

# How much binding is the Bill?

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## Abstract

We study whether and how much the interest bill conditions the size and composition of public expenditures. The group of EU 15 countries over the 1995-2016 period is the object of analysis. We study both total public expenditures and public expenditures by function of government in order to unveil which sectors are more responsive to an interest bill variation.

Keywords: interest bill, public expenditures, public debt.

JEL codes: H61, H62, H63, E62, E63.

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## 1. Introduction

The issue with public debt is its sustainability but, even when sustainable, it often poses a substantial burden on and conditions budget policy, if not even economic growth (Panizza & Presbitero, 2013). Such a burden is quantified by the interest bill in GDP terms. However, public debt is not a major concern in all countries with high debt-to-GDP ratios, even when the interest bill is large: there are some countries with high ratios that do not seem to bother.

In the recent past, we have witnessed to debt-motivated fiscal consolidations (based on expenditures, tax or both; Cafiso & Cellini 2014), which have had deep consequences both in terms of economic development (Alesina & Ardagna 2010), social cohesion (Agnello et al. 2017) and trust in the EU integration dogma.

Our research aims to provide evidence to judge the truthiness of a supposed relationship between the cost of debt and primary public expenditures. There is indirect reference to such a relationship in different contexts. We discuss those in the next section, they refer to economic developments prior to the Euro Area debt crisis and have as theoretical background the simple algebra of budget accounting and some new proposal on reforming EU economic governance. The same suggest the existence of an inverse relationship from the cost of debt to public expenditures and therefore motivate our empirical research.

Starting from the intent to verify such a relationship, we dig deeper by considering also public expenditures by function in order to understand which branch of public activity is more responsive to a debt cost variation. We develop our empirical analysis on a panel of fifteen EU countries over the 1995-2016 period, we estimate the effect country by country since we expect different effects for different countries.

The contribution of our research consists in documenting a strong negative effect of the interest bill on public primary expenditures at the aggregate level. This is observed to be significant at least in half EU15 countries and emerges in the majority of all the government functions.

The paper is structured as follows. Section 2 explains the motivations at the basis of our research. Section 3 presents the data we use. Section 4 describes and reports the results of the analysis. Section 5 draws the conclusions. The Appendix includes further Tables.

## 2. Background considerations

Financial integration in Europe has been an ongoing process for the last three decades. It is generally regarded as an achievement functional to Europe's economic development.

Nonetheless, some economists argue that it may have also paved the way to the Euro Area debt crisis in 2011-2012 (Korner & Zemanek 2013). The idea is that financial integration has allowed periphery EU countries to grow in debt (public and private) at an unrealistically low interest rate thanks to a positive credibility shock they benefited from binding their future closer to the very budget-responsible core EU countries (Caporin et al. 2018).<sup>1</sup> This became apparent through the EU intra account imbalances observed before 2007 (Lane 2006, European Commission 2010). All good as long as doubts on the sustainability of their debt materialized.

Generally speaking, debt grows when expenditures increase while income does not or, conversely, because income decreases while expenditures do not.<sup>2</sup> The first case therefore implies a relationship between expenditures and the cost of debt, which is intrinsic to the course of events mentioned, and it is likely to vary in intensity with the conditions to get indebted. Rates are more incisive the larger public debt is and this is easily quantified through the interest bill. *The first hint* of a possible relationship between the cost of debt and expenditures lies on such a view about the course of events that paved the way to the Euro Area debt crisis: decreasing rates, alias a decreasing interest bill, allowed increasing expenditures.

*The second motivation* why a relationship between the cost of debt and expenditures should be is embedded in the condition for debt stabilization. The interest bill is the key variable to stabilize the debt-to-GDP ratio: a primary surplus equal to the interest bill is to achieve for stabilization. The underlying assumption is that the interest bill might pressure budget policy because countries need to avoid an excessively unbalanced budget. The interest bill could therefore trigger a fiscal consolidation based either on expenditures or on taxes (with supposedly different effects on economic activity: Perotti 2013, Giordano et al. 2007). When considering expenditures, the supposed relationship is inverse also in this case. This can be shown using the same notation as in Cafiso (2012). The consolidated government-sector budget identity is:

$$\underbrace{G_t + i_t B_{t-1}}_{\text{expenditures}} = \underbrace{T_t + (B_t - B_{t-1})}_{\text{revenues}}, \quad \text{Equation 1}$$

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<sup>1</sup> The process leading to the Euro introduction has been characterized by decreasing interest rates on public debt in many Euro Area countries (Cafiso, 2016); see Figure 9 in the appendix.

<sup>2</sup> This holds also across borders: foreign debt grows when imports (expenditures) grow more than exports (income).

where  $G_t$  is public expenditures,  $T_t$  is tax revenues,  $i_t$  is the interest rate,  $B_t$  is the outstanding public debt. Accordingly,  $OB_t = T_t - G_t - i_t B_{t-1}$  is the Overall Budget and  $PB_t = T_t - G_t$  is the Primary Budget. Assuming  $T_t$  constant, when  $i_t B_{t-1}$  increases,  $G_t$  has to decrease to maintain balanced the budget. The focus on expenditure-based corrections stems from the decision to concentrate on what the budgetary authorities effectively control (Ayuso-i-Casals 2012).

