



THE STUDY OF FISCAL SUSTAINABILITY FOR THE CASE OF OVERINDEBTED EUROPEAN COUNTRIES

PhD Andreea STOIAN*

Rezumat

Studiul de față are ca scop analiza sustenabilității politicii fiscale în țările Uniunii Europene considerate a fi cele mai afectate de actuala recesiune economică și de criza datoriei publice: Portugalia, Irlanda, Italia, Grecia și Spania. În acest sens, este utilizată funcția de reacție fiscală care ne arată atât viteza cu care guvernul răspunde unor șocuri ale datoriei publice, cât și mărimea reacției de răspuns. Folosind date anuale din perioada 1995-2013, rezultatele indică crearea condițiilor ca politica fiscală să fie sustenabilă pe termen lung doar în cazul Italiei și al Portugaliei unde observăm o reacție directă și imediată a soldului primar ca răspuns la creșterea datoriei publice. Spre deosebire de aceste două țări, în cazul Irlandei semnalăm o reacție indirectă, în sensul că o creștere a gradului de îndatorare va determina reducerea surplusului primar. Pentru cazul Greciei și al Spaniei, testele statistice nu validează relația dintre soldul primar și datoria publică, dar observăm faptul că politica fiscală a Spaniei reacționează prompt și în sensul așteptat la creșterea ratei dobânzii la datoria publică.

Abstract

This study aims in analysing the fiscal sustainability for the case of European countries most affected by the economic downturn and sovereign debt: Portugal, Ireland, Italy, Greece and Spain. For that purpose, we apply fiscal reaction function which indicates the speed and the size of government response to shocks on public debt. We use annual data ranged on 1995-2013. The results show that only for the cases of Italy and Portugal governments managed to fulfil the

* Assistant Professor, Department of Finance and CEFIMO, Bucharest University of Economic Studies, andreea.stoian@fin.ase.ro

conditions for a sustainable fiscal policy. For these countries, the response is positive and immediate. On contrary, for Ireland we detect a negative reaction in the sense of a decreasing primary surplus to the increase of public debt by 1 p.p.. For the cases of Greece and Spain, the results are not statistically significant and we cannot conclude whether fiscal policy is sustainable or not. But we can emphasize a positive reaction to the increase of public debt cost in the case of Spain.

Keywords fiscal policy, fiscal sustainability, fiscal reaction function, primary balance, public debt

JEL Classification : E62, H62, H63

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1. Introduction

Fiscal sustainability still represents a debated issue and the economists put a focus on it due to the sharp sovereign debt crisis. The recent financial crisis and the current recession that hot worldwide went to an increase of budgetary deficits and of public debt. Therefore, efficient fiscal policy is required to be introduced for quick and positive response to shocks on public debt in order to absorb them and to avoid transforming them into systemic risk. Fiscal solvability is one of the main issues that government has to overcome. In that sense, Rădulescu (2012) indicated that financial markets hadn't paid enough attention to public finance imbalances before 2007, but they are doing right now by lending high priced money. Hence, Câmpeanu and Gyorgy (2009) indicated that government should introduce fiscal policies that manage to create primary surplus in order to achieve fiscal sustainability. Also, Câmpeanu (2011) emphasized the importance of using the best fiscal and budgetary tools to overcome the current challenges that governments have to overcome within a very fragile fiscal context. Braşoveanu Obreja and Braşoveanu (2012) showed that choosing

the most appropriate composition of fiscal adjustment could lead to a sizeable reduction of budgetary deficit but also to economic growth. They indicated that fiscal adjustments based on decreasing government spending are successful and expansionary.

Therefore, the aim of this study is to examine fiscal sustainability for the case of those European Union countries which are facing various difficulties generated by increasing public debt and economic recession. The countries considered for this study are Portugal, Ireland, Italy, Greece and Spain further refereed as PIIGS. We use fiscal reaction function to analyse the speed and the size of government response to shocks on public debt. For that purpose, the paper is structured as follows: Sections 2 and 3 describe the arithmetic of fiscal sustainability and the methodology used. Section 4 reports the empirical results and the discussions and Section 5 consists of concluding remarks of this study.

2. Mathematics of fiscal sustainability

The main stream of literature studying fiscal sustainability did not come to a conclusion when defining this concept. For instance, Blanchard (1990), Blanchard, Chouraqui, Hageman and Sartor (1990) and Horne (1991) considered that fiscal policy is sustainable when public debt does not explode and converges towards its initial level, nor governments are forced to adjust fiscal policy by increasing taxation or cutting government spending, monetize fiscal deficit or repudiate public debt.

