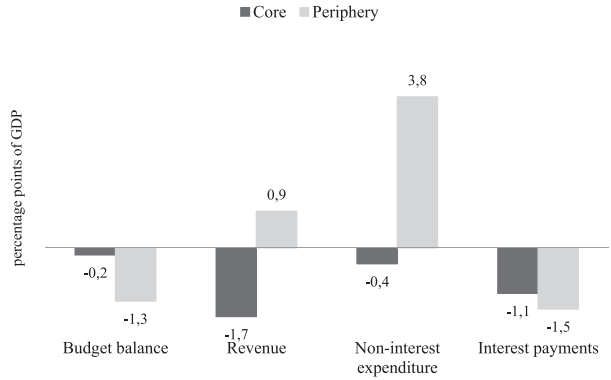
they entered the global financial crisis with a cyclically adjusted primary balance in the red. Italy was the only exception to this rule. By comparison, among the core countries, only France ran a cyclically adjusted primary balance deficit at the time.[19] Still worse, although the peripheral countries lacked fiscal space, most of them introduced large fiscal stimuli in response to the crisis. As a result, when yields diverged in 2010-2012, all the peripheral countries experienced solvency problems. They either accepted assistance from the EU bailout mechanisms, e.g., the European Financial Stability Facility (EFSF) and European Stability Mechanism (ESM) (Ireland, Greece, Portugal and Spain), or were major beneficiaries of unconventional monetary policy measures undertaken by the European Central Bank (ECB), which included bond purchase programs (Italy and Spain). These problems forced the peripheral countries to introduce large fiscal consolidations in 2010-2013. Nevertheless, their cyclically adjusted primary balance remained worse than in the core countries, although due to higher yields, they would need a better primary balance (or faster growth) than the core countries to achieve fiscal sustainability.

The July 2012 declaration by Mario Draghi, the President of the ECB, to do "whatever it takes to preserve the euro" and the announcement of Outright Monetary Transactions (OMT) in September 2012 was followed by yield re-

[19]That picture changes if cyclical adjustment of the primary balance is based on trend GDP instead of potential output. According to this alternative measure of cyclically adjusted primary balance, Austria and the Netherlands were also in the red.

Figure 4

Change in main fiscal categories. EU-12 core and peripheral countries from 1999 to 2007 (percentage points of GDP)



Note: 1999 values have been subtracted from 2007. All variables are cyclically adjusted based on potential GDP. Appraisal of fiscal policy in the EU-12 core and periphery does not change when analysis is based on values cyclically adjusted with trend GDP or without any cyclical adjustment.

convergence[20] (even though the OMT framework had not been used up to that point to make any bond purchases). The effect of this re-convergence on fiscal sustainability in the peripheral countries remains to be seen.

IV. ESTIMATION STRATEGY

The narrative analysis from the previous section suggests three hypotheses concerning differences in the effects of yield convergence on fiscal sustainability across the Euro area countries:

Hypothesis A: The peripheral countries were running unsustainable fiscal policies when they were receiving the windfall from yield convergence.
Hypothesis B: At that time, the core countries had strengthened their fiscal sustainability.
Hypothesis C: This distinction has been mirrored primarily in the differences between the core and peripheral countries in terms of non-interest expenditure changes during the windfall period.

[20]Although many observers credit these events for the falling sovereign spreads in peripheral countries (see, e.g., Corsetti et al. 2014), other researchers argue that it was rather related to the reduction in external imbalances of the countries in question (see, e.g., Gros 2013). Some other observers (in particular, Steikamp and Westermann 2014) go even further in their scepticism, as the ECB has the status of senior lender, and they find evidence that the share of senior lenders in the total sovereign debt increases sovereign bond yields.

The hypotheses are in line with the explanation of the European sovereign debt crisis by Aguiar et al. (2015) presented in the introduction to the paper. In the next section, we verify the hypotheses econometrically using heterogeneous fiscal reaction functions.

Note that it remains questionable whether testing sustainability in the hard sense is at all possible, as it would seem to require perfect knowledge of the future distribution of sovereign debt across different states of nature (Bohn 1995). Therefore, when testing sustainability with fiscal reaction functions, we define it in a weak sense, i.e., as a policy that responds to surges in sovereign debt with increases in primary balance. This approach leaves out the unfortunate case in which the government response is too weak to avoid sovereign debt accumulating to the level where there is a serious risk of default.

The literature on fiscal reaction functions has been rapidly growing in recent years. On theoretical grounds, the new impulse for its development was given, in particular, by Bohn (2007), who argued against the reliability of unit root and cointegration tests in evaluating fiscal sustainability.[21] On empirical grounds, this impulse was given by the global financial crisis, followed by serious fiscal tensions in various parts of the world, especially in the Euro area.[22]

Fiscal reaction functions are derived from the budget identity (see, in particular, the seminal paper by Bohn 1998):

$$D_t = (1 + i_t) \cdot D_{t-1} - PB_t \tag{1}$$

where D stands for the sovereign debt, i for the nominal interest rate on sovereign debt and PB for the primary balance.

After shifting to GDP ratios, the budget identity implies that a change in public debt yields the following:

$$\Delta\left(\frac{D}{Y}\right)_t = \left(\frac{r - g}{1 + g}\right)_t \cdot \left(\frac{D}{Y}\right)_{t-1} - \left(\frac{PB}{Y}\right)_t \tag{2}$$

where Y stands for GDP, r for the real interest rate on sovereign debt and g for the real growth rate of GDP.

Setting a stable debt-to-GDP ratio $\Delta\left(\frac{D}{Y}\right)_t = 0$ and defining $\alpha_t = \left(\frac{r - g}{1 + g}\right)_t$, one gets:

[21]Bohn (2007) has shown cointegration tests to be incapable of rejecting the consistency of data with the intertemporal budget constraint. If any finite number of differencing operations is sufficient to turn the debt variable stationary, then the budget identity is satisfied.

[22]See, e.g. Afonso and Balhote (2015), Baldi and Staehr (2015), Baskaran and Hessami (2013), Daniel and Shiamptanis (2013), European Commission (2011), Legrenzi and Milas (2013), Medeiros (2012), Schoder (2014), Theofilakou and Stournaras (2012) or Weichenrieder and Zimmer (2014).

$$\left(\frac{PB}{Y}\right)_t = \left(\frac{r - g}{1 + g}\right)_t \cdot \left(\frac{D}{Y}\right)_{t-1} = \alpha_t \cdot \left(\frac{D}{Y}\right)_{t-1} \tag{3}$$

Equation (3) allows the estimation of the simplest fiscal reaction function:

$$\left(\frac{\overline{PB}}{Y}\right)_t = \alpha \cdot \left(\frac{D}{Y}\right)_{t-1} + \varepsilon_t \tag{4}$$

Given that inequality $r > g$ should hold in the long run,[23] fiscal sustainability in the weak sense referred to previously requires a statistically significant and positive α.

