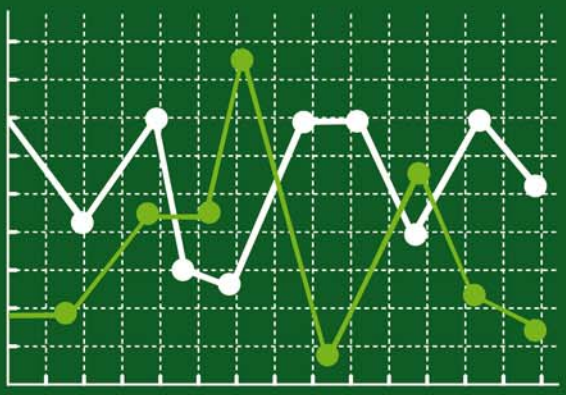
a/ working paper

WP 2015/01 (January)
Membership in the Euro Area and fiscal sustainability
Analysis through panel fiscal reaction functions

Piotr Ciżkowicz – Warsaw School of Economics
Andrzej Rzońca – Warsaw School of Economics and Polish Monetary Policy Council
Rafał Trzeciakowski – Warsaw School of Economics



asimmetrie | **a.p.s.** | associazione italiana per lo studio delle **asimmetrie economiche**
www.asimmetrie.org | info @ asimmetrie.org

The Italian Association for the Study of Economic Asymmetries (a/simmetrie) was established in 2013 as an independent, nonprofit think-tank based in Rome (Italy). a/simmetrie undertakes applied research and policy analysis on economic asymmetries, both in their economic nature, and in their political and juridical implications; provides a forum for the advocacy of policies leading to a more equitable and sustainable growth; and promotes the public debate in the field of economic policy-making, by involving researchers, politicians, and other relevant stakeholders.

The a/simmetrie working paper series publishes outputs from a/simmetrie research in progress, as well as papers presented at a/simmetrie conferences and seminars, and contributions from visiting fellows. Comments are welcome. Unless otherwise indicated, the views expressed in this publication are those of the author(s). Publication does not imply endorsement by a/simmetrie.

Italian Association for the Study of Economic Asymmetries
via Filippo Marchetti 19, I-00199 Roma, Italy
www.asimmetrie.org
info@asimmetrie.org

Membership in the Euro area and fiscal sustainability. Analysis through panel fiscal reaction functions.

Piotr Ciżkowicz
Warsaw School of Economics
pcizko@sgh.waw.pl

Andrzej Rzońca
Warsaw School of Economics
and Monetary Policy Council in the National Bank of Poland
arzonc@sgh.waw.pl

Rafał Trzeciakowski
Warsaw School of Economics
rafal.trzeciakowski@doktorant.sgh.waw.pl

Abstract

We estimate various panel fiscal reaction functions, including those of 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 non-investment 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 sovereign debt increased during 1996-2007. It was achieved mainly through pronounced adjustments in government non-investment expenditure. Our findings are in accordance with predictions of theoretical model by Aguiar et al. (2014) and are robust to various changes in modelling approach.

JEL classification: C23, E62, F34, H63

Keywords: fiscal reaction function, sovereign bond yields' convergence, fiscal adjustment composition

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

According to the first narrative, the debt crisis was closely linked to the global financial crisis which pushed peripheral member states into particularly deep recession resulting in 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 rather stable (see, e.g. Bronner et al., 2014).

The second narrative links the sovereign debt crisis to unsustainable fiscal policy which peripheral member states were running after joining the Euro area. According to this narrative, these countries could anticipate a bailout by the remaining 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., 2014) points to the following mechanism. The prospects of joining the Euro area allowed peripheral countries to benefit from higher credibility of remaining member states. This opportunity weakened incentive of their governments to spend less in order to borrow cheaply, while leaving their impatience unchanged.[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, fiscal policy run by peripheral countries turned out to be unsustainable.

Empirical literature on pre-crisis fiscal sustainability in the Euro area has been growing fast in recent years. Nevertheless, it does not provide evidence unambiguous enough to confirm one explanation and reject others. For example, Baldi and Staehr

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

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

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

(2013) do not find different fiscal reaction functions, for the pre-crisis period, in countries which eventually experienced serious sovereign debt problems, compared to the ones less affected. In contrast, Baskaran and Hessami (2013) find some evidence that introduction of the Euro and, in particular, suspension of the Stability and Growth Pact in late 2003 encouraged borrowing in countries which had traditionally run large fiscal deficits. In turn, Weichenrieder and Zimmer (2013) find that Euro area membership has weakened responsiveness of fiscal policy to the level of sovereign debt compared to the period prior to the euro adoption. However, they view their results as not robust enough to draw firm conclusions. Thus, further research is needed. We provide empirical evidence in favour of the third narrative, which provides at least three testable hypotheses. Firstly, perspective of joining and then membership in the Euro area subdued the importance of domestic factors in sovereign bond yields of peripheral countries. These factors regained their importance only after the fears of Euro area disintegration had spread. Secondly, peripheral countries run unsustainable fiscal policies before the global financial crisis. Their policies ceased to be sustainable not after adopting the Euro, but when their governments started gaining the windfall of low interest burden. Thirdly, during the period, when peripheral countries were gaining the windfall of low interest burden, the remaining countries strengthened their fiscal sustainability.

There is ample evidence supporting the first hypothesis[4], therefore, we focus on the remaining two. Our approach to study fiscal sustainability builds on the framework of fiscal reaction function proposed by Bohn (1998) and developed by many others, in particular De Mello (2005) and Mendoza and Ostry (2008). We use it in a form which controls for the possibility of spurious correlation, much like, *inter alia*, Afonso (2008), Afonso and Jalles (2011) or Medeiros (2012) have done. Following Favero and Marcellino (2005) and, in particular, Burger and Marinkov (2012), we apply the function not only to fiscal stance indicators, but also to major categories of government revenue and expenditure.

[4] See, e.g. Afonso et al., 2012; Afonso et al., 2013; Arghyrou and Kontonikas, 2011; Aßmann and Boysen-Hogrefe, 2012; Attinasi et al., 2009; Bernoth and Erdogan, 2012; Borgy et al., 2012; De Grauwe and Ji, 2012a and 2012b; De Santis, 2012; Gibson et al., 2012; Gerlach et al., 2010; Hagen et al., 2011; or Haugh et al., 2009)

We estimate fiscal reaction functions on a sample of 12 early member states of the Euro Area in the period of 1970-2013. We divide the sample into two groups based on the scale of benefits from sovereign bond yields' convergence related to establishment of the Euro area[5]. The benefits also form the split of the analysed period into two sub-periods: the baseline time (covering the years of 1970-1995 and 2008-2013) and the time of the windfall for the peripheral member states (covering the years 1996-2007).

Our main findings are as follows. Firstly, 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 non-investment expenditure and direct taxes. In contrast, in the member states which did not benefit from yields' convergence related to the Euro area establishment, responsiveness of fiscal stance to sovereign debt increased during 1996-2007. It was achieved mainly through pronounced adjustments of government non-investment expenditure. The findings are robust to changes in estimation method, composition of the sample, definition of the windfall and the measure of fiscal stance.

The paper makes three main contributions to the literature.

Firstly, while studying fiscal sustainability in the Euro area, the paper focuses on effects of the windfall gains from sovereign bond yields' convergence in the peripheral countries. To the best of our knowledge, none of the previous studies on fiscal reaction functions in the Euro area pay as much attention as this paper does to the role of windfall.

Secondly, due to such a focus, the paper contributes to relatively underdeveloped literature on the effects of windfall gains in advanced economies. Although the literature on windfall gains is broad and diverse, it is centred on developing countries. It has been focusing on natural resources (see, e.g. Mehlum et al., 2006), foreign aid (see, e.g. Svensson, 2000) or foreign borrowing (see, e.g. Vamvakidis, 2007). These sources of windfall are of no importance for vast majority of advanced economies. Exceptions include e.g. resource abundant countries (like Norway), which

[5] Other reasons for such a division are specified in the section 1.

have made good use of such kind of windfall (see, e.g. Gylafson, 2011). Obviously, the paper is not the first one to deal with the effects of windfall on peripheral countries of the Euro area. It follows, e.g. Fernández-Villaverde et al. (2013), however only in very general terms. These authors, on the one hand, associate the windfall with the global financial bubble, rather than with sovereign bond yields' convergence related to the Euro area establishment. On the other hand, they study general reform process in peripheral economies rather than fiscal policy.

Thirdly, the paper studies links between fiscal adjustment composition and fiscal sustainability through the lens of fiscal reaction functions[6]. The main advantage of this approach is being able to avoid discretion in defining the notion of fiscal sustainability. The paper extends analyses by Favero and Marcellino (2005) and Burger and Marinkov (2012). The former studies reactions of total revenue and expenditure only, whereas the latter analyses South Africa rather than of the Euro area.

The remainder of the paper is organized in five sections and an appendix. Section 1 provides a bird's eye view of the windfall in the peripheral economies resulting from the sovereign bond yields' convergence related to establishment of the Euro area and how it was used. Section 2 presents our estimation strategy. Section 3 provides estimation results of various fiscal reaction functions. Section 4 verifies the results' robustness. Section 5 discusses policy implications. Section 6 concludes. The appendix including figures and tables follows.

1. A BIRD'S EYE VIEW OF THE EFFECTS OF WINDFALL FROM THE SOVEREIGN BOND YIELDS' 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, spread

[6] Research on these links has intensified following the sovereign debt crisis in the Euro area (see, e.g. Afonso and Jalles, 2012; Alesina and Ardagna, 2013 or Heylen et al., 2013). However, most papers generally approached the issue from different angles than the one which fiscal reaction functions allow for.

against 10 year German bunds was ranging from 4 to 6 percentage points in Italy, Portugal and Spain. In Greece it was even exceeding 16 percentage points.

We label these 4 countries as peripheral. Ireland, with the 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 at al., 2014, Lane, 2012 or Shambaugh, 2012)[7] [8].

The spreads in peripheral countries started to narrow after December 1995, when details on euro adoption were agreed upon. During the subsequent 3 years, spreads dropped to about 20 basis points, except for Greece, where the yields' convergence took 2 years longer. Therefore, financial markets treated the peripheral countries like most economically stable core countries. The changes in spreads are examined in the Figure 1.

*** Insert Figure 1 here ***

Yields' convergence contributed to a deep decline of interest payments on sovereign debt in 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 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 yields' convergence were magnified in peripheral countries by larger sovereign debt levels compared to core countries. Although in 1996 the country with the largest net debt was Belgium, the next five most indebted EU states belonged to peripheral countries.

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

Described yields' convergence in peripheral countries resulted in negative interest rate growth differential (IRGD). While IRGD in the core countries became

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

[8] In the econometric analysis developed in Section 4 we check robustness of the results to the to the exclusion of Ireland from peripheral economies.

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[9], yields in peripheral countries fell below nominal GDP growth rate in 1996 and remained clearly below that rate until 2007 (see Figure 2)[10].

*** Insert Figure 2 here ***

Negative IRGD is inconsistent with dynamic efficiency of an economy as it implies that larger spending today does not require lower future spending (see, e.g. Fischer and Easterly, 1990). In case of fiscal policy, this means that, in theory, permanently negative IRGD prevents sovereign debt to GDP ratio from exploding notwithstanding primary deficit[11]. There where at least two reasons why negative IRGD in peripheral countries should be considered a windfall rather than permanent phenomena. Firstly, domestic saving rates in these countries have always been much lower than the capital share in GDP, indicating that they have been far from dynamic inefficiency. Secondly, there is plenty of empirical evidence confirming that country-specific credit and liquidity risk factors in yields of peripheral countries were dominated by the international factor. Therefore, the former factors were mispriced in the years preceding the global financial crisis[12]. After its outburst, when these factors started regaining their importance, the yields of peripheral countries soared[13].