The arithmetic of fiscal sustainability starts from the public debt dynamic equation (see in that sense, Hamilton and Flavin, 1986; Wilcox, 1989; Blanchard, 1990; Horne, 1991; Trehan and Walsh, 1991; Chalk and Hemming, 2000). Thus, government issues public debt (B_t) to finance primary deficit of primary expenditures (G_t) and government revenues (R_t), interest payment from time $t-1$ (iB_{t-1}) and public debt from previous period (B_{t-1}):

$$B_t = G_t - R_t + B_{t-1} + i \cdot B_{t-1} = G_t - R_t + (1 + i) \cdot B_{t-1} \quad (1)$$

Considering the variables above as ratio-to GDP, equation (1) re-writes:

$$b_t = g_t - r_t + \frac{1+i}{1+y} \cdot b_{t-1} \quad (2)$$

where:

i = interest rate on public debt;

y = GDP nominal growth rate.

In order to assure fiscal solvency, government has to fulfil inter-temporal budget constraint (IBC) which indicates that current public debt should equal the discounted value of primary balance and the discounted values of terminal public debt:

$$b_t = -E_t \sum_{k=0}^{\infty} \left(\frac{1+i}{1+y} \right)^{-(1+k)} (g_{t+k} - r_{t+k}) + \lim_{k \rightarrow \infty} E_t \left(\frac{1+i}{1+y} \right)^{-(1+k)} b_{t+k+1} \quad (3)$$

Fiscal policy is sustainable when IBC and transversality condition described by equation (4) is achieved:

$$\lim_{k \rightarrow \infty} E_t \left(\frac{1+i}{1+y} \right)^{-(1+k)} b_{t+k+1} = 0 \quad (4)$$

Equations (3) and (4) suggest that the government to run a sustainable fiscal policy it should service its payments by only generating primary surplus in the future avoiding public debt rollover. Many authors argue that fulfilling IBC represent only a necessary condition to achieve fiscal sustainability (e.g. Horne 1991). In that sense, Croce and Juan-Ramon (2003) stated that fiscal sustainability implies meeting inter-temporal budget constraint excluding the adjustment of fiscal policy.

3. Methodology

We investigated the existing literature studying fiscal sustainability and found two main empirical approaches: (i) econometric methods which consists in unit root tests, tests of co-integration, Vector Error Correction Mechanism, fiscal reaction function (e.g. Hamilton and Flavin, 1986; Wilcox, 1989; Trehan and Walsh, 1991; Bohn, 1998, 2005, 2006), and (ii) accounting approaches including derived indicators such as the primary gap which is the differential between primary balance and the primary balance that satisfies inter-temporal budget constraint and tax gap representing the first difference between that taxation rate which fulfils IBC and the current taxation rate (e.g., Blanchard, 1990; Pasinetti, 1998). European Commission - Directorate-General For Economic and Financial Affairs (2011) identified two more recent

approaches: a surveillance method which aims in early signalling fiscal vulnerabilities generated by large public debt, and a stochastic approach which starts from the hypothesis that a probabilistic analysis is more suitable than a deterministic one.

This study aims in investigating fiscal sustainability using *fiscal reaction function* which was firstly introduced by Barro (1979). It based on the public debt dynamic model described by equations (1) and (2). Rearranging equation (2) we find another from of it:

$$(b_t - b_{t-1}) \cdot \frac{1}{1+y} = p_t + \frac{i}{1+y} \cdot b_{t-1} - \frac{y}{1+y} \cdot b_t \quad (5)$$

where:

p_t =primary balance as ratio to GDP.

Considering equation (5), we argue that fiscal policy is sustainable when government manages to stabilize public debt to a constant ration, and $b_t = b_{t-1}$. Hence, equation (5) becomes:

$$p_t = \frac{i-y}{1+y} \cdot b_t \quad (6)$$

Based on equation (6), fiscal reaction function is can be re-written as follows:

$$p_t = f(b_t) + \varepsilon_t \quad (7)$$

where:

ε_t = error term.

Basically, fiscal reaction function allows the study of how primary balance changes when changes of public debt occur. The expected reaction is an increase of primary surplus when public debt-to-GDP ratio increases by 1 p.p., or at least a decrease of the primary deficit if this is the case. Moreover, the speed of reaction should be immediate, also indicating a more flexible fiscal policy that could be sustainable in the long run. The primary balance should adjust quickly to shocks on public debt. Therefore, the government spending and revenues should have a high elasticity.