Empirical fiscal reaction functions usually also include the output gap and government expenditure gap to control for the effects of cyclical fluctuations (see, e.g., Bohn 1998), a lag in the primary balance to allow for policy inertia (see, e.g., de Mello 2008), or a current account balance to control for the "twin deficits" effect (Mendoza and Ostry 2008 or European Commission 2011). The current account balance in our case is particularly useful, as the cost competitiveness of the peripheral countries had been deteriorating after their accession to the Eurozone. In the first step of econometric analysis, we start with the same specification as the European Commission (2011):

$$\begin{aligned} &Primary\ balance_{it} \\ &= \alpha_i + \alpha_1 \cdot Primary\ balance_{it-1} + \alpha_2 \cdot Debt_{it-1} + \alpha_3 \cdot Output\ gap_{it} + \alpha_4 \\ &\quad \cdot Cyclical\ gov.consumption_{it} + \alpha_5 \cdot Current\ account\ balance_{it} + \varepsilon_{it} \end{aligned} \tag{5}$$

where α_i is the country effect.[24] We modify the specification to take into account nonstationarity of the variables: according to the Maddala and Wu (1999) and Pesaran (2007) stationarity tests (results are presented in Table A1 in the online appendix), only *Output gap* and *Cyclical gov. consumption*

[23]At least in the long term, to which the notion of fiscal sustainability applies. Nevertheless, as already mentioned, Ball et al. (1998) provide some reservations to this claim with regard to sovereign bond yields.

[24]Unlike Bohn (1998) and like the European Commission (2011) and Mendoza and Ostry (2008), equation (5) does not include quadratic and the cubic sovereign debt to control for possible non-linearity in the responsiveness of the primary balance. Adding a squared debt variable does not yield statistically significant outcomes and does not alter our conclusions. The results are presented in Table A8 in the online appendix. It is worth noting that their inclusion in other studies gave results that are hardly robust. On the one hand, Bohn (1998) found that in the United States, larger sovereign debt led to stronger responsiveness of the primary balance. IMF (2003), using debt-threshold dummies, confirms this result for industrialized countries. Afonso (2008) finds an increasing responsiveness of the primary balance to sovereign debt in the EU-15. On the other hand, the opposite effect is found by Celasun et al. (2007) and the IMF (2003) for the developing countries and by Ghosh et al. (2013) and Medeiros (2012) for the industrialized economies and EU-15, respectively.

Table 1

Number of observations by country group and period

Group of countries	All years 1970-2013	Windfall 1996-2007	Remaining years 1970-1995 & 2008-2013
Core (Austria, Belgium, Finland, France, Germany, Luxembourg, Netherlands)	250	84	166
Periphery (Greece, Ireland, Italy, Portugal, Spain)	152	60	92
EU-12 (all of the above)	402	144	258

variables are stationary,[25] [26] The final specification of the fiscal reaction function (hereafter: Model 1) is therefore the following:

$$\begin{aligned}&\Delta Primary\ balance_{it}\\&= \alpha_i + \alpha_1 \cdot \Delta Primary\ balance_{it-1} + \alpha_2 \cdot \Delta Debt_{it-1} + \alpha_3 \cdot Output\ gap_{it} + \alpha_4 \\&\cdot Cyclical\ gov.consumption_{it} + \alpha_5 \cdot \Delta Current\ account\ balance_{it} + \varepsilon_{it}\end{aligned} \quad (6)$$

We estimate equation (6) for 9 subsamples as specified in Table 1. As indicated in the previous sections, the subsamples are created based on the scale of benefits from the sovereign bond yield convergence related to the establishment of the Euro area. Given that these definitions require some discretion, as part of the robustness analysis, we re-estimate the model under an alternative composition of both groups of countries and different splits of the analysed period (for more on the robustness analysis, see subsection 2 of section V).

To verify **Hypotheses A and B**, we compare the lagged debt estimates (α_2) between the windfall and remaining years for the peripheral and core countries. If the estimate for the peripheral countries, based on the windfall subsample, is statistically non-significant or negative, it will support **Hypothesis A**. By the

[25]We are aware that the results of both tests may be biased. The Maddala and Wu test assumes lack of cross-section dependence, which is actually the case for all analysed variables, but is most suitable for short and fixed time dimensions as in our sample (Hoang and McNown 2006). On the other hand, the Pesaran test assumes cross-section dependence but with T tending to infinity. Unfortunately, to the best of our knowledge, there is no test that addresses both of these shortcomings simultaneously.

[26]We decided to include *primary balance* in first differences for two reasons (besides the potential bias of the tests described in footnote no. 20). First, our stationarity test includes the so-called *heterogeneous alternatives*, which means that they are based on the distribution of *p*-values from tests run for the separate units (countries in our case). Hence, rejection of the null hypothesis of non-stationarity does not necessarily mean that the *Primary balance* variable is stationary for all countries. Second, and more importantly, the logic behind fiscal reaction functions (equation (4)) requires that either both deficit and debt measures are expressed in levels or in first differences. As stationarity tests of the variable *Debt* clearly indicate nonstationarity, we decided to express both measures as first differences. That said, we checked the robustness of results assuming stationarity of all variables. The outcomes presented in Table A9 in the online appendix indicate that our main findings are not altered by this change.

same token, for the core countries, a statistically significant positive α_2 for the windfall subsample higher than the remaining years subsample would support **Hypothesis B**.

In the second step, we estimate the responsiveness of the major categories of government revenue and expenditure to the changes in sovereign debt. Recall that as indicated in **Hypothesis C**, the divergence in fiscal sustainability between the peripheral and core countries was mostly driven by the different paths of government non-interest spending. We estimate separate fiscal reaction functions for (i) direct tax revenue (*Direct taxes*), (ii) indirect tax revenue (*Indirect taxes*), (iii) investment expenditure (*Investment expenditure*) and (iv) current expenditure (*Current expenditure*).[27] For each of these variables, we use the specification presented previously in (6), e.g.,

$$\begin{aligned}\Delta Direct\ taxes_{it} &= \alpha_i + \alpha_1 \cdot \Delta Direct\ taxes_{it-1} + \alpha_2 \cdot \Delta Debt_{it-1} + \alpha_3 \cdot Output\ gap_{it} + \alpha_4 \\ &\cdot Cyclical\ gov.consumption_{it} + \alpha_5 \cdot \Delta Current\ account\ balance_{it} + \varepsilon_{it}\end{aligned} \tag{7}$$

and each equation (hereafter, Models 2 – 5, respectively) has been estimated for 9 subsamples, which gives us 36 estimates of α_2. Direct comparison of α_2 values for the different subsamples and revenue or expenditure categories allows us to verify **Hypothesis C**.