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

[9] 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 (2011).

[10] 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 robustness of our results to the change of Italy's classification (i.e. shifting from peripheral to core countries).

[11] However, Ball, Elmendorf and Mankiw (1998) argue that attempt to roll over sovereign debt forever would fail in the case of 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.

[12] 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.

[13] See, e.g. Afonso et al., 2012; Afonso et al., 2013; Arghyrou and Kontonikas, 2011; Aßmann and Boysen-Hogrefe, 2012; Attinasi et al., 2009; 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; Hagen et al., 2011; or Haugh et al., 2009.

The period prior to introducing the Euro is commonly hailed as one of successful fiscal consolidations, which even resulted in a "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 peripheral countries almost 80% of this improvement was due to decline of interest payments[14] and the remaining part due to cyclical factors. It 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 core countries in 1996-1999 fiscal balance improved much less than in peripheral countries. In contrast to the one in peripheral countries, its improvement did not result exclusively from the decline of interest payments, nor from cyclical factors but also from cuts in non-interest spending. Changes in main fiscal categories in peripheral and core countries in 1996-1999 are compared in the Figure 3.

*** Insert Figure 3 here ***

In 1999-2007 fiscal policy was expansionary in both peripheral and core countries. However, both groups of countries substantially differed in terms of the size and composition of fiscal expansion. In peripheral countries fiscal balance worsened in spite of a decline in interest payments and booming economy. This worsening resulted from very large increases in non-interest spending. In every peripheral country they exceeded 2% of GDP in cyclically adjusted terms (and in Greece and Ireland – even 5% of GDP). Unlike in 1996-1999, their impact on fiscal stance was not seriously alleviated by tax increases, except for Portugal and Spain. In core countries the worsening of cyclically adjusted primary balance was not large enough to outweigh the decline of interest payments and the positive effects of automatic stabilizers on fiscal balance. Besides, 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 countercyclical fiscal stimulus after the burst of dotcom bubble, which was largely withdrawn in the subsequent years. That said, fiscal profligacy in large core

[14] This is probably why e.g. Briotti (2004) find that the more indebted the country was, the deeper the fiscal consolidation it undertook before the euro adoption.

economies early after the Euro area establishment, led to the suspension of the Stability and Growth Pact in 2003 and its' watering-down in 2005. Changes of main fiscal categories in peripheral and core countries in 1999-2007 are shown in the Figure 4.

*** Insert Figure 4 here ***

As the majority of peripheral countries increased their non-interest spending in 1996-2007 by more than they saved on interest payments, they entered the global financial crisis with cyclically adjusted primary balance in the red. Italy was the only exception to that rule. By comparison, among core countries only France had sovereign debt on an unsustainable path at the time. Still worse, although peripheral countries lacked fiscal space, most of them introduced large fiscal stimuli in response to the outburst of the crisis. As a result, when the yields diverged in 2010-2012, all peripheral countries experienced solvency problems. They either accepted assistance from the EU bailout mechanisms: European Financial Stability Facility (EFSF) or 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 peripheral countries to introduce large fiscal consolidations in 2010-2013. Nevertheless, their cyclically adjusted primary balance has remained worse than in core countries, even though due to higher yields they would need 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 have been followed by yields' re-convergence[15] (even though the OMT framework has not been used so far to make any bond purchase). The effects of this re-convergence on fiscal sustainability in peripheral countries remains to be seen.

[15] 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 a reduction in external imbalances in countries in question (see, e.g. Gros, 2013). Some other observers (in particular, Steikamp and Westermann, 2014) go even further in their skepticism, as the ECB has a status of senior lender and they find evidence that the share of senior lenders in the total sovereign debt increases sovereign bond yields.

2. ESTIMATION STRATEGY

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

Hypothesis A: peripheral countries were running unsustainable fiscal policies, when they were receiving the windfall from yields' convergence;

Hypothesis B: at that time, the core countries have strengthened their fiscal sustainability;

Hypothesis C: these distinction has been mirrored mainly in differences between core and peripheral countries in terms of non-interest expenditure changes during the windfall period.

The hypotheses are in line with the explanation of the European sovereign debt crisis by Aguiar et al. (2014) presented in the introduction to the paper. In the next two sections we verify the hypotheses econometrically, based on heterogeneous fiscal reaction functions.

The literature on fiscal reaction functions has been fast growing in recent years. On the theoretical ground, the new impulse to its development was given, in particular, by Bohn (2007), who argued against reliability of unit root and cointegration tests in evaluating fiscal sustainability. On empirical ground, 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 (see, e.g. Baldi and Staehr, 2013; Baskaran and Hessami, 2013; EC, 2011; Medeiros, 2012; Weichenrieder and Zimmer, 2013).

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

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

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:

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

where Y stands for GDP, r - real interest rate on sovereign debt and g - 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:

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

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

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

Given that in a dynamically efficient economy, an inequality: $r > g$ should hold[16], fiscal sustainability requires a statistically significant and positive α.

Empirical fiscal reaction functions usually include also output gap and government expenditure gap to control for effects of cyclical fluctuations (see, e.g. Bohn, 1998), lag of primary balance to allow for policy inertia (see, e.g. De Mello, 2005) or current account balance to control for the ''twin deficits'' effect (Mendoza and Ostry , 2008 or EC, 2011). In the first step of econometric analysis we start with the same specification as EC (2011):

$$pbalance_{it} = \alpha_i + \alpha_1 \cdot pbalance_{it-1} + \alpha_2 \cdot debt_{it-1} + \alpha_3 \cdot ogap_{it} + \alpha_4 \cdot ggap_{it} + \alpha_5 \cdot cab_{it} + \varepsilon_{it} \quad (5)$$

where α_i is country effect, $pbalance$ is the primary balance, $debt$ is the sovereign debt, $ogap$ is the output gap, $ggap$ is the cyclical component of government final consumption expenditure, cab is the current account balance[17]. We modify the specification in order to take into account nonstationarity of the variables: according to Maddala and Wu (1999) and Pesaran (2007) stationarity tests (results are

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

[17] Unlike Bohn (1998) and like EC (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 primary balance. It is worth noting that their inclusion in other studies gave results which are hardly robust. On the one hand, Bohn (1998) found that in the United States larger sovereign debt led to stronger responsiveness of primary balance. IMF (2003), using debt-threshold dummies, confirms this result for industrialized countries. Afonso (2008) finds an increasing responsiveness of primary balance to sovereign debt in the EU-15. On the other hand, the opposite effect is found by Calasun 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.

presented in Table 1) only $ogap$ and $ggap$ vriables are stationary[18]. The final specification of fiscal reaction function (hereafter: Model 1) is therefore:

$$\Delta pbalance_{it} = \alpha_i + \alpha_1 \cdot \Delta pbalance_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t \quad (6)$$

*** Insert Table 1 here ***

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

*** Insert Table 2 here ***

In order to verify **Hypotheses A and B,** we compare lagged debt estimates (α_2) between windfall and baseline period for peripheral and core countries. If the estimate for peripheral countries, based on windfall subsample, is statistically non-significant or significantly lower than the same parameter for baseline subsample, it will support **Hypothesis A**. By the same token for core countries, statistically significant positive α_2 for windfall subsample higher than baseline subsample would support **Hypothesis B**.

In the second step we estimate responsiveness of major categories of government revenue and expenditure to changes in sovereign debt. Recall that as indicated in **Hypothesis C** the divergence in fiscal sustainability between peripheral and core countries was mostly driven by different paths of government non-interest spending. We estimate separate fiscal reaction functions for (i) direct tax revenue (*dirtax*), (ii) indirect tax revenue (*indtax*), (iii) investment expenditure (*invexp*) and

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

(iv) non-investment expenditure (*consexp*)[19]. For each of the variables we use specification presented in (6) e.g.

$$\Delta dirtax_{it} = \alpha_i + \alpha_1 \cdot \Delta dirtax_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t \quad (7)$$

and each equation (hereafter: Model 2 - 5, respectively) has been estimated for 9 subsamples, which gives us 36 estimates of α_2. Direct comparison of $\alpha_2$values for 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 3. The majority of data are sourced from the AMECO database. Data on primary balance for Ireland and Spain is obtained from the IMF WEO and the data on sovereign bond yields – from the Eurostat. Descriptive statistics follow in Table 4.

*** Insert Table 3 here ***

*** Insert Table 4 here ***

We estimate the above equations using a set of panel data estimators. We begin with fixed effects (FE) and random effects (RE) estimators, which assumes homogeneous coefficients of the explanatory variables but allow for a different constant term for particular countries. The results, based on the estimators mentioned, may be biased due to several methodological problems. The first one is a possible cross-section dependence (or spatial correlation) of error terms. In the analyzed model, this is equivalent to the assumption that there are unobserved time-varying omitted variables common for all 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 particular subsamples). If these unobservable common factors are uncorrelated with the independent variables, the coefficient estimates based on FE and RE regression are

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

consistent, but standard errors 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 errors bias due to potential heteroskedasticity 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 that proposed by Arellano and Bond (1991) or 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 (2002) 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 corrected least square dummy variable estimator (LSDVC). That said, we are fully aware that our results ought to be viewed with caution – at the very least due to estimation problems typical for panel datasets with as short time dimension as in some of our subsamples.

3. ESTIMATION RESULTS

We start the econometric analysis with verification of **Hypotheses A and B** put forward in section two, on the basis of the theoretical model by Aguiar et al. (2014). To this aim we estimate Model 1 for each of nine subsamples defined in Table 2 using four different estimators. Table 5 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 FE, DK and LSDVC estimators, reaction appears actually stronger during the windfall period than the baseline. As the core country group dominates the EU-12 sample, this may be attributed to its' fiscal consolidations during the pre-accession period, which were indicated by descriptive investigation in section 2.

*** Insert Table 5 here ***

Tables 6 and Tables 7 show estimates for core and peripheral country groups respectively. Results yield the primary support for **Hypotheses A and B**:

(i) 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 it loses statistical significance for the FE, RE and LSDVC estimators[20]. It thus appears, that fiscal policy in peripheral countries ceases to react to changes in sovereign debt during the windfall years in accordance with **Hypothesis A**.

(ii) As further indicated by the coefficients of the $\Delta debt_{t-1}$ variable, fiscal positions of the core member states react much more strongly to the levels of debt in the windfall period than the baseline, with respective coefficients, amounted 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 windfall period core countries, as opposed to peripheral ones, have strengthened their fiscal sustainability.

The result, which demands further elaboration, is the stronger reaction of fiscal balance to sovereign debt in peripheral than core countries during the baseline period (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 baseline 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 countries. Second, Afonso (2008)

[20] 5% significance of the estimate obtained using DK estimator for windfall period in peripheral countries is rather spurious: the results of Pesaran's and Frees' tests 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 ideas of the estimator is to correct standard errors for the presence of cross-section **dependence**.

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 periphery than core country group in every single year, perhaps explaining the different responsiveness during the baseline period.

*** Insert Table 6 here ***

*** Insert Table 7 here ***

In the next step we estimate Model 2 – Model 5, i.e. fiscal reaction functions for tax and spending categories, which allow to verify **Hypothesis C**. Results are presented in Table 8 in panels A-D respectively.[21]

*** Insert Table 8 here ***

First, in panel A (Model 2), we estimate a reaction function for direct taxes. Results indicate that direct taxes were an adjustment instrument only during the baseline period 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 peripheral countries have been increasing the 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 opposite response in 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 results that both, core and periphery groups, used investment spending as an adjustment mechanism to changing debt levels during the baseline timespan. The adjustment has been significantly stronger for the periphery than core group (estimates of -0.28 and -0.22 respectively). Both groups of countries did not use investment expenditure to adjust to debt level during windfall years.