We found large debate concerning the speed of government response to shocks on public debt. it is considered that fiscal policy is sustainable when the fiscal reaction function suggests an immediate

and positive response. But, many authors argue that interest payments to public debt are delayed compared to the moment when government issues bonds. Therefore, they consider acceptable a delay in fiscal reaction function (Greiner, Koeller and Semmler, 2005). Moreover, there are many other delays occurring that make fiscal policy to have a slower reaction. For instance, McConnell and Brue (1996) identified at least three types of delays: (i) recognition delay which refers to the time between the moment when economic recession starts and the moment when public administration is aware; (ii) administrative delay represented by the period between the time when government decides to act (to adjust fiscal policy) and the time when policy measures are introduced; (iii) operational delay which refers to the time between the moment when the Parliament approves fiscal adjustments actions and the moment when they have an effect on economy (on output, unemployment, prices). Considering all these argues, we can accept a delay of reaction but it depends on the frequency on data that we use for analysis..

The author who studied fiscal sustainability by using fiscal reaction function also considered a set of control variables to check for the robustness of the government response to shocks on public debt. Hence, they took into account variables for the business cycle (Barro, 1979; Greiner, Koeller and Semmler, 2005; Kirchgaenssner and Prohl, 2006; Celasun, Debrun and Ostry, 2007; Burger, Stuart, Jooste and Ceuvas, 2011; Gosh, Kim, Mendoza, Ostry and Quareshi, 2011); lagged primary balance to capture an inertia effect of fiscal policy (de Mello, 2005; Kirchgaenssner and Prohl, 2006; Celasun, Debrun and Ostry, 2007; Burger, Stuart, Jooste and Ceuvas, 2011); temporary government spending (Barro, 1979; Kirchgaenssner and Prohl, 2006); lagged indebtedness ratio and squared and/or cubic public debt-to-GDP ratio (Bohn, 2005; Greiner, Koeller and Semmler, 2005; Gosh, Kim, Mendoza, Ostry and Quareshi, 2011); inflation rate, interest rate fiscal rules, dummy variables (de Mello, 2005; Greiner, Koeller and Semmler, 2005; Kirchgaenssner and Prohl, 2006; Gosh, Kim, Mendoza, Ostry and Quareshi, 2011). Consequently, equation (7) can be re-written as follows:

$$p_t = f(b_t) + Z_t + \varepsilon_t \quad (8)$$

where:

Z_t : set of control variables.

4. Database and empirical results

The aim of this paper is to study the sustainability of fiscal policy for those countries of European Union which confront great difficulties emerged from the economic recession and increasing public debt: Portugal, Ireland, Italy, Greece and Spain. Given their current situation we consider useful to show how governments react to shocks on public debt. For the beginning, we present the dynamic of principal variables implied by the model of fiscal sustainability: public debt-to-GDP ratio, primary balance-to-GDP ratio, the implicit interest rate on public debt computed as ratio between current interest payments and public debt from previous period, economic growth rate calculated as GDP nominal growth rate, public debt growth rate and the gap between implicit interest rate and GDP growth rate. All of these variables influence public debt dynamic and, therefore, fiscal sustainability in the long run.

Analysing annual data ranged on 1970-2013 for public debt-to-GDP ratio, we found that averages values indicate indebtedness ratios below GDP. Greece has the highest ratio (see Table 1):

Table 1
Descriptive statistics for public debt-to-GDP ratio

Indicator	Ireland	Spain	Greece	Italy	Portugal
Mean	69.16807	41.23550	73.69245	89.42993	54.28637
Median	65.94655	42.71360	76.55360	100.3389	54.01580
Maxim	120.1529	87.03290	168.0005	123.4884	117.1216
Minim	24.71090	11.80650	15.74000	37.24510	13.48930
Standard deviation	28.32860	20.72724	44.83777	27.14035	23.44167
Skewness	0.071721	0.067523	0.284239	-0.434636	0.849200
Kurtosis	1.791209	2.116430	2.133025	1.707161	4.157568
Jarque-Bera	2.716546	1.464713	1.970492	4.449625	7.216893
Probability	0.257104	0.480775	0.373347	0.108088	0.027094
Obs.	44	44	44	44	41

Source: own calculations based on annual data spanned on 1970-2013 for public debt-to-GDP ratio provided by Ameco

We can observe the case of Greece that records the highest indebtedness ratio and standard deviations which indicates large variations and possible difficulties in stabilizing public debt to a constant ratio.