Definitions of all variables used in the estimates and their data sources are presented in Table 2. Most of the data are sourced from the AMECO database. Data on the primary balance for Ireland and Spain are supplemented by IMF WEO, and the data on the sovereign bond yields are obtained from Eurostat. Descriptive statistics follow in Table 3.[28]

[27]This part of the econometric analysis follows Favero and Marcellino (2005) and Burger and Marinkov (2012). The former paper uses the fiscal reaction function framework for government revenue and expenditure, while the latter applies it to the specific categories of taxes and government expenditure.

[28]There are three main reasons why we use annual data instead of quarterly data. First, the vast majority of empirical literature on fiscal reaction functions is based on annual data (see, e.g., Ghosh et al. 2013; Medeiros 2012; Afonso and Jalles 2011; Mendoza and Ostry 2008; Celasun et al. 2007; Bohn 1998). To the best of our knowledge, there are only two papers that use quarterly data (Burger and Marinkov 2012; Baldi and Staehr 2015), while only de Mello (2008) uses monthly data; however, only one of them uses a panel data approach (Baldi and Staehr 2015). Second, Celasun et al. (2007) and Medeiros (2012) actually argued that higher frequency (monthly or quarterly) budgetary data often display a very high noise-to-signal ratio and are thus unreliable for the purpose of policy evaluation. Third, in using annual data we follow, for example, Corsetti, Meier and Müller (2012), as we share their opinion that fiscal policy response to changes in economic conditions on a quarterly basis is quite rare. Indeed, as shown by Born and Müller (2012), the hypothesis that government expenditure does not react to changes in other variables within a year cannot be rejected. Third, for the analysed period, quarterly estimates of the cyclically-adjusted primary balance (*Cycl. primary balance*) and the cyclical component of government final consumption expenditure (*Cyclical gov. consumption*) and output gap (*Output gap*) are not available for the countries in question.

Table 2

Variable definitions

Variable	Label	Unit	Definition	Source
Primary balance	Primary balance	% GDP	Primary balance of general government. Note that data is sourced from AMECO, however gaps for Ireland (1980-1984) and Spain (1980-1994) are completed with WEO data.	EC AMECO, IMF WEO
Debt	Debt	% GDP	Consolidated gross debt of general government.	EC AMECO
Output gap	Output gap	% GDP	Gap between actual GDP and potential GDP.	EC AMECO
Cyclical component of government final consumption expenditure	Cyclical gov. consumption	% GDP	Cyclical component of final consumption expenditure of general government, constructed by detrending the final government consumption expenditure as a share of GDP with the Hodrick-Prescott filter (smoothing parameter set at 100).	Authors' calculations based on EC AMECO
Current account balance	Current account balance	% GDP	Current account balance.	EC AMECO
Cyclically adjusted primary balance (trend GDP)	Cycl.primary balance (pot. GDP)	% GDP	Cyclically adjusted primary balance based on potential GDP.	EC AMECO
Cyclically adjusted primary balance (potential GDP)	Cycl.primary balance (trend GDP)	% GDP	Cyclically adjusted primary balance based on trend GDP.	EC AMECO
Indirect taxes	Indirect taxes	% GDP	Taxes linked to imports and production.	EC AMECO
Direct taxes	Direct taxes	% GDP	Current taxes on income and wealth.	EC AMECO
Investment expenditure	Investment expenditure	% GDP	Gross fixed capital formation of general government.	EC AMECO
Current expenditure	Current expenditure	% GDP	Total expenditure of general government excluding interest and gross fixed capital formation.	Authors' calculations based on EC AMECO
Cyclically adjusted primary balance		% GDP	Cyclically adjusted primary balance of general government based on potential GDP.	EC AMECO

(Continues)

Table 2. (Continued)

Variable	Label	Unit	Definition	Source
Cyclically adjusted revenue		% GDP	Cyclically adjusted revenue of general government based on potential GDP.	EC AMECO
Cyclically adjusted non-interest expenditure		% GDP	Cyclically adjusted non-interest expenditure of general government based on potential GDP.	EC AMECO
Cyclically adjusted interest payments		% GDP	Cyclically adjusted interest payments of general government based on potential GDP.	Authors' calculations based on EC AMECO
Interest-rate-growth differential		Percentage points	Differential between the cost of debt (computed by dividing interest payments in ECU/EUR by consolidated gross debt of general government in ECU/EUR) and growth rate of nominal GDP.	Authors' calculations based on EC AMECO
Bond spreads against Germany		Percentage points	Long-term government bond spreads against Germany based on EMU convergence criterion bond yields. German bond yields have been subtracted from values for every single country and then averaged. Yearly values have been aggregated from monthly data.	Authors' calculations based on Eurostat

Table 3

Descriptive statistics

		All years 1970-2013					Windfall 1996-2007					Remaining years 1970-1995 & 2008-2013				
Label	Unit	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max
Primary balance	% GDP	433	0.55	3.19	-11.6	9.81	144	2.25	2.50	-3.97	9.81	289	-0.29	3.16	-11.64	8.33
Debt	% GDP	513	56.51	33.76	4.05	175.05	144	63.65	29.43	6.07	127.15	369	53.73	34.95	4.05	175.05
Output gap	% potential GDP	515	-0.01	2.51	-12.58	8.13	144	0.87	1.70	-3.57	5.61	371	-0.35	2.69	-12.58	8.13
Cyclical gov. consumption	% GDP	528	-0.00	0.63	-2.27	2.52	144	-0.16	0.52	-1.50	1.51	384	0.06	0.66	-2.27	2.52
Current account balance	% GDP	528	0.27	5.77	-17.96	25.09	144	0.61	6.15	-17.63	13.22	384	0.14	5.63	-17.	25.09
Cycl.primary balance (pot. GDP)	% GDP	414	0.67	3.16	-25.41	9.05	270	0.04	3.33	-25.41	9.05	144	1.86	2.42	-3.68	8.79
Cycl.primary balance (trend GDP)	% GDP	414	0.57	3.40	-25.12	8.61	270	-0.14	3.54	-25.12	8.43	144	1.91	2.66	-6.69	8.61
Indirect taxes	% GDP	414	12.61	1.78	7.68	15.94	144	13.01	1.42	9.91	15.89	270	12.40	1.91	7.68	15.94
Direct taxes	% GDP	414	12.40	3.17	4.53	21.09	144	12.69	3.01	6.40	21.09	270	12.24	3.25	4.53	18.83
Investment expenditure	% GDP	414	3.05	0.91	1.00	5.46	144	2.88	0.95	1.07	5.26	270	3.13	0.88	1.00	5.46
Current expenditure	% GDP	414	40.64	6.28	24.37	58.93	144	39.45	5.75	25.68	53.15	270	41.28	6.46	24.37	58.93