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

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

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

(i) During the baseline period, peripheral countries reacted to rising levels of debt with cuts in both non-investment 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 rise the 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**.

(ii) The core member states in the baseline years responded to deteriorations in fiscal position with non-investment 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 non-investment expenditure consolidations than during the baseline period. This finding lends also further support for **Hypothesis B**.

4. ROBUSTNESS ANALYSIS

In this section we examine if the results are robust to various changes in modelling approach. All regressions presented in this section are carried out with fixed effects estimator, as previously there were no major differences between the various estimation methods[22].

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 primary balance is

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

exchanged for the cyclically adjusted primary balance as the dependent variable and lagged explanatory variable, while output gap is removed from explanatory variables. In part I, we utilize the cyclically adjusted primary balance based on trend GDP[23] and show results in Table 9. 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[24] instead of trend GDP. Results are presented in Table 10. As previously, the $\Delta debt_{t-1}$ coefficient is positive and significant, except the periphery sample during the windfall period.

*** Insert Table 9 here ***

*** Insert Table10 here ***

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 11. Results for other estimators are available on demand and they do not change our conclusions. When Belgium or Finland are excluded from the core sample, statistical significance of fiscal responses during the baseline period is lost for the core countries. However, the strength of the response remains similar and increased during the windfall years and whole sample in the core country group. On the other hand, exclusion of Greece from the periphery sample alters results in terms of both response strength and statistical significance during all years and baseline periods in the periphery. There is not much change in the all years EU-12 sample.

*** Insert Table 11 here ***

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 interest rate-growth differentials during the windfall period. This results in moving Italy from the periphery to core country group. The outcome is presented in Table 12 and does not alter our previous conclusions.

[23] Trend GDP is calculated using the Hodrick-Prescott filter (DG ECFIN, 2014; DG ECFIN, 2000).
[24] Potential GDP is calculated based on a TFP adjusted Cobb-Douglas production function approach (DG ECFIN, 2014; Denis et al., 2002).

*** Insert Table 12 here ***

Finally, in part V we change the composition of baseline and windfall timespans. The windfall period is now defined as pre-crisis Euro area membership years[25]. Estimates are presented in Table 13 and remain similar as previously, however the lagged debt coefficient loses statistical significance during the baseline period in 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 core countries during the windfall years (**Hypothesis B**).

*** Insert Table 13 here ***

In conclusion, the results are robust not only to the choice of different estimators (as shown in the previous section), but also to the changes of the dependent variable (parts I and II), exclusions of countries from the sample (part III), changes in country groups definitions (part IV) and alternative time periods definitions (part V). Relatively small deviations are present in the robustness analysis, however they are to be expected due to the small size of our sample.

5. DISCUSSION AND POLICY IMPLICATIONS

As mentioned in the introduction to the paper, studies analyzing fiscal sustainability in the Euro area through the lens of fiscal reaction functions are hardly conclusive (cf. Baldi and Staehr, 2013; Baskaran and Hessami, 2013; EC, 2011; Medeiros, 2012; Weichenrieder and Zimmer, 2013). Our results are in line with these studies, which find different reaction functions, for the pre-crisis period, in the peripheral countries, compared to the core ones. We find the evidence that many similar studies fail to establish (see, e.g. Baldi and Staehr, 2013 or Weichenrieder and Zimmer, 2013), possibly because we put stress on windfall gained by the peripheral countries from the yields' convergence, while these studies usually focus either on establishment of the Euro area or on Euro adoption by peripheral countries. It is worth noting that studies on fiscal reaction functions for Japan, which since 1990's has been gaining a windfall of low interest burden due to unconventional monetary policy measures,

[25] 2001-2007 for Greece and 1999-2007 for all other countries.

reach similar conclusions to ours (see, e.g. Doi, Hoshi and Okimoto, 2011; Ito, Watanabe and Yabu, 2011; Mauro et al., 2013 or Sakuragawa and Hosono, 2011).

Another main finding appears to be much less controversial. There is ample evidence that the composition of fiscal adjustments matters for fiscal sustainability (see, e.g. Afonso, Nickel and Rother, 2005; Afonso and Jalles, 2012; Alesina and Ardagna, 1998, 2010 or 2013, Alesina and Perotti, 1996; Alesina, Perotti and Tavares, 1998; Baldacci, Gupta and Mulas-Granados, 2010; von Hagen, Hughes Hallett, and Strauch, 2002; von Hagen and Strauch, 2001; Heylen et al., 2013; McDermott and Wescott, 1996; Purfield, 2003 or Tsibouris et al., 2006). Our results suggest that this evidence also holds when one avoids discretion in defining the notion of fiscal sustainability and instead refers to the budget identity.

If these findings were correct, then they would have far reaching implications for appropriate policy. They suggest that any actions which supress significance of country specific credit risk in sovereign bonds' prices, sow the seeds of a new crisis, given inherent government's temptation not to save a windfall of low interest burden. Paradoxically, the more reason there is in the claims that the Euro area members are susceptible to similar risk to the one faced by countries forced to issue debt in foreign currency (see, e.g. De Grauwe, 2012a or 2012b), the greater the threat such actions cause. They widen the ranges of deficit and debt levels, within which market does not act as a deterrent against unsustainable fiscal policy. There is little chance that a government would not fully exploit this broader opportunity to run unsustainable fiscal policy. The longer the market reactions are muted, the more seriously the market may overreact (cf. Manganelli and Wolswijk, 2009). Our findings would also contribute to the on-going debate on 'austerity'[26]. Namely, they suggest that the peripheral countries have largely exhausted fiscal space during the pre-crisis period and have had no choice but to struggle for restoring it thereafter. They suggest also that to make public finances sustainable these countries should have adjusted mainly non-investment government spending, rather than relied on tax increases or cuts in investment outlays.

[26] It is surveyed, e.g. by Balcerowicz et al. (2013).

6. CONCLUDING REMARKS

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

This allows us, firstly, to test two hypotheses which are implied by the explanation of the European sovereign debt crisis provided by the theoretical model by Aguiar et al. (2014). 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 core countries which did not benefit from yields' convergence related to the Euro area establishment, fiscal sustainability was strengthened during 1996-2007. These findings are robust to various changes in modelling approach. They suggest that windfall gains are perilous not only for developing countries but are likely to cause severe fiscal tensions even in advanced economies.

Secondly, fiscal reaction functions that we estimate provide a new type of evidence that the composition of fiscal innovations matters for fiscal sustainability. We find that unsustainable fiscal policy in the peripheral countries during 1996-2007 resulted from lack of sufficient adjustment in government non-investment expenditure and direct taxes. In contrast, the strengthened fiscal sustainability in the core countries at the time was mainly related to pronounced adjustments of government non-investment expenditure.

We find our contributions both timely and policy relevant. That said, we are fully aware that our results ought to be viewed with caution – at the very least due to estimation problems typical for panel datasets with a short time dimension.

References:

Afonso, A. (2008), "Ricardian fiscal regimes in the European Union", *Empirica* 35:313-334

Afonso, A., Arghyrou, M.G. and Kontonikas, A. (2012), „The determinants of sovereign bond yield spreads in the EMU", *Working Papers* 2012/36, Department of Economics at the School of Economics and Management (ISEG), Technical University of Lisbon.

Afonso, A. & Jalles, J.T. (2011), „Appraising fiscal reaction functions", *Working Papers* 2011/23, Department of Economics at the School of Economics and Management (ISEG), Technical University of Lisbon.

Afonso A., Jalles J. T. (2012), "Measuring the success of fiscal consolidations." *Applied Financial Economics*. 22(13): 1053-1061

Afonso A., Nickel C., Rother P. (2005) "Fiscal consolidations in the Central and Eastern European countries." *ECB Working Paper*. 473

Aguiar, M., Amador, M., Farhi, E. & Gopinath, G. (2014), "Coordination and Crisis in Monetary Unions", Working Paper 20277, NBER, July.

Alesina A., Ardagna S. (1998) "Tales of fiscal adjustment." *Economic Policy*. 13(27): 487-546

Alesina A., Ardagana S. (2010) "Large changes in fiscal policy: taxes versus spending." *Tax Policy and the Economy*. 24: 35-68

Alesina A., Ardagna S. (2013) "The Design of Fiscal Adjustments." *Tax Policy and the Economy*. 27: 19-67

Alesina A., Perotti R. (1996) "Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects." *NBER Working Paper*. 5730

Alesina A., Perotti R., Tavares J. (1998) "The Political Economy of Fiscal Adjustments." *Brookings Papers on Economic Activity*. 1(1998): 197-266.

Arellano, Manuel & Bond, Stephen, 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," Review of Economic Studies, Wiley Blackwell, vol. 58(2), pages 277-97, April.

Arellano, M. and Bover O. (1995), 'Another Look at the Instrumental Variable Estimation of Error-Components Models', Journal of Econometrics, vol. 68, pp. 29-51

Arghyrou, M.G. and Kontonikas, A. (2011), „The EMU sovereign-debt crisis: Fundamentals, expectations and contagion", *European Economy - Economic Papers* 436, Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission.

Aßmann, Ch. and Boysen-Hogrefe, J. (2012), "Determinants of government bond spreads in the euro area: in good times as in bad," *Empirica*, Springer, vol. 39(3): 341-356, August.

Attinasi, M-G. & Checherita-Westphal, C., and Nickel, Ch. (2009), „What explains the surge in euro area sovereign spreads during the financial crisis of 2007-09?", *Working Paper Series* 1131, European Central Bank.

Auerbach, A.J. (2011), „Fiscal Institutions for a Currency Union", University of California, Berkeley, May.

Balcerowicz L, Rzońca A., Kalina L, Łaszek A. (2013) *Economic Growth in the European Union*. Brussels: Lisbon Council

Baldacci E., Gupta S., Mulas-Granados C. (2010) "Restoring Debt Sustainability After Crises: Implications for the Fiscal Mix." *IMF Working Paper*. 10/232

Baldi, G. and Staehr, K. (2013), „The European Debt Crisis and Fiscal Reaction Functions in Europe 2000-2012", *Discussion Papers of DIW Berlin* 1295, DIW Berlin, German Institute for Economic Research.

Ball L., Elmendorf D. W., Mankiw N. G. (1998) "The Deficit Gamble." *Journal of Money, Credit and Banking*. 30(4): 699-720

Barrios, S., Iversen, P., Lewandowska, M., and Setzer, R. (2009), „Determinants of intra-euro area government bond spreads during the financial crisis", E*uropean Economy - Economic Papers* 388, Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission.

Baskaran, T. and Hessami, Z. (2013), „Monetary Integration, Soft Budget Constraints, and the EMU Sovereign Debt Crises", *Working Paper Series of the Department of Economics, University of Konstanz* 2013-03, Department of Economics, University of Konstanz.

Bernoth, K. and Erdogan, B. (2012), „Sovereign bond yield spreads: A time-varying coefficient approach", *Journal of International Money and Finance*, Elsevier, vol. 31(3): 639-656.

Bohn, H. (1998), „The Behavior of U.S. Public Debt and Deficits", *The Quarterly Journal of Economics*, vol 113, no. 3, pp. 949-963.

Bohn, H. (2007), „Are Stationary and Cointegration Restrictions Really Necessary for the Intertemporal Budget Constraint?", *Journal of Monetary Economics*, vol. 57(7): 1837-1847.