The results reported in Table 2 also indicate which country recorded indebtedness ratios larger than GDP and their frequency.

Table 2

Frequency of the indebtedness ratio

Country/Range	Standard deviation	Obs.	Country/Range	Standard deviatio	Obs.
Ireland			Italy		
[20, 40)	4.626727	8	[20, 40)	NA	1
[40, 60)	6.037915	10	[40, 60)	5.487812	11
[60, 80)	4.573662	8	[60, 80)	5.397146	3
[80, 100)	5.565997	12	[80, 100)	5.986827	7
[100, 120)	3.410100	5	[100, 120)	5.471858	16
[120, 140)	NA	1	[120, 140)	1.252209	6
Spain			Portugal		
[0, 20)	1.567879	11	[0, 50)	12.87587	15
[20, 40)	7.526293	7	[50, 100)	10.41050	23
[40, 60)	6.878370	17	[100, 150)	4.755036	3
[60, 80)	2.704925	7			
[80, 100)	4.307765	2			
Greece					
[0, 50)	9.416709	16			
[50, 100)	17.92975	15			
[100, 150)	14.46654	10			
[150, 200)	3.733008	3			

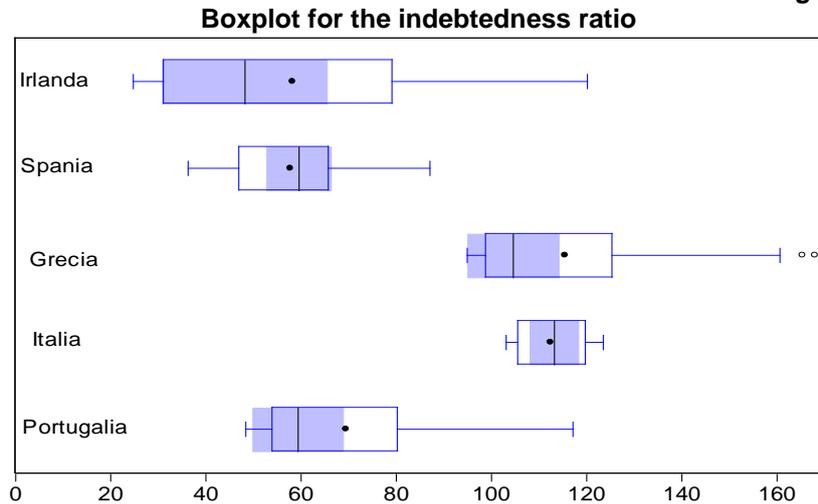
Source: own calculations based on annual data spanned on 1970-2013 provided by Ameco

Italy record the highest frequency of 50% of indebtedness ratios larger the GDP. Then, it comes Ireland that has a frequency of 41%, followed by Greece 26%, Portugal 7% and Spain which has no public debt-to-GDP ratio higher than GDP.

Resizing the analysed period and focusing on the period after the Treaty of Maastricht was introduced, we notice that excepting Ireland which reported only for 3 time indebtedness ratios larger than GDP, for the rest of the countries under investigation, we notice that large public debt-to-GDP ratio recorded after 1995 when the convergence criteria which limits this ratio to 60% of GDP became fully operational.

Studying the boxplot of indebtedness ratio for the case of PIIGS on annual data extracted for 1995-2013, we observe that Greece has the highest exposure and outliers indicating extreme values of public debt-to-GDP ratio larger than 160% of GDP (see Figure 1):

Figure 1



Source: own calculations based on annual data spanned on 1995-2013 provided by Ameco

Excepting the case of Spain which hasn't recorded yet any indebtedness ratio larger than GDP, the rest of the countries had high public debt-to-GDP ratios. The figure also suggests that Greek government has difficulties in stabilizing public debt compared to the case of Italy which had indebtedness ratios larger than GDP for the period investigated but the variations were small indicating a more severe control of public debt.

Blanchard (1990) defined fiscal sustainability when indebtedness ratio does not explode and it comes back to its initial level. Starting this definition, Pasinetti (1998) considered that fiscal policy is sustainable when public debt-to-GDP ratio at time t should be lower than the ratio at time 0 :

$$\left(\frac{D}{Y}\right)_t \leq \left(\frac{D}{Y}\right)_0 \quad (9)$$

when:

D = public debt in nominal terms;
 Y = GDP in nominal terms.