We estimate the above equations using a set of panel data estimators. We begin with fixed effects (FE) and random effects (RE) estimators, which assume homogeneous coefficients of the explanatory variables but allow for a different constant term for the particular countries. Results based on the mentioned estimators may be biased due to several methodological problems. The first is a possible cross-section dependence (or spatial correlation) of error terms. In the analysed model, this is equivalent to the assumption that there are unobserved time-varying omitted variables common for all the countries, which impact individual states. Actually, the results of the Pesaran's test for cross-section dependence indicate that this is a characteristic of the data set used (but not necessarily of the particular subsamples). If these unobservable common factors are uncorrelated with the independent variables, the coefficient estimates based on FE and RE regressions are consistent, but standard error estimates are biased. Therefore, we use the Driscoll and Kraay (1998) nonparametric covariance matrix estimator (DK), which corrects for the error structure spatial dependence. This estimator also addresses the second problem, namely, standard error bias due to potential heteroscedasticity and autocorrelation of the error terms. The third problem results from the fact that the estimated equations are dynamic, so standard panel data estimators such as fixed effects (FE) and random effects (RE) are biased. One approach to addressing this problem is to apply an instrumental variable estimator, such as the one proposed by Arellano and Bond (1991) and Arellano and Bover (1995). These estimators are asymptotically consistent, but their properties are unsatisfactory in the case of short samples. As Kiviet (1995) notes, it is possible to correct the bias of the standard estimators without affecting their efficiency. In this article, we apply a corrected least square dummy variable estimator (LSDVC) proposed by Bun and Kiviet (2003) and modified for the analysis of the unbalanced panels by Bruno (2005).

Taking into account all of the above restrictions, we use four types of panel data estimators: fixed effects (FE), random effects (RE), Driscoll-Kraay (DK) and the corrected least square dummy variable estimator (LSDVC). That said, we are fully aware that our results should be viewed with caution – at the very least due to the estimation problems typical of panel datasets with such short time dimensions as in some of our subsamples.

V. ESTIMATION RESULTS

V.1. Results

We start the econometric analysis with verification of **Hypotheses A and B** put forward in section IV on the basis of the theoretical model by Aguiar et al. (2015). To this end, we estimate Model 1 for each of nine subsamples defined

in Table 1 using four different estimators. Table 4 provides results for the whole EU-12 sample with estimators and time periods grouped in the particular columns. These models cover the largest data panel with up to 402 observations; however, they also conceal any heterogeneity within the EU-12. Lagged public debt coefficients for all periods and estimators are positive and statistically significant, indicating that governments area-wide reduce fiscal deficits when faced with increases in debt levels. In the FE, DK and LSDVC estimators, reactions actually appear stronger during the windfall period than the remaining years. As the core country group dominates the EU-12 sample, this may be attributed to fiscal consolidations during the pre-accession period, which were indicated by the descriptive investigation in section III (Table 4).

Tables 5 and 6 show estimates for the core and peripheral country groups, respectively. Results yield primary support for **Hypotheses A and B**:

1. Estimates of $\Delta Debt_{t-1}$ are positive and statistically significant in all cases except for the windfall period in the peripheral country group, where statistical significance is lost for the FE, RE and LSDVC estimators.[29] It thus appears that fiscal policy in the peripheral countries ceases to react to the changes in sovereign debt during the windfall years in accordance with **Hypothesis A**
2. As further indicated by the coefficients of the $\Delta Debt_{t-1}$ variable, the fiscal positions of the core member states react much more strongly to the levels of debt in the windfall period than the remaining years, with respective coefficients amounting to 0.260-0.438 for the former and 0.132-0.138 for the latter period (depending on the estimator used). The results support **Hypothesis B**, which indicates that during the windfall period, the core countries, as opposed to the peripheral ones, have strengthened their fiscal sustainability.

The result, which demands further elaboration, is the stronger reaction of the fiscal balance to sovereign debt in the peripheral than the core countries during remaining years (estimates of 0.172-0.178 compared to 0.132-0.138). We see two plausible and non-exclusive explanations for such results. First, the European sovereign debt crisis is part of the remaining years period. This may be unfortunate, but we cannot afford to leave it out, considering the limited size of our sample. The peripheral member states, due to their dire fiscal positions, were required to conduct stronger fiscal consolidations during this period than the core

[29]5% significance of the estimate obtained using the DK estimator for the windfall period in the peripheral countries is rather spurious: the results of Pesaran's test shown in the table indicate cross-section **independence** in this particular subsample. Utilizing the DK estimator in this case may yield biased estimates, as the idea of the estimator is to correct standard errors for the presence of cross-section **dependence**.

Table 4

Estimation results. Fiscal reaction function, EU-12, dependent variable: primary balance

	FE			RE			DK			LSDVC		
	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years
ΔPrimary	-0.163**	-0.251***	-0.125	-0.161**	-0.239***	-0.111	-0.163**	-0.251	-0.125*	-0.139***	-0.186**	-0.088
balance$_{t-1}$	(0.069)	(0.059)	(0.074)	(0.070)	(0.065)	(0.079)	(0.060)	(0.151)	(0.058)	(0.042)	(0.085)	(0.062)
ΔDebt$_{t-1}$	0.143***	0.216*	0.157***	0.138***	0.157**	0.158***	0.143***	0.216***	0.157***	0.143***	0.213***	0.158***
	(0.027)	(0.105)	(0.041)	(0.024)	(0.069)	(0.038)	(0.024)	(0.057)	(0.024)	(0.029)	(0.050)	(0.051)
Output gap$_t$	0.072	-0.070	0.113*	0.080	-0.155**	0.131**	0.072	-0.070	0.113*	0.070*	-0.074	0.111
	(0.060)	(0.084)	(0.062)	(0.059)	(0.060)	(0.059)	(0.059)	(0.118)	(0.056)	(0.041)	(0.101)	(0.109)
Cyclical gov.	-1.604***	-1.408***	-1.651***	-1.576***	-1.537***	-1.599***	-1.604***	-1.408***	-1.651***	-1.590***	-1.398***	-1.627***
consumption$_t$	(0.159)	(0.345)	(0.158)	(0.162)	(0.350)	(0.162)	(0.406)	(0.279)	(0.488)	(0.157)	(0.264)	(0.248)
ΔCurrent	-0.018	-0.050	0.004	-0.008	0.001	0.014	-0.018	-0.050	0.004	-0.017	-0.051	0.004
account	(0.070)	(0.074)	(0.092)	(0.066)	(0.060)	(0.094)	(0.059)	(0.111)	(0.064)	(0.058)	(0.094)	(0.073)
balance$_t$												
constant	-0.225***	0.234***	-0.365***	-0.216***	0.244**	-0.361***	-0.225	0.234	-0.365			
	(0.032)	(0.051)	(0.096)	(0.064)	(0.110)	(0.137)	(0.194)	(0.374)	(0.219)			
N	402	144	258	402	144	258	402	144	258	402	132	258
Within R^2	0.2807	0.2239	0.3394	0.2805	0.2127	0.3390	0.2807	0.2239	0.3394			
Pesaran's test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						