Borgy, V., Laubach, T., Mésonnier, J-S., and Renne, J-P. (2012), „Fiscal Sustainability, Default Risk and Euro Area Sovereign Bond Spreads Markets", *Working papers* 350, Banque de France.

Briotti, M.G. (2004), „Fiscal adjustment between 1991 and 2002 - stylised facts and policy implications", *Occasional Paper Series* 09, European Central Bank.

Bronner F., Erce A., Martin A., Ventura J. (2014) "Sovereign debt markets in turbulent times: Creditor discrimination and crowding-out effects." *Journal of Monetary Economics*. 61(2014): 114-142

Bruno, G.S.F. (2005), „Approximating the bias of the LSDV estimator for dynamic unbalanced panel data models", *Economics Letters*, vol. 87(3): 361-366.

Burger, P. and Marinkov, M. (2012), „Fiscal rules and regime-dependent fiscal reaction functions: The South African case", *OECD Journal on Budgeting*, vol. 2012/1.

Bun, M. and Kiviet, J. (2002), "On the Diminishing Returns of Higher-order Terms in Asymptotic Expansions of Bias", *Tinbergen Institute Discussion Papers 02-099/4*, Tinbergen Institute, revised 24 Oct 2002, http://ideas.repec.org/p/dgr/uvatin/20020099.html.

Caballero R. J. (2010) "Sudden Financial Arrest." *IMF Economic Review*. 58(1): 6-36

Caporale, G.M. and Girardi, A. (2011), „Fiscal Spillovers in the Euro Area", *CESifo Working Paper Series*, no. 3693.

Celasun, O., Debrun, X. & Ostry, D.J., 2007, „Primary Surplus Behavior and Risks to Fiscal Sustainability in Emerging Market Countries: A "Fan-Chart" Approach", *IMF Staff Papers*, vol 53, no. 3, pp. 401-425.

De Grauwe, P. and Ji, Y. (2012a), „Mispricing of Sovereign Risk and Multiple Equilibria in the Eurozone", *Open Access publications from Katholieke Universiteit Leuven* urn:hdl:123456789/343969, Katholieke Universiteit Leuven.

De Grauwe, P. and Ji, Y. (2012b), „Mispricing of Sovereign Risk and Macroeconomic Stability in the Eurozone", *JCMS: Journal of Common Market Studies*, 50: 866–880.

de Mello, L. (2005), „Estimating a Fiscal Reaction Function: The Case of Debt Sustainability in Brazil", OECD Economics Department Working Papers, no. 423.

De Santis, R.A. (2012), "The Euro area sovereign debt crisis: safe haven, credit rating agencies and the spread of the fever from Greece, Ireland and Portugal", *Working Paper Series* 1419, European Central Bank.

Denis, C., McMorrow K. & Roeger, W. (2002), "Production function approach to calculating potential growth and output gaps – estimates for the EU Member States and the US", *European Economy*, No. 176, DG ECFIN Economic Papers, European Commission, September.

DG ECFIN (2000), "European Economy Public finances in EMU - 2000", *European Economy*, No. 3, European Commission.

DG ECFIN (2014), "Cyclical Adjustment of Budget Balances", *DG ECFIN Economic Forecasts*, European Commission, Spring.

Doi T., Hoshi T., Okimoto T. (2011) "Japanese government debt and sustainability of fiscal policy." *Journal of the Japanese and International Economies*. 25(4): 414-433

Driscoll, J. C. and Kraay, A. (1998), „Consistent Covariance Matrix Estimation With Spatially Dependent Panel Data", The Review of Economics and Statistics, MIT Press, vol. 80(4): 549-560.

EC (2011), „Public finances in EMU - 2011", European Economy, no. 3.

Favero, C.A. and Marcellino, M. (2005), „Modelling and Forecasting Fiscal Variables for the Euro Area", Oxford Bulletin of Economics and Statistics, Department of Economics, University of Oxford, vol. 67(s1): 755-783, December.

Fernández-Villaverde J., Garicano L., Santos T. (2013) "Political Credit Cycles: the Case of the Euro Zone." *Journal of Economic Perspectives*. 27(3): 145-166

Fischer, S., Easterly, W. (1990) "The economics of the government budget constraint." *World Bank Research Observer* 5(2): 127-142

Frees, E. (2004). Longitudinal and panel data: Analysis and Applications in the Social Sciences. Cambridge: Cambridge University Press

Gerlach, S., Schulz, A., Wolff, G. (2010), „Banking and sovereign risk in the euro-area", *CEPR Discussion Paper*, No. 7833.

Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., and Qureshi, M. S. (2013), „Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies", *The Economic Journal*, 123: F4–F30.

Gibson, H.D., Hall, S.G., and Tavlas, G.S. (2012), „The Greek financial crisis: Growing imbalances and sovereign spreads", *Journal of International Money and Finance*, Elsevier, vol. 31(3): 498-516.

Gros D. (2013) "The austerity debate is beside the point for Europe." *Economic Policy, CEPS Commentaries.* May 8

Gylafson T. (2011) Natural Resource Endowment: A Mixed Blessing? *CESifo Working Paper.* 3353

Hagen von J., Hughes Hallett A., Strauch R. (2002) "Budgetary Consolidation in Europe: Quality, Economic Conditions, and Persistence." *Journal of the Japanese and International Economies*. 16(4): 512-535

Hagen von, J., Schuknecht, L., and Wolswijk, G. (2011), „Government bond risk premiums in the EU revisited: The impact of the financial crisis", *European Journal of Political Economy*, Elsevier, vol. 27(1): 36-43, March.

Hagen von J., Strauch R. (2001) "Fiscal Consolidations: Quality, Economic Conditions, and Success." *Public Choice*. 109(3-4): 327-46

Haugh, D., Ollivaud, P., and Turner, D. (2009), „What Drives Sovereign Risk Premiums?: An Analysis of Recent Evidence from the Euro Area", *OECD Economics Department Working Papers*, No. 718, OECD Publishing.

Heylen F., Hoebeeck A., Buyse T. (2013) "Government efficiency, institutions, and the effects of fiscal consolidation on public debt." *European Journal of Political Economy*. 31(C): 40-59.

Hoang, N.T. & McNown, R.F. (2006), "Panel Data Unit Roots Tests Using Various Estimation Methods", *University of Colorado Bulletin*, University of Colorado at Boulder.

Hoffland, D.L. (1977), „The "New York City Effect" in the Municipal Bond Market", *Financial Analysts Journal*, CFA Institute, vol. 33(2): 36-39.

IMF, 2003, „Public Debt in Emerging Markets", *World Economic Outlook*, pp. 113-152.

Ito A., Watanabe T., Yabu T. (2011) "Fiscal Policy Switching in Japan, the US, and the UK." *Journal of the Japanese and International Economies*. 25(4): 380-413

Kang J. S., Shambaugh J. C. (2014) "Progress Towards External Adjustment in the Euro Area Periphery and the Baltics." *IMF Working Paper*. 14/131

Kiviet, J.F. 1995, „On Bias, Inconsistency and Efficiency of Various Estimators in Dynamic Panel Data Models", *Journal of Econometrics*, vol. 68(1): 53-78.

Lane P. R. (2012) "The European Sovereign Debt Crisis." *Journal of Economic Perspectives*. 26(3): 49-68

Laubach, T. (2011), „Fiscal Policy and Interest Rates: The Role of Sovereign Default Risk", in Clarida, R.H. and Giavazzi, F. eds., *NBER International Seminar on Macroeconomics 2010*, National Bureau of Economic Research, pp. 7-29.

Maddala, G.S. & Wu, S. (1999), "A comparative study of unit root tests with panel data and a new simple test", *Oxford Bulletin of Economics and Statistics*, Vol. 61, pp. 631–652.

Manganelli, S. and Wolswijk, G. (2009), „What drives spreads in the euro area government bond market?", *Economic Policy*, CEPR & CES & MSH, vol. 24(4): 191-240.

Mauro P., Romeu R., Binder A., Zaman A. (2013) "A Modern History of Fiscal Prudence and Profligacy." *IMF Working Paper*. 13/5

McDermott J. C., Wescott R. F. (1996) "An Empirical Analysis of Fiscal Adjustments." *IMF Staff Papers*. 43(4)

Medeiros, J. (2012), „Stochastic debt simulation using VAR models and a panel fiscal reaction function – results for a selected number of countries", *European Economy - Economic Papers* 459, Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission.

Mehlum H., Moene K. O., Torvik R. (2006), "Cursed by Resources or Institutions?" *World Economy*. 29(8): 1117-1131

Mendoza, G. and Ostry, J. (2008), „International evidence on fiscal solvency: Is fiscal policy 'responsible'?", Journal of Monetary Economics, 55(6): 1081-1093.

Pesaran, M.H. (2007), "A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence", *Journal of Applied Econometrics*, Vol. 22, pp. 265-312.

Purfield C. (2003) "Fiscal Adjustment in Transition Countries: Evidence from the 1990s." *IMF Working Paper*. 03/36

Sakuragawa M., Hosono K. (2011) "Fiscal Sustainability in Japan." *Journal of Japanese and International Economies*. 25(4): 434-446

Shambaugh J. C. (2012) "The Euro's Three Crises." *Brookings Papers on Economic Activity*. 44(1): 157-231

Steikamp S., Westermann F. (2014) "The role of creditor seniority in Europe's sovereign debt crisis." *Economic Policy*. 79(July): 495-552

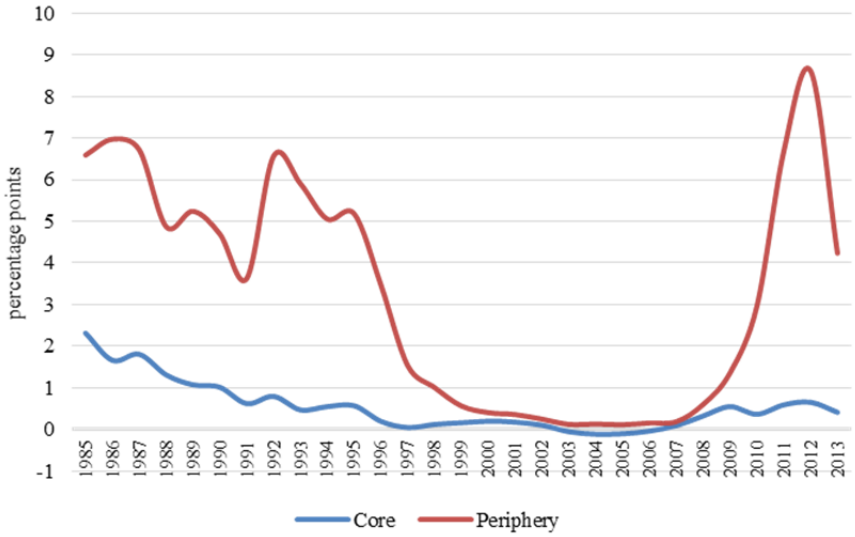
Svensson J. (2000) "Foreign Aid and Rent-Seeking." *Journal of International Economics*. 51(2): 437–461.