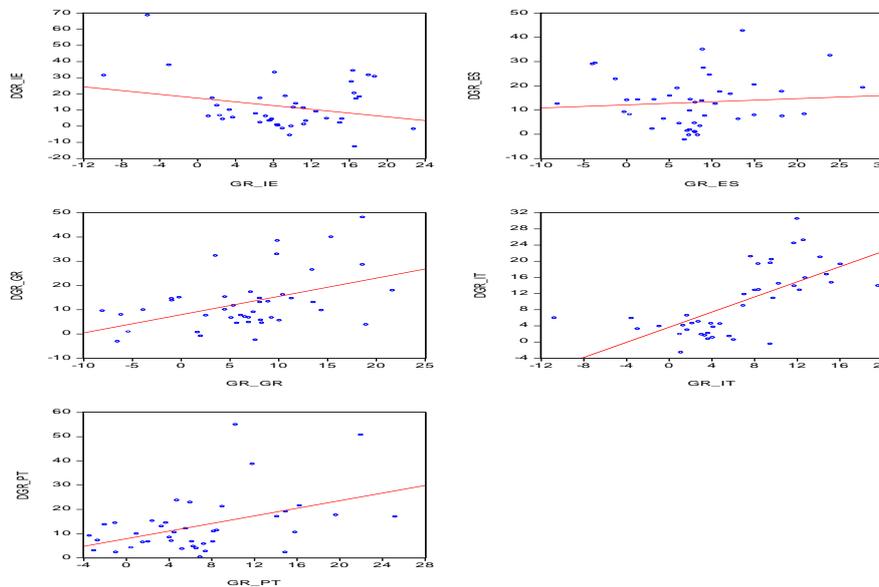
If we consider the growth rate of public debt, θ , and GDP growth rate, y , then for the fiscal policy to be sustainable in the long run the public debt growth rate should be lower than GDP growth rate.

$$\frac{\theta}{y} \cdot \frac{D}{Y} \leq \frac{D}{Y} \quad (10)$$

Studying the correlation between θ and y , we found that excepting Ireland which has a negative relationship, for the rest of the countries investigated we noticed a positive correlation (Figure 2):

Figure 2

Correlation between GDP growth rate (y) and public debt growth rate (θ)



Source: GDP growth rate (y) was calculated as relative variation of nominal GDP. Public debt growth rate was calculated as relative variation of nominal public debt. We used annual data of nominal GDP and public debt extracted from 1970-2013 provided by Ameco

We also observe that Italy had the highest public debt growth rate while for the case of Spain the GDP growth rate was much larger than public debt growth rate.

Studying the distribution of the gap between the GDP growth rate and public debt growth rate (see Table 3), we found that more than half of its values are negative, hence suggesting a public debt growth rate larger than economic growth rate.

Table 3

The distribution of the gap between GDP growth rate and public debt growth rate

Country/Range	Obs.	Country/Range	Obs.
Ireland		Italy	
[-100, -50)	1	[-20, -10)	8
[-50, 0)	23	[-10, 0)	22
[0, 50)	19	[0, 10)	12
Spain		[10, 20)	1
[-40, -30)	2	Portugal	
[-30, -20)	4	[-60, -40)	1
[-20, -10)	7	[-40, -20)	2
[-10, 0)	12	[-20, 0)	26
[0, 10)	16	[0, 20)	11
[10, 20)	2		
Greece			
[-30, -20)	5		
[-20, -10)	9		
[-10, 0)	15		
[0, 10)	12		
[10, 20)	2		

Source: own calculations based on annual data spanned on 1970-2013 provided by Ameco. GDP growth rate was calculated as relative variation of nominal GDP (y). Public debt growth rate was calculated as relative variation of nominal public debt (θ). When $y - \theta < 0$, then $y < \theta$.

Portugal recorded the highest frequency of negative gap (72%), followed by Italy (70%), Greece and Ireland (67%), and, respectively, Spain (58%).

Now, considering equation (3), when interest rate on public debt (i) is larger than GDP growth rate (y), then governments should generate primary surplus to run sustainable fiscal policy in the long run for the fulfilment of the solvency constraint, which could imply significant financial efforts to achieve this goal. Therefore, it could be

less costly to issue government bonds on an interest rate below the economic growth rate.