Notes: The dependent variable is primary balance and the estimated model is given by $\Delta\text{Primary balance}_{it} = \alpha_i + \alpha_1 \cdot \Delta\text{Primary balance}_{it-1} + \alpha_2 \cdot \Delta\text{Debt}_{it-1} + \alpha_3 \cdot \text{Output gap}_{it} + \alpha_4 \cdot \text{Cyclical gov. consumption}_{it} + \alpha_5 \cdot \Delta\text{Current account balance}_{it} + \varepsilon_{it}$. The first row of the table lists the estimators used in the subsequent regressions, while the second row indicates time dimension of the sample. We use four types of panel data estimators: fixed effects (FE), random effects (RE), Driscoll–Kraay with corrected standard errors (DK) and a bias-corrected least squares dummy variables (LSDVC). Above regressions have been performed without time fixed effects, however their addition does not alter our conclusions. Results are available upon request. Specific years for time periods are given in Table 1. For Pesaran's (2004) cross-section dependence test results shown are p-values. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 5

Estimation results. Fiscal reaction function, EU-12 core, dependent variable: primary balance

	FE			RE			DK			LSDVC		
	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years
ΔPrimary balance$_{t-1}$	-0.217**	-0.216**	-0.178**	-0.214***	-0.244***	-0.161**	-0.217**	-0.216	-0.178*	-0.195***	-0.157	-0.147*
	(0.078)	(0.062)	(0.071)	(0.079)	(0.076)	(0.076)	(0.087)	(0.138)	(0.085)	(0.052)	(0.101)	(0.086)
ΔDebt$_{t-1}$	0.121***	0.438**	0.132**	0.120***	0.260***	0.138***	0.121**	0.438***	0.132**	0.121***	0.428***	0.135***
	(0.032)	(0.136)	(0.049)	(0.031)	(0.092)	(0.049)	(0.037)	(0.112)	(0.041)	(0.036)	(0.097)	(0.050)
Output gap$_t$	-0.025	0.023	-0.024	-0.013	-0.103	0.014	-0.025	0.023	-0.024	-0.027	0.022	-0.026
	(0.052)	(0.105)	(0.081)	(0.057)	(0.106)	(0.074)	(0.067)	(0.111)	(0.069)	(0.068)	(0.149)	(0.078)
Cyclical gov. consumption$_t$	-1.922***	-1.652***	-2.038***	-1.890***	-1.750***	-1.968***	-1.922***	-1.652***	-2.038***	-1.908***	-1.620***	-2.022***
	(0.149)	(0.394)	(0.215)	(0.144)	(0.440)	(0.198)	(0.301)	(0.421)	(0.376)	(0.256)	(0.557)	(0.312)
ΔCurrent account balance$_t$	0.058	-0.083	0.106	0.061	-0.052	0.113	0.058	-0.083	0.106	0.061	-0.085	0.109
	(0.057)	(0.126)	(0.099)	(0.059)	(0.116)	(0.098)	(0.086)	(0.119)	(0.104)	(0.077)	(0.131)	(0.119)
constant	-0.181***	0.472***	-0.396***	-0.180***	0.408***	-0.397***	-0.181	0.472	-0.396*			
	(0.037)	(0.058)	(0.101)	(0.064)	(0.123)	(0.152)	(0.209)	(0.461)	(0.169)			
N	250	84	166	250	84	166	250	84	166	250	77	166
Within R^2	0.2775	0.2842	0.3555	0.2774	0.2592	0.3546	0.2775	0.2842	0.3555			
Pesaran's test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						

Notes: The dependent variable is primary balance and the estimated model is given by $\Delta\text{Primary balance}_{it} = \alpha_i + \alpha_1 \cdot \Delta\text{Primary balance}_{it-1} + \alpha_2 \cdot \Delta\text{Debt}_{it-1} + \alpha_3 \cdot \text{Output gap}_{it} + \alpha_4 \cdot \text{Cyclical gov. consumption}_{it} + \alpha_5 \cdot \Delta\text{Current account balance}_{it} + \varepsilon_{it}$. The first row of the table lists the estimators used in the subsequent regressions, while the second row indicates time dimension of the sample. We use four types of panel data estimators: fixed effects (FE), random effects (RE), Driscoll–Kraay with corrected standard errors (DK) and a bias-corrected least squares dummy variables (LSDVC). Specific years for time periods are given in Table 1. For Pesaran's (2004) cross-section dependence test results shown are p-values. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 6

Estimation results. Fiscal reaction function, EU-12 periphery, dependent variable: primary balance

	FE			RE			DK			LSDVC		
	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years
ΔPrimary balance$_{t-1}$	-0.089	-0.273***	-0.076	-0.084	-0.220***	-0.064	-0.089	-0.273	-0.076	-0.054	-0.184*	-0.016
	(0.132)	(0.059)	(0.165)	(0.134)	(0.053)	(0.172)	(0.084)	(0.150)	(0.105)	(0.090)	(0.096)	(0.160)
ΔDebt$_{t-1}$	0.164**	0.106	0.177**	0.155***	0.083	0.172***	0.164***	0.106**	0.177***	0.163***	0.106	0.178**
	(0.042)	(0.088)	(0.060)	(0.040)	(0.075)	(0.058)	(0.025)	(0.037)	(0.030)	(0.035)	(0.066)	(0.069)
Output gap$_t$	0.100	-0.195	0.146	0.106	-0.208	0.161**	0.100	-0.195	0.146*	0.098	-0.194	0.141
	(0.082)	(0.165)	(0.086)	(0.083)	(0.155)	(0.081)	(0.065)	(0.106)	(0.062)	(0.065)	(0.149)	(0.154)
Cyclical gov. consumption$_t$	-1.404***	-1.299**	-1.513***	-1.375***	-1.359***	-1.452***	-1.404**	-1.299**	-1.513**	-1.382***	-1.280***	-1.471**
	(0.194)	(0.309)	(0.319)	(0.200)	(0.369)	(0.308)	(0.465)	(0.293)	(0.504)	(0.219)	(0.391)	(0.575)
ΔCurrent account balance$_t$	-0.099	-0.089	-0.102	-0.076	-0.053	-0.095	-0.099	-0.089	-0.102	-0.099	-0.082	-0.106
	(0.137)	(0.158)	(0.166)	(0.128)	(0.127)	(0.161)	(0.119)	(0.157)	(0.130)	(0.105)	(0.102)	(0.168)
constant	-0.289***	0.019	-0.242	-0.272*	0.023	-0.214	-0.289	0.019	-0.242			
	(0.061)	(0.101)	(0.169)	(0.148)	(0.226)	(0.266)	(0.244)	(0.249)	(0.364)			
N	152	60	92	152	60	92	152	60	92	152	55	92
Within R^2	0.3120	0.2466	0.3569	0.3115	0.2389	0.3563	0.3120	0.2466	0.3569			
Pesaran's test	0.0000	0.6304	0.0000	0.0000	0.5360	0.0000						