Tsibouris G. C., Horton M. A., Flanagan M. J. and Maliszewski W. S. (2006) "Experience with Large Fiscal Adjustments." *IMF Occasional Paper*. 246

Vamvakidis A. (2007) "External Debt and Economic Reform: Does a Pain Reliever Delay the Necessary Treatment." *IMF Working Paper*. 07/50

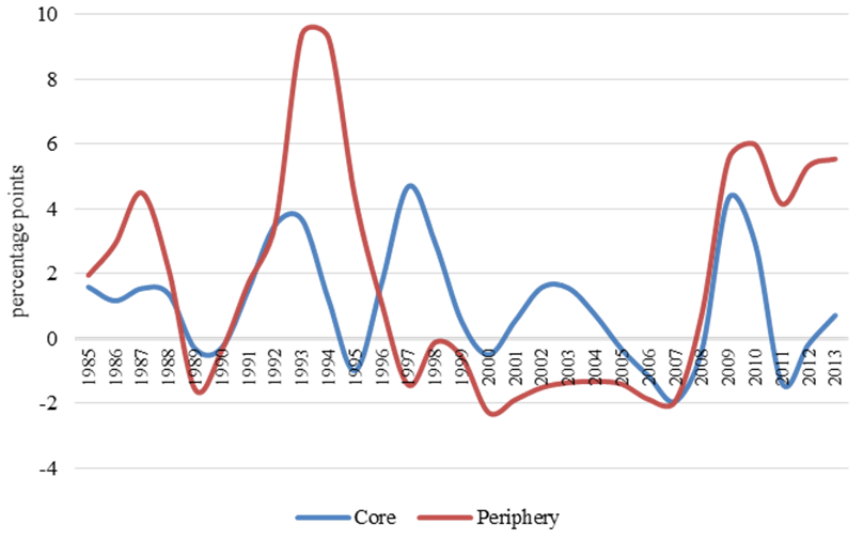
Weichenrieder, A. and Zimmer, J. (2013), „Euro Membership and Fiscal Reaction Functions", *CESifo Working Paper Series* 4255, CESifo Group Munich.

FIGURE 1. Government bond spreads against Germany (percentage points)



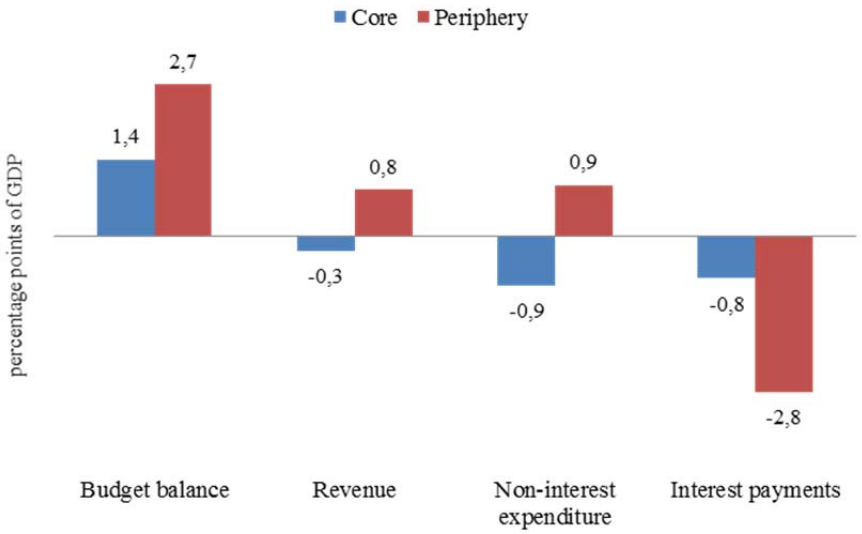
Note: German long-term government bond yields have been subtracted from values for every single country (including Germany) and then averaged. Further information on the source and computation method are given in Table 3.

FIGURE 2. Interest rate-growth differential (percentage points)



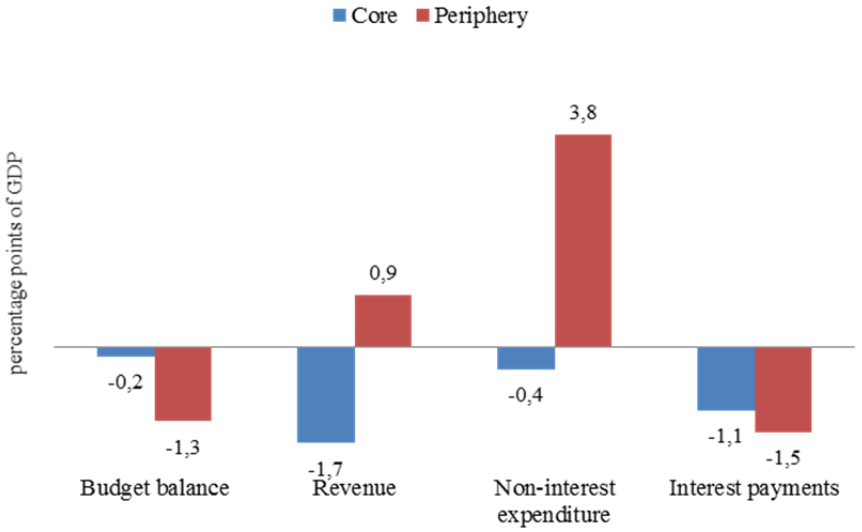
Note: Interest rate growth differential is defined as the differential between the cost of debt and growth rate of nominal GDP. Effective interest rate on sovereign debt is approximated by the ratio of government interest payments to sovereign debt. The same approximation is used, e.g. by Favero and Monacelli (2005). Further information on the source and computation method are given in Table 3.

FIGURE 3. Change in main fiscal categories. EU-12 core and peripherial 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.

FIGURE 4. Change in main fiscal categories. EU-12 core and peripherial 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.

TABLE 1. Panel unit root tests

Test	Levels/first differences	Trend	Lags	Variables: pbalance	debt	ogap	ggap	cab	dirtax	indtax	invexp	consexp	capb_p	capb_t
Maddala and Wu 1999	Levels	No	0	59.921***	59.922	59.923***	59.924***	59.925*	59.93***	59.931	59.928*	59.929*	59.926***	59.927***
	Levels	No	1	65.777***	13.37	122.474***	238.083***	40.287**	51.167***	50.148***	38.875**	37.148**	56.211***	48.528***
	Levels	No	2	44.054***	16.209	80.265***	152.563***	36.782**	41.184**	37.676**	28.354	26.586	37.199**	33.115
	Levels	No	3	37.749**	20.535	88.567***	136.497***	32.39	32.524	31.759	21.196	31.281	33.535*	34.464*
	Levels	Yes	0	41.555**	4.701	52.117***	98.104***	30.297	40.368**	29.155	26.751	30.123	51.964***	42.279**
	Levels	Yes	1	49.048***	25.6	96.433***	181.411***	40.257**	47.951***	45.909***	24.51	43.655***	43.509***	35.698*
	Levels	Yes	2	31.906	22.097	57.482***	106.593***	46.461***	44.174***	32.092	11.463	24.527	28.828	25.27
	Levels	Yes	3	27.608	29.546	65.579***	94.899***	41.744**	30.386	36.064*	10.133	26.652	24.103	23.475
	Dif.	No	0	366.968***	142.495***	366.065***	406.849***	443.984***	320.868***	326.985***	329.609***	316.286***	430.71***	413.737***
	Dif.	No	1	234.341***	96.154***	323.642***	393.783***	233.938***	182.921***	208.067***	214.295***	196.024***	235.124***	213.741***
	Dif.	No	2	149.736***	68.287***	198.492***	290.253***	145.134***	135.126***	143.485***	129.157***	127.054***	147.906***	130.172***
	Dif.	No	3	106.919***	66.546***	196.633***	219.695***	152.133***	108.106***	122.929***	89.3***	83.483***	97.506***	82.099***
	Dif.	Yes	0	306.723***	126.428***	301.847***	333.403***	377.686***	258.77***	274.634***	281.44***	262.52***	354.767***	341.076***
	Dif.	Yes	1	190.585***	72.525***	261.715***	322.512***	189.42***	133.273***	167.65***	180.794***	154.237***	179.872***	160.69***
	Dif.	Yes	2	116.551***	51.05***	148.548***	228.114***	110.224***	91.043***	109.89***	104.227***	103.558***	108.147***	92.256***
	Dif.	Yes	3	83.811***	51.692***	156.09***	162.463***	111.482***	71.532***	90.938***	72.309***	70.117***	69.912***	55.038***
Pesaran (2007)	Levels	No	0	-3.087***	3.449	-4.275***	-6.837***	-0.385	-2.496***	-1.162	-0.67	-0.581	-3.748***	-3.345***
	Levels	No	1	-2.322**	1.321	-4.342***	-7.279***	-0.501	-1.825**	-1.169	0.13	0.348	-2.334**	-2.221**
	Levels	No	2	-1.382*	0.865	-2.676***	-6.241***	-0.006	0.078	-0.202	0.917	1.502	-0.966	-0.601
	Levels	No	3	-0.645	0.44	-2.785***	-4.673***	0.303	-0.285	-0.467	1.351	1.764	-0.525	-0.311
	Levels	Yes	0	-2.102**	6.128	-3.057***	-4.883***	0.364	-2.151**	-0.501	0.232	-0.049	-3.079***	-2.704***
	Levels	Yes	1	-0.868	3.204	-3.202***	-5.364***	-0.132	-1.992**	-0.804	1.577	1.122	-0.907	-0.602
	Levels	Yes	2	0.016	3.642	-1.515*	-4.345***	-0.326	-0.583	0.744	2.459	1.659	0.681	1.279
	Levels	Yes	3	0.042	4.015	-1.895**	-2.435***	0.104	-1.171	0.749	3.041	1.358	1.01	1.515
	Dif.	No	0	-13.352***	-8.722***	-13.624***	-14.336***	-14.917***	-13.388***	-13.252***	-12.679***	-13.302***	-14.147***	-13.903***
	Dif.	No	1	-9.263***	-4.037***	-11.648***	-11.788***	-10.16***	-9.022***	-9.676***	-7.088***	-7.66***	-10.012***	-9.945***
	Dif.	No	2	-5.831***	-1.908**	-8.004***	-8.747***	-6.588***	-5.983***	-5.292***	-3.786***	-4.017***	-5.633***	-5.477***
	Dif.	No	3	-3.113***	-0.879	-8.162***	-7.659***	-4.826***	-4.801***	-3.695***	-1.355*	-1.633*	-2.914***	-2.481***
	Dif.	Yes	0	-12.672***	-8.056***	-12.788***	-13.297***	-14.119***	-12.101***	-12.123***	-11.549***	-13.166***	-13.071***	-12.906***
	Dif.	Yes	1	-8.547***	-3.704***	-10.198***	-10.251***	-8.703***	-7.245***	-8.255***	-5.719***	-6.418***	-8.344***	-8.131***
	Dif.	Yes	2	-5.021***	-1.595*	-6.431***	-6.866***	-5.012***	-4.378***	-3.661***	-2.425***	-2.891***	-4.095***	-3.753***
	Dif.	Yes	3	-2.064**	-1.111	-7.182***	-5.596***	-3.066***	-3.523***	-1.418*	0.096	-0.86	-1.496*	-1.003

Notes: The first test is Maddala and Wu (1999) panel unit root test. Results shown are chi-square statistics. The second test is a Pesaran (2007) Panel Unit Root Test (CIPS). Results are Zt-bars. Stars denote stationarity at 1% (***), 5% (**), 10% (*) levels.