Studying the gap between ($i-y$) on annual data extracted for 1995-2013, we notice that excepting Ireland, the rest of the country considered for this analysis issued government bonds on a cost larger than economic growth rate (see Table 4):

Table 4

The distribution of the gap between implicit interest rate on public debt and GDP growth rate

Country/Range	Obs.	Country/Range	Obs.
Ireland		Italy	
[-20, -10)	3	[-10, -5)	1
[-10, 0)	10	[0, 5)	15
[0, 10)	4	[5, 10)	2
[10, 20)	2	[10, 15)	1
Spain		Portugal	
[-5, 0)	9	[-4, -2)	1
[0, 5)	8	[-2, 0)	4
[5, 10)	2	[0, 2)	6
Greece		[2, 4)	5
[-5, 0)	6	[4, 6)	2
[0, 5)	6	[6, 8)	1
[5, 10)	6		
[10, 15)	1		

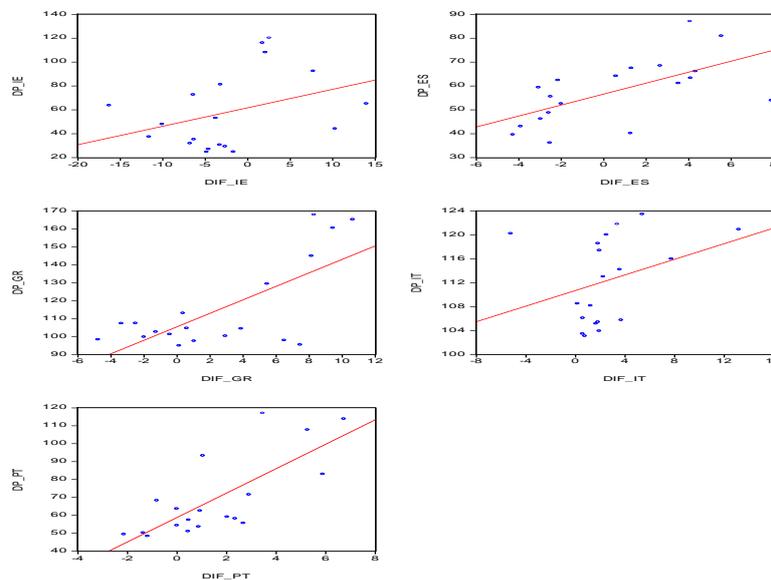
Source: own calculations based on annual data spanned on 1995-2013 provided by Ameco. GDP growth rate was calculated as relative variation of nominal GDP (y). The implicit interest rate on public debt was provided by. When $i-y < 0$, then $i < y$

For the case of Italy the gap was positive for 95% of the values recorded, followed by Portugal (74%), Greece (68%), Spain (53%) and Ireland (32%). We can discuss this situation considering what Escolano stated in his paper of 2010. He argued that the negative discount factor $(i-y)/(1+y)$ from equation (3) describes the 'modified golden rule' which emerges from the efficiency of economic growth process and from agents' preferences for current consumption. Moreover, he also suggested that the modified golden rule can be validated for developed and stable economies which reached to a steady state in the long run. On the other hand, issuing government bonds on a cost larger than economic growth rate for undetermined time could be arguable due to a high public debt service generated by high interest rates. Also studying the correlation between this gap and

indebtedness ratio we found positive relationship suggesting that public debt-to-DP ratio increased while the interest rate on public debt became higher than the economic growth rate (see Figure 3):

Figure 3

The correlation between the gap of implicit interest rate on public debt (j) and GDP growth rate(y) and indebtedness ratio