Notes: The dependent variable is primary balance and the estimated model is given by $\Delta\text{Primary balance}_{it} = \alpha_i + \alpha_1 \cdot \Delta\text{Primary balance}_{it-1} + \alpha_2 \cdot \Delta\text{Debt}_{it-1} + \alpha_3 \cdot \text{Output gap}_{it} + \alpha_4 \cdot \text{Cyclical gov. consumption}_{it} + \alpha_5 \cdot \Delta\text{Current account balance}_{it} + \varepsilon_{it}$. The first row of the table lists the estimators used in the subsequent regressions, while the second row indicates time dimension of the sample. We use four types of panel data estimators: fixed effects (FE), random effects (RE), Driscoll–Kraay with corrected standard errors (DK) and a bias-corrected least squares dummy variables (LSDVC). Specific years for time periods are given in Table 1. For Pesaran's (2004) cross-section dependence test results shown are p-values. Standard errors are given in parentheses.Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 7

Estimation results. Coefficients of $\Delta Debt_{t-1}$ from revenue and expenditure reaction functions, EU-12 core, EU-12 periphery and EU-12, dependent variable: direct taxes (panel A), indirect taxes (panel B), investment expenditure (panel C), current expenditure (panel D)

		FE			RE			DK			LSDVC		
Dependent variable	Group of countries	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years
A.Direct taxes	EU-12	0.024***	0.004	0.029***	0.027***	0.016	0.031***	0.024***	0.004	0.029***	0.024***	0.005	0.029
		(0.006)	(0.032)	(0.009)	(0.007)	(0.024)	(0.008)	(0.007)	(0.010)	(0.009)	(0.007)	(0.023)	(0.018)
	Core	0.021	0.039	0.023	0.023	0.041	0.023	0.021	0.039*	0.023	0.021	0.038	0.024
		(0.013)	(0.028)	(0.028)	(0.014)	(0.027)	(0.024)	(0.014)	(0.019)	(0.019)	(0.016)	(0.046)	(0.025)
	Periphery	0.023**	-0.012	0.030**	0.026***	0.003	0.031***	0.023**	-0.012	0.030**	0.022*	-0.011	0.028
		(0.007)	(0.051)	(0.008)	(0.007)	(0.044)	(0.009)	(0.008)	(0.015)	(0.010)	(0.013)	(0.036)	(0.028)
B.Indirect taxes	EU-12	0.007	0.025*	0.013	0.009	0.015*	0.013	0.007	0.025	0.013*	0.006	0.024	0.013
		(0.007)	(0.013)	(0.009)	(0.007)	(0.009)	(0.009)	(0.004)	(0.014)	(0.006)	(0.005)	(0.016)	(0.011)
	Core	-0.013**	-0.008	-0.009	-0.013***	-0.011	-0.011	-0.013	-0.008	-0.009	-0.013	-0.008	-0.010
		(0.004)	(0.016)	(0.009)	(0.005)	(0.008)	(0.009)	(0.008)	(0.012)	(0.013)	(0.008)	(0.022)	(0.013)
	Periphery	0.020*	0.038*	0.023	0.022***	0.031**	0.023*	0.020*	0.038*	0.023	0.020**	0.037	0.022
		(0.009)	(0.017)	(0.014)	(0.008)	(0.015)	(0.014)	(0.009)	(0.015)	(0.011)	(0.010)	(0.031)	(0.019)
C.Investment expenditure	EU-12	-0.025***	-0.010	-0.026***	-0.024***	-0.017	-0.025***	-0.025***	-0.010*	-0.026***	-0.025***	-0.010	-0.026***
		(0.006)	(0.010)	(0.005)	(0.006)	(0.011)	(0.006)	(0.003)	(0.005)	(0.004)	(0.003)	(0.010)	(0.006)
	Core	-0.018***	-0.002	-0.022**	-0.017***	-0.006	-0.022***	-0.018**	-0.002	-0.022**	-0.018***	-0.002	-0.022***
		(0.003)	(0.008)	(0.006)	(0.003)	(0.007)	(0.006)	(0.006)	(0.016)	(0.006)	(0.006)	(0.019)	(0.007)
	Periphery	-0.026**	-0.010	-0.028***	-0.024***	-0.019	-0.027***	-0.026***	-0.010	-0.028***	-0.025***	-0.009	-0.028**
		(0.007)	(0.016)	(0.006)	(0.007)	(0.014)	(0.006)	(0.005)	(0.014)	(0.006)	(0.006)	(0.017)	(0.013)

(Continues)

Table 7. (Continued)

Dependent variable	Group of countries	FE			RE			DK			LSDVC		
		All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years	All years	Windfall	Remaining years
D.Current expenditure	EU-12	-0.097***	-0.115	-0.120***	-0.087***	-0.070	-0.122***	-0.097*	-0.115*	-0.120*	-0.096***	-0.115***	-0.122**
		(0.021)	(0.076)	(0.035)	(0.018)	(0.053)	(0.027)	(0.051)	(0.057)	(0.056)	(0.019)	(0.039)	(0.052)
	Core	-0.099**	-0.321**	-0.145**	-0.100**	-0.205***	-0.161***	-0.099**	-0.321**	-0.145***	-0.099***	-0.315***	-0.148***
		(0.038)	(0.103)	(0.053)	(0.039)	(0.069)	(0.047)	(0.027)	(0.112)	(0.038)	(0.035)	(0.079)	(0.046)
	Periphery	-0.115***	-0.023	-0.123**	-0.104***	0.020	-0.122***	-0.115	-0.023	-0.123	-0.114***	-0.024	-0.124
		(0.023)	(0.050)	(0.039)	(0.020)	(0.037)	(0.035)	(0.068)	(0.041)	(0.070)	(0.041)	(0.052)	(0.119)

Notes: In panel A the estimated model is given by $\Delta\text{Direct taxes}_{it} = \alpha_i + \alpha_1 \cdot \Delta\text{Direct taxes}_{it-1} + \alpha_2 \cdot \Delta\text{Debt}_{it-1} + \alpha_3 \cdot \text{Output gap}_{it} + \alpha_4 \cdot \text{Cyclical gov. consumption}_{it} + \alpha_5 \cdot \Delta\text{Current account balance}_{it} + \varepsilon_{it}$, in panel B the estimated model is given by $\Delta\text{Indirect taxes}_{it} = \alpha_i + \alpha_1 \cdot \Delta\text{Indirect taxes}_{it-1} + \alpha_2 \cdot \Delta\text{Debt}_{it-1} + \alpha_3 \cdot \text{Output gap}_{it} + \alpha_4 \cdot \text{Cyclical gov. consumption}_{it} + \alpha_5 \cdot \Delta\text{Current account balance}_{it} + \varepsilon_{it}$, in panel C the estimated model is given by $\Delta\text{Investment expenditure}_{it} = \alpha_i + \alpha_1 \cdot \Delta\text{Investment expenditure}_{it-1} + \alpha_2 \cdot \Delta\text{Debt}_{it-1} + \alpha_3 \cdot \text{Output gap}_{it} + \alpha_4 \cdot \text{Cyclical gov. consumption}_{it} + \alpha_5 \cdot \Delta\text{Current account balance}_{it} + \varepsilon_{it}$, in panel D the estimated model is given by $\Delta\text{Current expenditure}_{it} = \alpha_i + \alpha_1 \cdot \Delta\text{Current expenditure}_{it-1} + \alpha_2 \cdot \Delta\text{Debt}_{it-1} + \alpha_3 \cdot \text{Output gap}_{it} + \alpha_4 \cdot \text{Cyclical gov. consumption}_{it} + \alpha_5 \cdot \Delta\text{Current account balance}_{it} + \varepsilon_{it}$. The first row of the table lists the estimators used in the subsequent regressions, while the second row indicates time dimension of the sample. We use four types of panel data estimators: fixed effects (FE), random effects (RE), Driscoll–Kraay with corrected standard errors (DK) and a bias-corrected least squares dummy variables (LSDVC). Specific years for time periods are given in Table 1. Standard errors are given in parentheses.Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