TABLE 2. Number of observations by country group and period

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

TABLE 3. Variable definitions

Variable	Name in models	Unit	Definition
Primary balance	pbalance	% 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.
Debt	debt	% GDP	Consolidated gross debt of general government.
Output gap	ogap	% GDP	Gap between actual GDP and potential GDP.
Cyclical component of government final consumption expenditure	ggap	% 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).
Current account balance	cab	% GDP	Current account balance.
Cyclically adjusted primary balance (trend GDP)	capb_p	% GDP	Cyclically adjusted primary balance based on potential GDP.
Cyclically adjusted primary balance (potential GDP)	capb_t	% GDP	Cyclically adjusted primary balance based on trend GDP.
Indirect taxes	indtax	% GDP	Taxes linked to imports and production.
Direct taxes	dirtax	% GDP	Current taxes on income and wealth.
Investment expenditure	invexp	% GDP	Gross fixed capital formation of general government.
Non-investment expenditure	consexp	% GDP	Total expenditure of general government excluding interest and gross fixed capital formation.
Cyclically adjusted budget balance	NA	% GDP	Cyclically adjusted budget balance of general government based on potential GDP.
Cyclically adjusted revenue	NA	% GDP	Cyclically adjusted revenue of general government based on potential GDP.
Cyclically adjusted non-interest expenditure	NA	% GDP	Cyclically adjusted non-interest expenditure of general government based on potential GDP.
Cyclically adjusted interest payments	NA	% GDP	Cyclically adjusted interest payments of general government based on potential GDP.
Interest-rate-growth differential	NA	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.
Bond spreads against Germany	NA	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 (including Germany) and then averaged. Yearly values have been aggregated from monthly data.

TABLE 4. Descriptive statistics

			All years 1970-2013					Baseline 1970-1995 & 2008-2013					Windfall 1996-2007				
	Name in models	Unit	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max
Primary balance	pbalance	% GDP	433	0.55	3.19	-11.6	9.81	289	-0.29	3.16	-11.64	8.33	144	2.25	2.50	-3.97	9.81
Debt	debt	% GDP	513	56.51	33.76	4.05	175.05	369	53.73	34.95	4.05	175.05	144	63.65	29.43	6.07	127.15
Output gap	ogap	% potential GDP	515	-0.01	2.51	-12.58	8.13	371	-0.35	2.69	-12.58	8.13	144	0.87	1.70	-3.57	5.61
Cyclical component of government final consumption expenditure	ggap	% GDP	528	-0.00	0.63	-2.27	2.52	384	0.06	0.66	-2.27	2.52	144	-0.16	0.52	-1.50	1.51
Current account balance	cab	% GDP	528	0.27	5.77	-17.96	25.09	384	0.14	5.63	-17.	25.09	144	0.61	6.15	-17.63	13.22
Cyclically adjusted primary balance (potential GDP)	capb_p	% 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
Cyclically adjusted primary balance (trend GDP)	capb_t	% 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	indtax	% GDP	414	12.61	1.78	7.68	15.94	270	12.40	1.91	7.68	15.94	144	13.01	1.42	9.91	15.89
Direct taxes	dirtax	% GDP	414	12.40	3.17	4.53	21.09	270	12.24	3.25	4.53	18.83	144	12.69	3.01	6.40	21.09
Investment expenditure	invexp	% GDP	414	3.05	0.91	1.00	5.46	270	3.13	0.88	1.00	5.46	144	2.88	0.95	1.07	5.26
Non-investment expenditure	consexp	% GDP	414	40.64	6.28	24.37	58.93	270	41.28	6.46	24.37	58.93	144	39.45	5.75	25.68	53.15

TABLE 5. Estimation results. Fiscal reaction function, EU-12, dependent variable: primary balance

	FE			RE			DK			LSDVC		
	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007
	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall
$\Delta pbalance_{t-1}$	-0.163**	-0.125	-0.251***	-0.161**	-0.111	-0.239***	-0.163**	-0.125*	-0.251	-0.139***	-0.088	-0.186**
	(0.069)	(0.074)	(0.059)	(0.070)	(0.079)	(0.065)	(0.060)	(0.058)	(0.151)	(0.042)	(0.062)	(0.085)
$\Delta debt_{t-1}$	0.143***	0.157***	0.216*	0.138***	0.158***	0.157**	0.143***	0.157***	0.216***	0.143***	0.158***	0.213***
	(0.027)	(0.041)	(0.105)	(0.024)	(0.038)	(0.069)	(0.024)	(0.024)	(0.057)	(0.029)	(0.051)	(0.050)
$ogap_t$	0.072	0.113*	-0.070	0.080	0.131**	-0.155**	0.072	0.113*	-0.070	0.070*	0.111	-0.074
	(0.060)	(0.062)	(0.084)	(0.059)	(0.059)	(0.060)	(0.059)	(0.056)	(0.118)	(0.041)	(0.109)	(0.101)
$ggap_t$	-1.604***	-1.651***	-1.408***	-1.576***	-1.599***	-1.537***	-1.604***	-1.651***	-1.408***	-1.590***	-1.627***	-1.398***
	(0.159)	(0.158)	(0.345)	(0.162)	(0.162)	(0.350)	(0.406)	(0.488)	(0.279)	(0.157)	(0.248)	(0.264)
Δcab_t	-0.018	0.004	-0.050	-0.008	0.014	0.001	-0.018	0.004	-0.050	-0.017	0.004	-0.051
	(0.070)	(0.092)	(0.074)	(0.066)	(0.094)	(0.060)	(0.059)	(0.064)	(0.111)	(0.058)	(0.073)	(0.094)
constant	-0.225***	-0.365***	0.234***	-0.216***	-0.361***	0.244**	-0.225	-0.365	0.234	NA	NA	NA
	(0.032)	(0.096)	(0.051)	(0.064)	(0.137)	(0.110)	(0.194)	(0.219)	(0.374)			
N	402	258	144	402	258	144	402	258	144	402	258	132
Within R^2	0.2807	0.3394	0.2239	0.2805	0.3390	0.2127	0.2807	0.3394	0.2239	NA	NA	NA
Between R^2	0.0267	0.2636	0.0520	0.0308	0.2890	0.2302	NA	NA	NA	NA	NA	NA
Overall R^2	0.2755	0.3373	0.1963	0.2757	0.3378	0.2105	NA	NA	NA	NA	NA	NA
Pesaran's test (p-val)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	NA	NA	NA	NA	NA	NA
Frees' test (statistic)	1.397***	1.102***	1.194***	1.455***	1.047***	1.206***	NA	NA	NA	NA	NA	NA
Breush-Pagan's test (p-val)	NA	NA	NA	1.0000	1.0000	1.0000	NA	NA	NA	NA	NA	NA

Notes: The dependent variable is primary balance and the estimated model is given by $\Delta pbalance_t = \alpha_i + \alpha_1 \cdot \Delta pbalance_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t$. Core consists of Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands. Periphery encompasses Greece, Ireland, Italy, Portugal and Spain. EU-12 is the sum of core and periphery. Variables definitions are reported in Table 3. 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). For Breush-Pagan's and Pesaran's (2004) cross-section dependence test results shown are p-values. For Frees' (2004) cross-section dependence test results shown are Q-statistics. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

TABLE 6. Estimation results. Fiscal reaction function, EU-12 core, dependent variable: primary balance

	FE			RE			DK			LSDVC		
	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007
	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall
$\Delta pbalance_{t-1}$	-0.217**	-0.178**	-0.216**	-0.214***	-0.161**	-0.244***	-0.217**	-0.178*	-0.216	-0.195***	-0.147*	-0.157
	(0.078)	(0.071)	(0.062)	(0.079)	(0.076)	(0.076)	(0.087)	(0.085)	(0.138)	(0.052)	(0.086)	(0.101)
$\Delta debt_{t-1}$	0.121***	0.132**	0.438**	0.120***	0.138***	0.260***	0.121**	0.132**	0.438***	0.121***	0.135***	0.428***
	(0.032)	(0.049)	(0.136)	(0.031)	(0.049)	(0.092)	(0.037)	(0.041)	(0.112)	(0.036)	(0.050)	(0.097)
$ogap_t$	-0.025	-0.024	0.023	-0.013	0.014	-0.103	-0.025	-0.024	0.023	-0.027	-0.026	0.022
	(0.052)	(0.081)	(0.105)	(0.057)	(0.074)	(0.106)	(0.067)	(0.069)	(0.111)	(0.068)	(0.078)	(0.149)
$ggap_t$	-1.922***	-2.038***	-1.652***	-1.890***	-1.968***	-1.750***	-1.922***	-2.038***	-1.652***	-1.908***	-2.022***	-1.620***
	(0.149)	(0.215)	(0.394)	(0.144)	(0.198)	(0.440)	(0.301)	(0.376)	(0.421)	(0.256)	(0.312)	(0.557)
Δcab_t	0.058	0.106	-0.083	0.061	0.113	-0.052	0.058	0.106	-0.083	0.061	0.109	-0.085
	(0.057)	(0.099)	(0.126)	(0.059)	(0.098)	(0.116)	(0.086)	(0.104)	(0.119)	(0.077)	(0.119)	(0.131)
constant	-0.181***	-0.396***	0.472***	-0.180***	-0.397***	0.408***	-0.181	-0.396*	0.472	NA	NA	NA
	(0.037)	(0.101)	(0.058)	(0.064)	(0.152)	(0.123)	(0.209)	(0.169)	(0.461)			
N	250	166	84	250	166	84	250	166	84	250	166	77
Within R^2	0.2775	0.3555	0.2842	0.2774	0.3546	0.2592	0.2775	0.3555	0.2842	NA	NA	NA
Between R^2	0.2374	0.1237	0.1629	0.2046	0.1908	0.3655	NA	NA	NA	NA	NA	NA
Overall R^2	0.2743	0.3516	0.2144	0.2744	0.3526	0.2402	NA	NA	NA	NA	NA	NA
Pesaran's test (p-val)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	NA	NA	NA	NA	NA	NA
Frees' test (statistic)	1.222***	0.804***	1.162***	1.251***	0.737***	1.470***	NA	NA	NA	NA	NA	NA
Breush-Pagan's test (p-val)	NA	NA	NA	1.0000	1.0000	1.0000	NA	NA	NA	NA	NA	NA

Notes: The dependent variable is primary balance and the estimated model is given by $\Delta pbalance_t = \alpha_i + \alpha_1 \cdot \Delta pbalance_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t$. Core consists of Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands. Periphery encompasses Greece, Ireland, Italy, Portugal and Spain. EU-12 is the sum of core and periphery. Variables definitions are reported in Table 3. 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). For Breush-Pagan's and Pesaran's (2004) cross-section dependence test results shown are p-values. For Frees' (2004) cross-section dependence test results shown are Q-statistics. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

TABLE 7. Estimation results. Fiscal reaction function, EU-12 periphery, dependent variable: primary balance