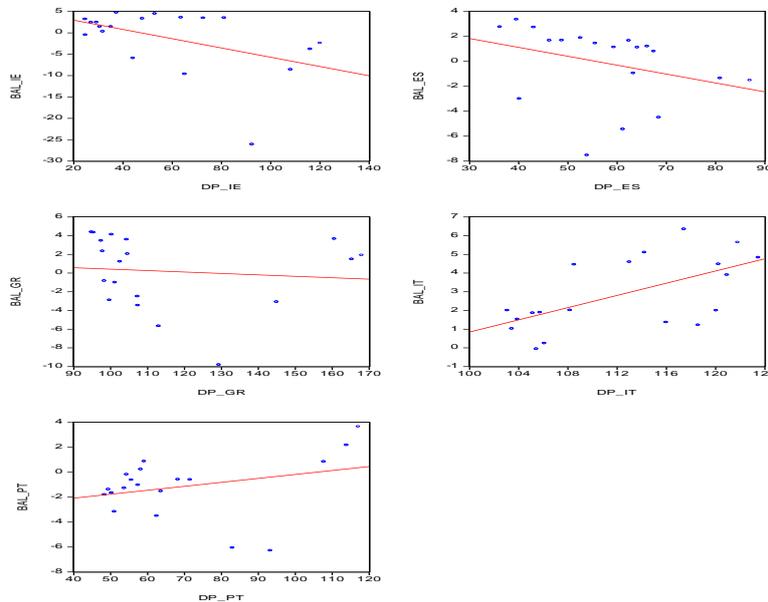
Source: own calculations based on annual data spanned on 1995-2013 provided by Ameco

To sum up for the moment, we found that the countries considered for analysis had high public debt-to-GDP ratios after introducing the convergence criteria from the Treaty of Maastricht, the public debt growth rate was higher than GDP growth rate for most of the data observed and that the implicit interest rate on public debt was also larger than economic growth rate for most of the cases. Given this context, we can state that PIIGS could confront large difficulties in achieving fiscal sustainability in the long run. Therefore, it is required for the government to be able to generate primary surplus to service its future payments. Therefore, we also analysed

the correlation between public debt-to-GDP ratio and primary balance on annual data ranged on 1995-2013. We noticed a negative correlation for the case of Ireland, Spain and Greece and a positive relation for the case of Portugal and Italy (see Figure 4). If Spain and Ireland could have run such correlation considering the decreasing indebtedness ratio in the case of Ireland and relatively small public debt-to-GDP ratios in the case of Spain, this is not the situation for the case of Greece.

Figure 4

The correlation between indebtedness ratio and primary balance



Source: own calculations based on annual data spanned on 1995-2013 provided by Ameco. Primary balance is calculated as first difference between government revenues and primary expenditures cyclically adjusted

Hence, we believe that studying fiscal sustainability based on fiscal reaction function will provide useful insight regarding how governments response to shocks on public debt. We estimate fiscal reaction function described by equation (8) by OLS for individual countries under investigation. We use annual data extracted for 1995-2013. The principal variables implied by model are: cyclically adjusted

primary balance (p) and public debt-to-GDP ratio (b). Then, to check for the robustness we use control variables: inflation rate (r), implicit interest rate on public debt (i) and industrial production (ip) as proxy for the business cycle. The results are reported in the table below:

Table 5

The results for fiscal reaction function

Country	Variable	Coefficient	Std. Error	t-Statistic	Prob.	R ²	F-statistic
Ireland	b	-0.108395	0.052503	-2.064529	0.0546	0.218283	4.746998
	constant	5.138004	2.043463	2.514362	0.0223		
Spain	b	0.135678	0.084523	1.605229	0.1344	0.865582	19.31840
	i	0.875588	0.191364	4.575502	0.0006		
	r	0.382021	0.280712	1.360897	0.1986		
	ip	0.424626	0.082727	5.132848	0.0002		
	constant	-53.64951	11.98349	-4.476951	0.0008		
Greece	p(-1)	0.846968	0.171439	4.940355	0.0002	0.647830	13.79655
	b	0.032351	0.022340	1.448124	0.1682		
	constant	-3.776715	2.638019	-1.431648	0.1728		
Italy	b	0.163211	0.049983	3.265327	0.0046	0.371318	10.04069
	constant	-15.47478	5.391188	-2.870384	0.0106		
Portugal	p(-1)	0.461589	0.158534	2.911607	0.0107	0.362204	4.259237
	b	0.050733	0.018448	2.749978	0.0149		
	constant	-3.992879	1.190817	-3.353060	0.0044		

The results reveal the particularities of governments' response of each country. The expected reaction is positive in the sense of increasing primary surplus or at least in decreasing primary deficit to an increase of public debt-to-GDP ratio by 1 p.p..