countries.[30] Second, Afonso (2008) found stronger responsiveness of fiscal policy at higher debt levels in the EU-15 data during the 1970-2003 period. Mean consolidated gross debt in our sample is greater for the peripheral than core country group in every single year, perhaps explaining the differences responsiveness during the remaining years.[31]

In the next step, we estimate Model 2 – Model 5, i.e., the fiscal reaction functions for tax and spending categories, which make it possible to verify **Hypothesis C**. The results are presented in Table 7 in panels A-D, respectively.[32]

First, in panel A (Model 2), we estimate a reaction function for direct taxes. The results indicate that direct taxes were an adjustment instrument only during the remaining years in the peripheral countries, which responded with tax increases to higher debt levels. In the remaining subsamples, the estimates are not significant.

Second, in panel B (Model 3), the reaction function is based on indirect taxes. In general, it appears that the peripheral countries were increasing indirect taxes in response to rising debt in both periods, with stronger and more statistically significant estimates for the windfall years. In the core member states, rising debt coincided with the opposite response of the indirect taxes; however, the estimates are statistically significant only for the whole sample.

Third, in panel C (Model 4), an expenditure reaction function with investment expenditure is estimated. It follows from the results that both core and periphery groups used investment spending as an adjustment mechanism to the changing debt levels during the remaining years. The adjustment has been significantly stronger for the periphery than for the core group (estimates of -0.28 and -0.22, respectively). Both groups of countries did not use investment expenditure to adjust to debt levels during the windfall years.

Fourth, in panel D (Model 5), a current expenditure reaction function is estimated. In this case, the results signal that current expenditure had been an adjustment mechanism in the remaining years for both core and peripheral member states, with stronger and more statistically significant results for the core group. However, during the windfall timespan, the results indicate even more substantial changes in the reaction to debt fluctuations than during the remaining years in the core group and a lack of statistically significant relationships for the peripheral countries.

[30]To ascertain the impact of the European sovereign debt crisis, we re-estimated the model based on the pre- (1970-1995) and post-windfall (2008-2013) years. Indeed, while the reaction of fiscal balance to sovereign debt has been much stronger in the peripheral countries than in the core group in the post-windfall period (0.299 compared to 0.145), it has been weaker in the pre-windfall period (0.140 compared to 0.161). Our results are robust to such change and are presented in Table A10 in the online appendix.

[31]Note that regressions have been performed without time fixed effects; however, their addition does not alter our conclusions. The results are presented in Table A11 in the online appendix.

[32]For the sake of brevity, we restrict presentation of the results to lagged debt estimates only. Remaining estimates are available upon request.

Recoupling the results gives strong support to **Hypothesis C**:

1. During the remaining years, the peripheral countries reacted to rising levels of debt with cuts in both current and investment expenditure. However, in the windfall years, the fiscal stances of the peripheral member states ceased to react to growing debt with expenditure cuts and increases in direct taxes but instead moved to increase indirect taxes. As tax-based fiscal consolidations are typically less likely to reduce debt-to-GDP ratios (Alesina and Ardagna 2013), our results give further credence to **Hypothesis A**.
2. The core member states in the remaining years responded to deteriorations in fiscal position with current spending cuts and much smaller decreases in investment expenditure. In the windfall period, the core countries moved to strengthen their fiscal stances with much stronger current expenditure consolidations than during the remaining period. This finding lends further support to **Hypothesis B**.

V.2. Robustness analysis

In this subsection, we examine whether the results are robust to various changes in the modelling approach. All regressions presented in this subsection are carried out with the fixed effects estimator, as previously there were no major differences between the various estimation methods.[33]

In part I and II of the analysis, we check if the results are sensitive to the way in which cyclical factors are controlled for in the model. To this end, in Model 1, the primary balance is exchanged for the cyclically adjusted primary balance as the dependent variable and lagged explanatory variable, while the output gap is removed from explanatory variables. In part I, we utilize the cyclically adjusted primary balance based on trend GDP[34] and show results in Table A2 in the online appendix. As in our primary results, the $\Delta Debt_{t-1}$ coefficient is positive and statistically significant across all timespans and country groups, except for the windfall period in the peripheral member states, where it lacks statistical significance. The strength of responsiveness is similar to previous results. Subsequently, in part II, we utilize the cyclically adjusted primary balance based on potential GDP[35] instead of trend GDP. The results are presented in Table A3 in the online appendix. As previously, the $\Delta Debt_{t-1}$ coefficient is positive and significant, except the periphery sample during the windfall period.

In part III, we check whether our results are robust to excluding any single country from our sample. Debt coefficients with their standard errors and significance levels from this procedure are summarized in Table A4 in the online appendix.

[33]Results for the other estimators are available on demand, and they do not change our conclusions.

[34]Trend GDP is calculated using the Hodrick-Prescott filter (European Commission 2000; European Commission 2014)

[35]Potential GDP is calculated based on a TFP-adjusted Cobb-Douglas production function approach (Denis et al. 2002; European Commission 2014).

On the one hand, when Belgium or Finland are excluded from the core sample, the statistical significance of the primary balance response to growing sovereign debt during the remaining years period is lost for the core countries. However, the response during the whole period and windfall years remains significant, and as in other cases, it is particularly strong during windfall years for this group of countries. Note that a strong response during the windfall years and a lack of statistical significance of the response during the remaining years is fully consistent with **Hypothesis B**. On the other hand, the exclusion of Greece from the periphery sample alters the results in terms of both the response strength and statistical significance during the all years and remaining years periods in the periphery. This result suggests that the weakening of the response in the periphery during the windfall years may be driven by Greece. Note, however, that irrespective of peripheral country, excluding the response during the windfall years in the periphery is insignificant. Hence, the results are still supportive of **Hypothesis A**.