	FE			RE			DK			LSDVC		
	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007
	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall
$\Delta pbalance_{t-1}$	-0.089	-0.076	-0.273***	-0.084	-0.064	-0.220***	-0.089	-0.076	-0.273	-0.054	-0.016	-0.184*
	(0.132)	(0.165)	(0.059)	(0.134)	(0.172)	(0.053)	(0.084)	(0.105)	(0.150)	(0.090)	(0.160)	(0.096)
$\Delta debt_{t-1}$	0.164**	0.177**	0.106	0.155***	0.172***	0.083	0.164***	0.177***	0.106**	0.163***	0.178**	0.106
	(0.042)	(0.060)	(0.088)	(0.040)	(0.058)	(0.075)	(0.025)	(0.030)	(0.037)	(0.035)	(0.069)	(0.066)
$ogap_t$	0.100	0.146	-0.195	0.106	0.161**	-0.208	0.100	0.146*	-0.195	0.098	0.141	-0.194
	(0.082)	(0.086)	(0.165)	(0.083)	(0.081)	(0.155)	(0.065)	(0.062)	(0.106)	(0.065)	(0.154)	(0.149)
$ggap_t$	-1.404***	-1.513***	-1.299**	-1.375***	-1.452***	-1.359***	-1.404**	-1.513**	-1.299**	-1.382***	-1.471**	-1.280***
	(0.194)	(0.319)	(0.309)	(0.200)	(0.308)	(0.369)	(0.465)	(0.504)	(0.293)	(0.219)	(0.575)	(0.391)
Δcab_t	-0.099	-0.102	-0.089	-0.076	-0.095	-0.053	-0.099	-0.102	-0.089	-0.099	-0.106	-0.082
	(0.137)	(0.166)	(0.158)	(0.128)	(0.161)	(0.127)	(0.119)	(0.130)	(0.157)	(0.105)	(0.168)	(0.102)
constant	-0.289***	-0.242	0.019	-0.272*	-0.214	0.023	-0.289	-0.242	0.019	NA	NA	NA
	(0.061)	(0.169)	(0.101)	(0.148)	(0.266)	(0.226)	(0.244)	(0.364)	(0.249)			
N	152	92	60	152	92	60	152	92	60	152	92	55
Within R^2	0.3120	0.3569	0.2466	0.3115	0.3563	0.2389	0.3120	0.3569	0.2466	NA	NA	NA
Between R^2	0.0564	0.2963	0.0364	0.0614	0.3359	0.0034	NA	NA	NA	NA	NA	NA
Overall R^2	0.3019	0.3510	0.2172	0.3023	0.3516	0.2267	NA	NA	NA	NA	NA	NA
Pesaran's test (p-val)	0.0000	0.0000	0.6304	0.0000	0.0000	0.5360	NA	NA	NA	NA	NA	NA
Frees' test (statistic)	0.224**	0.271	-0.008	0.195**	0.279	0.066	NA	NA	NA	NA	NA	NA
Breush-Pagan's test (p-val)	NA	NA	NA	1.0000	1.0000	1.0000	NA	NA	NA	NA	NA	NA

Notes: The dependent variable is primary balance and the estimated model is given by $\Delta pbalance_t = \alpha_i + \alpha_1 \cdot \Delta pbalance_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t$. Core consists of Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands. Periphery encompasses Greece, Ireland, Italy, Portugal and Spain. EU-12 is the sum of core and periphery. Variables definitions are reported in Table 3. 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). For Breush-Pagan's and Pesaran's (2004) cross-section dependence test results shown are p-values. For Frees' (2004) cross-section dependence test results shown are Q-statistics. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

TABLE 8. 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), non-investment expenditure (panel D)

		FE			RE			DK			LSDVC		
		1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007
Dependent variable	Group of countries	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall
A. Direct taxes	EU-12	0.024***	0.029***	0.004	0.027***	0.031***	0.016	0.024***	0.029***	0.004	0.024***	0.029	0.005
		(0.006)	(0.009)	(0.032)	(0.007)	(0.008)	(0.024)	(0.007)	(0.009)	(0.010)	(0.007)	(0.018)	(0.023)
	Core	0.021	0.023	0.039	0.023	0.023	0.041	0.021	0.023	0.039*	0.021	0.024	0.038
		(0.013)	(0.028)	(0.028)	(0.014)	(0.024)	(0.027)	(0.014)	(0.019)	(0.019)	(0.016)	(0.025)	(0.046)
	Periphery	0.023**	0.030**	-0.012	0.026***	0.031***	0.003	0.023**	0.030**	-0.012	0.022*	0.028	-0.011
		(0.007)	(0.008)	(0.051)	(0.007)	(0.009)	(0.044)	(0.008)	(0.010)	(0.015)	(0.013)	(0.028)	(0.036)
B.Indirect taxes	EU-12	0.007	0.013	0.025*	0.009	0.013	0.015*	0.007	0.013*	0.025	0.006	0.013	0.024
		(0.007)	(0.009)	(0.013)	(0.007)	(0.009)	(0.009)	(0.004)	(0.006)	(0.014)	(0.005)	(0.011)	(0.016)
	Core	-0.013**	-0.009	-0.008	-0.013***	-0.011	-0.011	-0.013	-0.009	-0.008	-0.013	-0.010	-0.008
		(0.004)	(0.009)	(0.016)	(0.005)	(0.009)	(0.008)	(0.008)	(0.013)	(0.012)	(0.008)	(0.013)	(0.022)
	Periphery	0.020*	0.023	0.038*	0.022***	0.023*	0.031**	0.020*	0.023	0.038*	0.020**	0.022	0.037
		(0.009)	(0.014)	(0.017)	(0.008)	(0.014)	(0.015)	(0.009)	(0.011)	(0.015)	(0.010)	(0.019)	(0.031)
C.Investment expenditure	EU-12	-0.025***	-0.026***	-0.010	-0.024***	-0.025***	-0.017	-0.025***	-0.026***	-0.010*	-0.025***	-0.026***	-0.010
		(0.006)	(0.005)	(0.010)	(0.006)	(0.006)	(0.011)	(0.003)	(0.004)	(0.005)	(0.003)	(0.006)	(0.010)
	Core	-0.018***	-0.022**	-0.002	-0.017***	-0.022***	-0.006	-0.018**	-0.022**	-0.002	-0.018***	-0.022***	-0.002
		(0.003)	(0.006)	(0.008)	(0.003)	(0.006)	(0.007)	(0.006)	(0.006)	(0.016)	(0.006)	(0.007)	(0.019)
	Periphery	-0.026**	-0.028***	-0.010	-0.024***	-0.027***	-0.019	-0.026***	-0.028***	-0.010	-0.025***	-0.028**	-0.009
		(0.007)	(0.006)	(0.016)	(0.007)	(0.006)	(0.014)	(0.005)	(0.006)	(0.014)	(0.006)	(0.013)	(0.017)
D.Non-investment expenditure	EU-12	-0.097***	-0.120***	-0.115	-0.087***	-0.122***	-0.070	-0.097*	-0.120*	-0.115*	-0.096***	-0.122**	-0.115***
		(0.021)	(0.035)	(0.076)	(0.018)	(0.027)	(0.053)	(0.051)	(0.056)	(0.057)	(0.019)	(0.052)	(0.039)
	Core	-0.099**	-0.145**	-0.321**	-0.100**	-0.161***	-0.205***	-0.099**	-0.145***	-0.321**	-0.099***	-0.148***	-0.315***
		(0.038)	(0.053)	(0.103)	(0.039)	(0.047)	(0.069)	(0.027)	(0.038)	(0.112)	(0.035)	(0.046)	(0.079)
	Periphery	-0.115***	-0.123**	-0.023	-0.104***	-0.122***	0.020	-0.115	-0.123	-0.023	-0.114***	-0.124	-0.024
		(0.023)	(0.039)	(0.050)	(0.020)	(0.035)	(0.037)	(0.068)	(0.070)	(0.041)	(0.041)	(0.119)	(0.052)

Notes: The estimated model is $\Delta depvar_t = \alpha_i + \alpha_1 \cdot \Delta depvar_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t$ where *depvar* is direct tax revenue (dirtax) in panel A, indirect tax revenue (indtax) in panel B, investment expenditure (invexp) in panel C, and non-investment expenditure (consexp) in panel D. Core consists of Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands. Periphery encompasses Greece, Ireland, Italy, Portugal and Spain. EU-12 is the sum of core and periphery. Variables definitions are reported in Table 3. 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). For Breusch-Pagan's and Pesaran's (2004) cross-section dependence test results shown are p-values. For Frees' (2004) cross-section dependence test results shown are Q-statistics. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

TABLE 9. Robustness analysis part I. Change in the dependent variable: cyclically adjusted primary balance based on trend GDP

	EU-12			Core			Periphery		
	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007
	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall
$\Delta capb\_t_{t-1}$	-0.158***	-0.132***	-0.302***	-0.221***	-0.120*	-0.295***	-0.145*	-0.165**	-0.186***
	(0.039)	(0.039)	(0.046)	(0.059)	(0.049)	(0.043)	(0.053)	(0.055)	(0.027)
$\Delta debt_{t-1}$	0.162***	0.163***	0.228**	0.101**	0.079**	0.411**	0.192***	0.196**	0.126
	(0.025)	(0.040)	(0.098)	(0.029)	(0.022)	(0.138)	(0.030)	(0.059)	(0.088)
$ggap_t$	-1.076***	-1.177***	-0.589**	-0.686***	-0.740***	-0.825**	-1.412**	-1.628**	-0.547
	(0.201)	(0.262)	(0.228)	(0.131)	(0.108)	(0.241)	(0.327)	(0.437)	(0.334)
Δcab_t	0.013	0.017	-0.023	0.100	0.193**	-0.121	-0.087	-0.167	0.122
	(0.060)	(0.092)	(0.086)	(0.064)	(0.073)	(0.116)	(0.098)	(0.154)	(0.154)
constant	-0.246***	-0.313**	-0.009	-0.145***	-0.197***	0.306**	-0.369***	-0.171	-0.278
	(0.036)	(0.108)	(0.057)	(0.037)	(0.053)	(0.086)	(0.052)	(0.259)	(0.166)
N	388	244	144	251	167	84	137	77	60
Within R^2	0.1827	0.1936	0.2143	0.1107	0.1036	0.3245	0.2525	0.2755	0.1270
Between R^2	0.0431	0.1924	0.0117	0.0272	0.0379	0.1374	0.0052	0.0383	0.0012
Overall R^2	0.1790	0.1976	0.1649	0.1087	0.1004	0.2463	0.2467	0.2720	0.1052
Pesaran's test (p-val)	0.0000	0.0046	0.0000	0.0000	0.0071	0.0000	0.0231	0.0947	0.1230
Frees' test (statistic)	0.933***	0.235	0.758***	0.811***	0.237*	0.772***	0.238**	0.274	-0.035

Notes: The estimated model is given by $\Delta capb\_t_t = \alpha_i + \alpha_1 \cdot \Delta capb\_t_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ggap_t + \alpha_4 \cdot \Delta cab_t + \varepsilon_t$. Only $debt_{t-1}$ coefficients are presented, remaining estimates are available upon request. Core consists of Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands. Periphery encompasses Greece, Ireland, Italy, Portugal and Spain. EU-12 is the sum of core and periphery. Variables definitions are reported in Table 3. Presented regressions were carried out using fixed effects estimator. Results for other estimators are available on demand and they do not change our conclusions. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

TABLE 10. Robustness analysis part II. Change in the dependent variable: cyclically adjusted primary balance based on potential GDP

	EU-12			Core			Periphery		
	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007
	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall
$\Delta capb\_p_{t-1}$	-0.188***	-0.147***	-0.345***	-0.240***	-0.133**	-0.319***	-0.174**	-0.171**	-0.293***
	(0.036)	(0.034)	(0.041)	(0.058)	(0.045)	(0.037)	(0.048)	(0.052)	(0.059)
$\Delta debt_{t-1}$	0.138***	0.145***	0.199*	0.084**	0.064**	0.389**	0.165***	0.178**	0.098
	(0.026)	(0.042)	(0.096)	(0.031)	(0.022)	(0.133)	(0.034)	(0.062)	(0.077)
$ggap_t$	-1.179***	-1.253***	-0.742***	-0.857***	-0.882***	-1.002***	-1.448**	-1.591**	-0.707*
	(0.197)	(0.249)	(0.236)	(0.105)	(0.088)	(0.224)	(0.368)	(0.459)	(0.302)
Δcab_t	-0.010	-0.017	-0.017	0.065	0.129	-0.101	-0.098	-0.174	0.087
	(0.071)	(0.098)	(0.083)	(0.085)	(0.092)	(0.115)	(0.122)	(0.186)	(0.163)
constant	-0.180***	-0.262**	0.062	-0.100**	-0.154**	0.332***	-0.277***	-0.158	-0.212
	(0.037)	(0.110)	(0.059)	(0.038)	(0.053)	(0.084)	(0.059)	(0.267)	(0.165)
N	385	242	143	250	166	84	135	76	59
Within R^2	0.1851	0.1963	0.2335	0.1328	0.1214	0.3310	0.2372	0.2593	0.1569
Between R^2	0.0425	0.1507	0.0186	0.4074	0.0148	0.1075	0.0244	0.0750	0.0189
Overall R^2	0.1825	0.1981	0.1947	0.1297	0.1182	0.2544	0.2338	0.2560	0.1403
Pesaran's test (p-val)	0.0000	0.0060	0.0000	0.0000	0.0061	0.0000	0.0504	0.1298	0.5128
Frees' test (statistic)	0.606***	-0.002	0.319**	0.766***	0.312*	0.412**	0.048	-0.320	-0.257