In the case of Ireland, the response is negative. The increase of public debt by 1 p.p. goes to a decrease of the primary surplus/increase of the primary deficit by 0.01 p.p. This reaction could be argued considering the decreasing trend of public debt for the period analysed. For the period ranged on 1970-2015 we observed a negative correlation between the public debt growth rate and the economic growth rate and for the period 1995-2013, the gap between the implicit interest rate on public debt and the GDP growth rate was negative for 68% cases implying a cost of public debt lower than economic growth rate. Given this context, the results suggest that Irish government run a more flexible fiscal policy and didn't aim in

adjusting it to shocks on public debt. But starting 2008 until 2013, the indebtedness ratio increased by almost 3 times its standard deviation. In this situation, if government does not adjust fiscal policy and fiscal reaction function remains unchanged, Ireland will confront difficulties in fulfilling the solvency constraint.

For the case of Spain, we observe that indebtedness ratio is not statistically significant, hence we cannot state whether it has an influence or not on the primary balance. But, the results show a positive correlation between industrial production and primary balance. Thus, we may conclude that Spanish fiscal policy is procyclical which could be harmful given the current context of economic recession. We also noticed that primary surplus positively responds to the increase of the cost of public debt. In that sense, Doluca, Hübner, Rumpf and Weigert (2012) showed that Spain and Italy are the only European Union countries which confront major difficulties generated by the cost of government bonds which is the largest since the formation of euro area. Spain is the only country among PIIGS which still has indebtedness ratios lower than GDP, even if the public debt growth rate is higher than economic growth rate. Therefore, we suggest that a more flexible fiscal policy adjusting to the dynamic of public debt would be useful to face the possible increase of public debt as a result of the deep economic recession.

Greece, the country which confronts the largest public debt-to-GDP ratio, runs a fiscal policy which does not react significantly to shocks on public debt. The results indicate that indebtedness ratio is not statistically significant. We observe only an inertia effect generated by past fiscal policy. Greece will definitely need a more flexible fiscal policy which should react properly to shock on public debt. For the moment, the adjustment of fiscal policy would require substantial financial resources which would create a large burden on population.

Italy and Portugal are the only countries for which the results reveal an immediate and positive response of the government to changes in public debt-to-GDP ratio. The size of the reaction differs accordingly to the size of the indebtedness ratio. In the case of Italy, an increase by 1 p.p. of the indebtedness ratio goes to an increase of primary surplus by 0.16 p.p. while in the Portugal's case this increase is only by 0.05 p.p..

The results indicated by our analysis are consistent to some extent with the results found in the existing literature. The possible distinctions are due to different investigation methods or database used for analysis. Hence, Afonso (2000) using unit root and co-integration tests for annual data spanned on 1968-1997 found that fiscal policy is not sustainable for the case of countries considered for investigation in our study. Ricciutti (2003) indicated that for Italy's case that fiscal policy is sustainable after conducted an investigation for 1861-1998 period and applying unit root tests. Marinheiro (2005) also revealed the fiscal sustainability for the case of Portugal for data ranged on 1903-2003.

5. Concluding remarks

Given the current macroeconomic context characterized by a deep economic recession, a healthy and flexible fiscal policy plays an important role in overcoming these difficulties. This study aimed in investigating fiscal sustainability for the case of European Union countries which have a poor economic situation: Portugal, Ireland, Italy, Greece and Spain. For that purpose, we used fiscal reaction function which gives important details about the speed and the size of reaction. We used annual data spanned on 1995-2013. The results show particularities of governments; response of each country under investigation. Hence, for Ireland's case we found a negative response to shocks on public debt which can be argued considering the decrease of public debt-to-GDP ratio. But for the last years, the substantial increase of the indebtedness ratio can generate difficulties for the Irish government if it doesn't adjust fiscal reaction function as for the inter-temporal budget constraint to be fulfilled. For the case of Spain and Greece the results are not statistically significant, hence indicating no influence of public debt-to-GDP ratio on primary balance. But these results can be discussed separately. For instance, Spain has low indebtedness ratios compared to the rest of the PIIGS countries. In that sense Carballo-Cruz (2011) suggested that the difficulties which Spain has to overcome emerged rather from the private debt and high unemployment rate than from sovereign debt. Spanish fiscal policy also reacts to the increase of the cost of public debt. Greece, which has the most difficult situation, runs a fiscal policy which does no response to shocks on public debt. Therefore,

adjustments should be carried out. Stoian and Alves (2011) suggested as the most convenient scenario the stabilization of public debt. Italy and Portugal are the only PIIGS countries for which the results indicate a positive and immediate reaction of fiscal policy to shocks on public debt. The size of the reaction differs accordingly to the indebtedness ratio. Therefore, we can conclude that for the case of these two countries, governments meet the conditions to run a sustainable fiscal policy in the long run.

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