Subsequently, in part IV, we alter the composition of the core and periphery groups. The aim is to investigate the results when the periphery group is defined as the countries with negative IRGD during the windfall period. This results in moving Italy from the periphery to the core country group. The outcome is presented in Table A5 in the online appendix and does not alter our previous conclusions.

Next, in part V, we change the composition of the remaining years and windfall timespans. The windfall period is now defined as the pre-crisis Euro area membership years.[36] Estimates are presented in Table A6 in the online appendix and remain similarto previous estimates; however, the lagged debt coefficient loses statistical significance during the remaining years period in the core countries. It is difficult to account for this; nevertheless, the result of a statistically insignificant response during the windfall period in the periphery remains valid (**Hypothesis A**) along with high fiscal policy responsiveness in the core countries during the windfall years (**Hypothesis B**).

Finally, in part VI, we abandon the division of the sample into core and periphery groups as well as windfall and remaining years periods. Instead, we divide all observations based on the values of the IRGD, as windfall is associated with negative IRGD values, while remaining years is associated with positive IRGD values. Estimates are presented in Table A7 in the online appendix and do not change our conclusions.

In conclusion, the results are robust not only to the choice of different estimators (as shown in the previous subsection) but also to changes in the dependent variable (parts I and II), exclusions of countries from the sample (part III), changes in the country group definitions (part IV), alternative period definitions (part V) and a fully impartial sample division based on the values of the IRGD

[36]2001-2007 for Greece and 1999-2007 for all other countries.

(part VI). Relatively small deviations are present in the robustness analysis; however, they are to be expected due to the small size of our sample.

VI. DISCUSSION AND CONCLUSIONS

We estimate various fiscal reaction functions for the 12 Euro area member states during the 1970-2013 period.

First, we test two hypotheses that are implied by the explanation of the European sovereign debt crisis provided by the theoretical model by Aguiar et al. (2015). We find that the peripheral countries, in which sovereign bond yields fell deeply in the years 1996-2007, were running unsustainable fiscal policies. In contrast, in the core countries, which did not benefit from the yield convergence related to the establishment of the Euro area, fiscal sustainability was strengthened during 1996-2007. These findings are robust to various changes in the modelling approach. They suggest that windfall gains are perilous for the developing countries and that they are likely to cause severe fiscal tensions even in advanced economies (cf. Fernández-Villaverde et al. 2013).

Our findings support these studies, which argue that at least some peripheral countries were running unsustainable fiscal policy prior to the European sovereign debt crisis (see Baskaran and Hessami 2013; Schoder 2014 or Theofilakou and Stournaras 2012). The findings are also consistent with the evidence indicating increased sensitivity of the fiscal stance in the Euro area to changes in sovereign bond yields (see Theofilakou and Stournaras 2012). They imply that this increased sensitivity could simply be a reflection of fiscal profligacy in peripheral countries induced by a large windfall of lower interest payments. Lastly, they are in line with structural breaks in sovereign debt dynamics detected for most Euro area countries around or shortly after the outburst of the global financial crisis (see Cuestas et al. (2014), i.e., after domestic factors regained their weight in sovereign bond yields.

However, many previous studies fail to establish evidence that would be at least partially similar to our findings (see, e.g., Baldi and Staehr 2015; Daniel and Shiamptanis 2013; Greiner et al. 2007; Legrenzi and Milas 2013). We believe that this difference stems from the fact that, unlike us, they do focus on Euro area establishment rather than on the windfall gained by the peripheral countries from sovereign bond yield convergence. We are reassured in this belief by our robustness analysis as well as by studies on fiscal reaction functions for Japan, which since the 1990s has been gaining a windfall from the low interest burden due to unconventional monetary policy measures. These studies reach similar conclusions to ours (see, e.g., Doi et al. 2011; Ito et al. 2011; Mauro et al. 2013; or Sakuragawa and Hosono 2011).

Second, the estimated fiscal reaction functions provide a new type of evidence that the composition of fiscal innovation matters for fiscal sustainability. We find that unsustainable fiscal policy in the peripheral countries during 1996-2007 resulted from the lack of sufficient adjustment in government current expenditure and direct taxes. In contrast, the strengthened fiscal sustainability in the core countries was mainly related to pronounced adjustments of the government current expenditure. This is in accordance with a large body of literature on the impact of fiscal adjustment composition on fiscal sustainability (see, e.g., Afonso et al. 2006; Afonso and Jalles 2012; Alesina and Ardagna 2013; Alesina and Ardagna 2010 or Alesina and Ardagna 1998; Alesina and Perotti 1997; Alesina et al. 1998; Baldacci et al. 2010; von Hagen et al. 2002; von Hagen and Strauch 2001; Heylen et al. 2013; McDermott and Westcott 1996; Purfield 2003; or Tsibouris et al. 2006). However, our findings are the opposite of those of Schaltegger and Weder (2015). This difference cannot stem from the avoidance of discretion in defining fiscal sustainability in their study because we do avoid such a discretion as well. The difference is most likely due to the different countries studied. We analyse advanced economies, while those authors study developing countries, where taxes and government expenditure are significantly lower.

We find our contributions both timely and relevant to policy. Given governments' inherent temptation not to save windfalls from lowered interest burdens, any actions that suppress the significance of country-specific credit risk in sovereign bond prices sow the seeds of a future crisis. Such claims add weight to the risks argued by De Grauwe and Ji (2012a, 2012b), who view the euro area as susceptible to a similar risk to the one faced by countries forced to issue debt in a foreign currency. Suppressing country-specific risk widens the ranges of deficit and debt levels, within which the market does not act as a deterrent against unsustainable fiscal policy. The longer the market reactions are muted, the more seriously the market may overreact in the future (cf. Manganelli and Wolswijk 2009). Our findings also contribute to the ongoing debate on "austerity".[37] Namely, they suggest that the peripheral countries largely exhausted fiscal space during the pre-crisis period and have had no choice but to struggle to restore it thereafter. To make public finances sustainable, these countries should have adjusted mainly current government spending rather than relying on tax increases or cuts in investment outlays.

That said, we are fully aware that our results should be viewed with caution – at the very least due to the estimation problems typical for panel datasets with a short time dimension.

37. It is surveyed, e.g., by Balcerowicz et al. (2013).

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SUMMARY

We estimate various panel fiscal reaction functions, including those of the main categories of general government revenue and expenditure for 12 Euro area member states over the 1970-2013 period. We find that in the peripheral countries where sovereign bond yields decreased sharply in the years 1996-2007, fiscal stance ceased to respond to sovereign debt accumulation. This was due to lack of sufficient adjustment in government current expenditure and direct taxes. In contrast, in the core member states, which did not benefit from yields' convergence related to the Euro area establishment, responsiveness of fiscal stance to inherited sovereign debt increased during 1996-2007. This was achieved mainly through pronounced adjustments in government current expenditure. The findings are robust to various changes in modelling approach.

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