Notes: The estimated model is given by $\Delta capb\_t_t = \alpha_i + \alpha_1 \cdot \Delta capb\_t_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ggap_t + \alpha_4 \cdot \Delta cab_t + \varepsilon_t$. Only $debt_{t-1}$ coefficients are presented, remaining estimates are available upon request. Core consists of Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands. Periphery encompasses Greece, Ireland, Italy, Portugal and Spain. EU-12 is the sum of core and periphery. Variables definitions are reported in Table 3. Presented regressions were carried out using fixed effects estimator. Results for other estimators are available on demand and they do not change our conclusions. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

TABLE 11. Robustness analysis part III. Exclusion of a country from the sample

	EU-12			Core			Periphery		
Excluded country	1970-2011	1970-1995 & 2008-2011	1996-2007	1970-2011	1970-1995 & 2008-2011	1996-2007	1970-2011	1970-1995 & 2008-2011	1996-2007
	All years	Baseline	Windfall	All years	Baseline	Windfall	All years	Baseline	Windfall
Austria	0.141***	0.156***	0.206*	0.112**	0.125*	0.446**	NA	NA	NA
	(0.028)	(0.043)	(0.107)	(0.031)	(0.051)	(0.160)			
Belgium	0.148***	0.155***	0.217*	0.133**	0.123	0.462**	NA	NA	NA
	(0.029)	(0.044)	(0.109)	(0.049)	(0.074)	(0.149)			
Finland	0.146***	0.154***	0.230*	0.124**	0.105	0.529***	NA	NA	NA
	(0.030)	(0.047)	(0.114)	(0.040)	(0.063)	(0.113)			
France	0.143***	0.156***	0.209*	0.117**	0.132**	0.443**	NA	NA	NA
	(0.027)	(0.042)	(0.108)	(0.031)	(0.049)	(0.164)			
Germany	0.138***	0.158***	0.174*	0.099***	0.119*	0.341**	NA	NA	NA
	(0.028)	(0.044)	(0.090)	(0.022)	(0.056)	(0.126)			
Luxembourg	0.146***	0.160***	0.209*	0.126**	0.139**	0.449**	NA	NA	NA
	(0.027)	(0.042)	(0.107)	(0.034)	(0.051)	(0.173)			
Netherlands	0.154***	0.174***	0.183*	0.145**	0.182***	0.380*	NA	NA	NA
	(0.027)	(0.040)	(0.098)	(0.037)	(0.020)	(0.157)			
Greece	0.123***	0.120**	0.339***	NA	NA	NA	0.136	0.124	0.250
	(0.030)	(0.043)	(0.100)				(0.073)	(0.081)	(0.117)
Ireland	0.160***	0.181***	0.243*	NA	NA	NA	0.203***	0.223**	0.121
	(0.023)	(0.036)	(0.132)				(0.023)	(0.050)	(0.125)
Italy	0.140***	0.161***	0.194*	NA	NA	NA	0.162**	0.186*	0.057
	(0.029)	(0.044)	(0.103)				(0.049)	(0.066)	(0.055)
Portugal	0.143***	0.163***	0.210*	NA	NA	NA	0.164*	0.191*	0.086
	(0.029)	(0.045)	(0.109)				(0.054)	(0.077)	(0.088)
Spain	0.132***	0.138***	0.212*	NA	NA	NA	0.144**	0.143*	0.097
	(0.025)	(0.040)	(0.110)				(0.042)	(0.059)	(0.091)

Notes: The estimated model is given by $\Delta pbalance_t = \alpha_i + \alpha_1 \cdot \Delta pbalance_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t$. Only $debt_{t-1}$ coefficients are presented, remaining estimates are available upon request. The sample of the countries consists of EU-12, core or periphery, respectively, without a country mentioned in the column named 'excluded country'. Variables definitions are reported in Table 3. All regressions were carried out with the fixed effects estimator as previously, there were no major differences between the various methods. Results for other estimators are available on demand and they do not change our conclusions. Results shown are coefficients, while standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

TABLE 12. Robustness analysis part IV. Change in definition of countries included in periphery group

	Core group with Italy			Periphery group without Italy		
	1970-2013	1970-1995 & 2008-2013	1996-2007	1970-2013	1970-1995 & 2008-2013	1996-2007
	All years	Baseline	Windfall	All years	Baseline	Windfall
$\Delta pbalance_{t-1}$	-0.190**	-0.152*	-0.207**	-0.125	-0.116	-0.310***
	(0.078)	(0.065)	(0.062)	(0.145)	(0.184)	(0.041)
$\Delta debt_{t-1}$	0.129***	0.124**	0.456***	0.162**	0.186*	0.057
	(0.029)	(0.045)	(0.115)	(0.049)	(0.066)	(0.055)
$ogap_t$	0.054	0.086	0.039	0.071	0.131	-0.316
	(0.084)	(0.106)	(0.085)	(0.092)	(0.099)	(0.134)
$ggap_t$	-1.633***	-1.641***	-1.638***	-1.567***	-1.710**	-1.412**
	(0.309)	(0.393)	(0.337)	(0.119)	(0.314)	(0.306)
Δcab_t	0.073	0.133	-0.078	-0.131	-0.140	-0.144
	(0.062)	(0.094)	(0.115)	(0.156)	(0.192)	(0.180)
constant	-0.163***	-0.301**	0.429***	-0.354***	-0.322	0.032
	(0.040)	(0.100)	(0.049)	(0.059)	(0.171)	(0.082)
N	282	186	96	120	72	48
Within R^2	0.2526	0.3098	0.3095	0.3412	0.4007	0.2866
Between R^2	0.0708	0.3988	0.1295	0.0978	0.3830	0.0840
Overall R^2	0.2514	0.3107	0.2336	0.3293	0.3894	0.2569
Pesaran's test (p-val)	0.0000	0.0000	0.0000	0.0000	0.0000	0.9925
Frees' test (statistic)	1.143***	0.609***	0.832***	0.082	0.421**	-0.123

Notes: The estimated model is given by $\Delta pbalance_t = \alpha_i + \alpha_1 \cdot \Delta pbalance_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t$. Periphery definition is changed to negative interest rate-growth differential during the windfall period, which results in moving Italy from periphery to core. Core consists of Austria, Belgium, Finland, France, Germany, Italy, Luxembourg and the Netherlands. Periphery encompasses Greece, Ireland, Portugal and Spain. EU-12 is the sum of core and periphery. Variables definitions are reported in Table 3. Presented regressions were carried out using fixed effects estimator. Results for other estimators are available on demand and they do not change our conclusions. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

TABLE 13. Robustness analysis part V. Change in definition of windfall period

	EU-12		Core		Periphery	
	1970-1998 & 2008-2013	1999-2007	1970-1998 & 2008-2013	1999-2007	1970-1998 & 2008-2013	1999-2007
	Baseline	Windfall	Baseline	Windfall	Baseline	Windfall
$\Delta pbalance_{t-1}$	-0.157*	-0.312***	-0.230*	-0.325***	-0.088	-0.334**
	(0.083)	(0.065)	(0.111)	(0.073)	(0.142)	(0.119)
$\Delta debt_{t-1}$	0.132**	0.219*	0.082	0.375**	0.167*	0.163
	(0.046)	(0.107)	(0.054)	(0.135)	(0.063)	(0.117)
$ogap_t$	0.090	0.069	-0.059	0.253**	0.136	-0.117
	(0.072)	(0.120)	(0.088)	(0.080)	(0.086)	(0.188)
$ggap_t$	-1.599***	-1.918***	-1.958***	-2.063***	-1.486***	-1.718
	(0.181)	(0.432)	(0.196)	(0.207)	(0.259)	(0.820)
Δcab_t	-0.018	0.020	0.111	-0.067	-0.129	0.040
	(0.101)	(0.076)	(0.096)	(0.105)	(0.177)	(0.151)
constant	-0.129	-0.380**	-0.075	-0.334*	-0.143	-0.216
	(0.088)	(0.134)	(0.096)	(0.144)	(0.140)	(0.188)
N	296	106	187	63	109	43
Within R^2	0.2763	0.3550	0.2687	0.4169	0.3317	0.3640
Between R^2	0.2622	0.0443	0.0007	0.3887	0.3145	0.3379
Overall R^2	0.2734	0.3259	0.2652	0.3370	0.3208	0.2937
Pesaran's test (p-val)	0.0000	0.0010	0.0000	0.0087	0.0000	1.1244
Frees' test (statistic)	2.047***	0.387*	1.541***	0.472**	0.506***	-0.276

Notes: The estimated model is given by $\Delta pbalance_t = \alpha_i + \alpha_1 \cdot \Delta pbalance_{t-1} + \alpha_2 \cdot \Delta debt_{t-1} + \alpha_3 \cdot ogap_t + \alpha_4 \cdot ggap_t + \alpha_5 \cdot \Delta cab_t + \varepsilon_t$. Windfall period definition is changed to beginning with accession to the Euro area, which results in a timespan 1999-2007 (2001-2007 for Greece). Core consists of Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands. Periphery encompasses Greece, Ireland, Italy, Portugal and Spain. EU-12 is the sum of core and periphery. Variables definitions are reported in Table 3. Presented regressions were carried out using fixed effects estimator. Results for other estimators are available on demand and they do not change our conclusions. Standard errors are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

a/ working papers series

Italian Association for the Study of Economic Asymmetries
postal: via Filippo Marchetti 19, I-00199 Roma, Italy
www.asimmetrie.org / email: info@asimmetrie.org

2014/07 Alberto Bagnai & Christian Alexander Mongeau Ospina: Long- and Short-Run Price Asymmetries in the Italian Energy Market: the Case of Gasoline and Heating Gasoil
2014/06 Sergio Cesaratto: Balance of Payments or Monetary Sovereignty? In Search of the EMU's Original Sin – a Reply to Lavoie
2014/05 Alberto Bagnai & Christian Alexander Mongeau Ospina: The a/simmetrie Annual Macroeconometric Model of the Italian economy: Structure and Properties
2014/04 Rodrigo M. Zeidan: Derivatives and Non-Financial Companies: Lessons From the Financial Crisis
2014/03 Carsten A. Holz: The Quality of China's GDP Statistics
2014/02 Josef C. Brada & El-hadj Bah: Growing Income Inequality as a Challenge to 21st Century Capitalism
2014/01 Alberto Bagnai: Un External Compact per rilanciare l'Europa

2013/02 Alberto Bagnai & Arsène Rieber & Anh-Dao Tran: Economic Growth and Balance of Payments Costraint in Vietnam
2013/01 Alberto Bagnai: Unhappy Families are all Alike: Minskyan Cycles, Kaldorian Growth, and the Eurozone Peripheral Crises

Our working papers are available at the following Internet addresses:
http://www.asimmetrie.org/category/working-papers/
https://ideas.repec.org/s/ais/wpaper.html