The commitment to maintain the budget balanced depends on several concurrent motivations. First and foremost, because of formal budget rules (to wit, the Stability and Growth Pact or the Fiscal Compact in case of the Euro Area) that restrain the Government from generating excessive deficit. Secondly, because of the necessity for the government to convey budget discipline to capital markets in order not to incur in market penalties when public debt will be renewed. Thirdly, because of domestic attitude towards budget issues, to wit, citizens might disapprove an excessively loose budget policy.

Following Figure 1 and Figure 2 show respectively the amount of the interest bill and of primary expenditures in the group of EU 15 countries. These are both reported in GDP terms for ease of comparison across countries. The dynamics of the interest bill is really decreasing in all countries until 2007, and for some others all along the period considered. The evolution of expenditures is less homogeneous across countries, particularly because in GDP terms. Nevertheless, southern-European countries such as Greece, Italy and Portugal exhibit really an upward trend that contrasts with the clearly downward trend of their interest bill in Figure 1.

*The third motivation* for our research lies on the current debate on reforming EU economic governance. The new rules proposed, aimed to overcome the Maastricht-based 3% maximum deficit rule, concentrate on the expenditures side of the budget (Carnot 2014). Expenditures are judged more effective to guarantee fiscal sustainability since they anchor better the debt-to-GDP ratio (Kinda 2015). Among the others, Andrieu et al. (2015) write an operational rule where debt levels above a threshold determine an expenditures reduction (expenditure growth rule in their annex). Coherently, we are interested to verify whether or not a feedback of this kind between debt and expenditures emerges from real-world data.

In a nutshell, these three motivations are at the basis of our study that aims to judge the truthiness of the alleged effect from the interest bill to public primary expenditures.

Figure 1 – Real Interest Bill in GDP terms



Figure 2 – Primary Expenditures in GDP terms



The reason for the sectoral focus we take in our analysis is that different sectors of government activity are shown to be targeted differently when the government decides to consolidate the budget (Castro 2017). Along this line, when evaluating the cost of debt on public expenditures, we check whether some function of government result more responsive than others to a variation of that cost. Indeed, systematic differences would imply that some functions are more often targeted for correction. This is important because debt-induced fiscal consolidations might result in a more structural change of public expenditure (structural versus *una-tantum* fiscal corrections) and that structure is widely acknowledged to have effects on long-run growth (Barro 1990, Devarajan et al. 1996, Acosta-Ormaechea & Morozumi 2013). The ‘excuse’ of debt (like the ‘Europe requires’ mantra spelled by many politicians in some south-European countries) could offer a chance to national authorities to implement expenditure corrections with specific characteristics, corrections more difficult to implement if justified on other grounds.<sup>3</sup>

### 3. Data

The variable object of analysis is *public expenditures*, which is the amount of money spent by the General Government for goods and services. The general government aggregate is constituted by the Central government, State governments, Local governments and Social Security Funds.<sup>4</sup> Bartolini et al. (2017) explain that considering all the government levels is necessary when studying budget policy since an expenditure structure fragmented across different levels of government may influence the consolidation outcome.

Since our objective is to study whether and how the interest bill impacts on the government’s budget policy, we refer to *Primary Public Expenditures* (PPE), namely, the amount of expenditures not used to pay interests on public debt. In fact, interests on public debt is the variable whose effect we are interested in and it is an explicative in the PPE regression.

We use expenditure data both at the *aggregate* level (to wit, for all the functions of government) and *disaggregated* for each single function separately. Aggregate budget data are extracted from the EU Commission’s *Ameco* database, while the disaggregated data are

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<sup>3</sup> As an example of this, Italy’s government managed to pass an extremely unpopular pension reform in 2012 (“Riforma Fornero”) on the basis that was an unavoidable correction necessary to guarantee debt sustainability in the medium to long term. It is commonly shared that if not supported by widespread concern about an increasingly unbearable cost of debt that would have not been a possible reform to pass.

<sup>4</sup> Among the reporting EU Member States and EFTA countries, state government is only applicable in Belgium, Germany, Spain, Austria and Switzerland. Social security funds are not separately reported in Ireland, Cyprus, Malta, the United Kingdom and Norway.

extracted from EUROSTAT's *Government Statistics* database. Both are consistent with each other.

The other explanatory variables we use are: the real aggregate GDP (from the OECD), the employment rate (from the OECD), the nominal effective exchange rate (from the OECD), the structure of the population for age layer (from the OECD) and general election data (from IDEA - Institute for Democracy and Electoral Assistance).

In the following section, we use the variation of PPE as dependent variable, we plot it here in Figure 3 for visual inspection.

Figure 3 – Variation of Real Primary Public Expenditures



## *Expenditures by Function of Government*

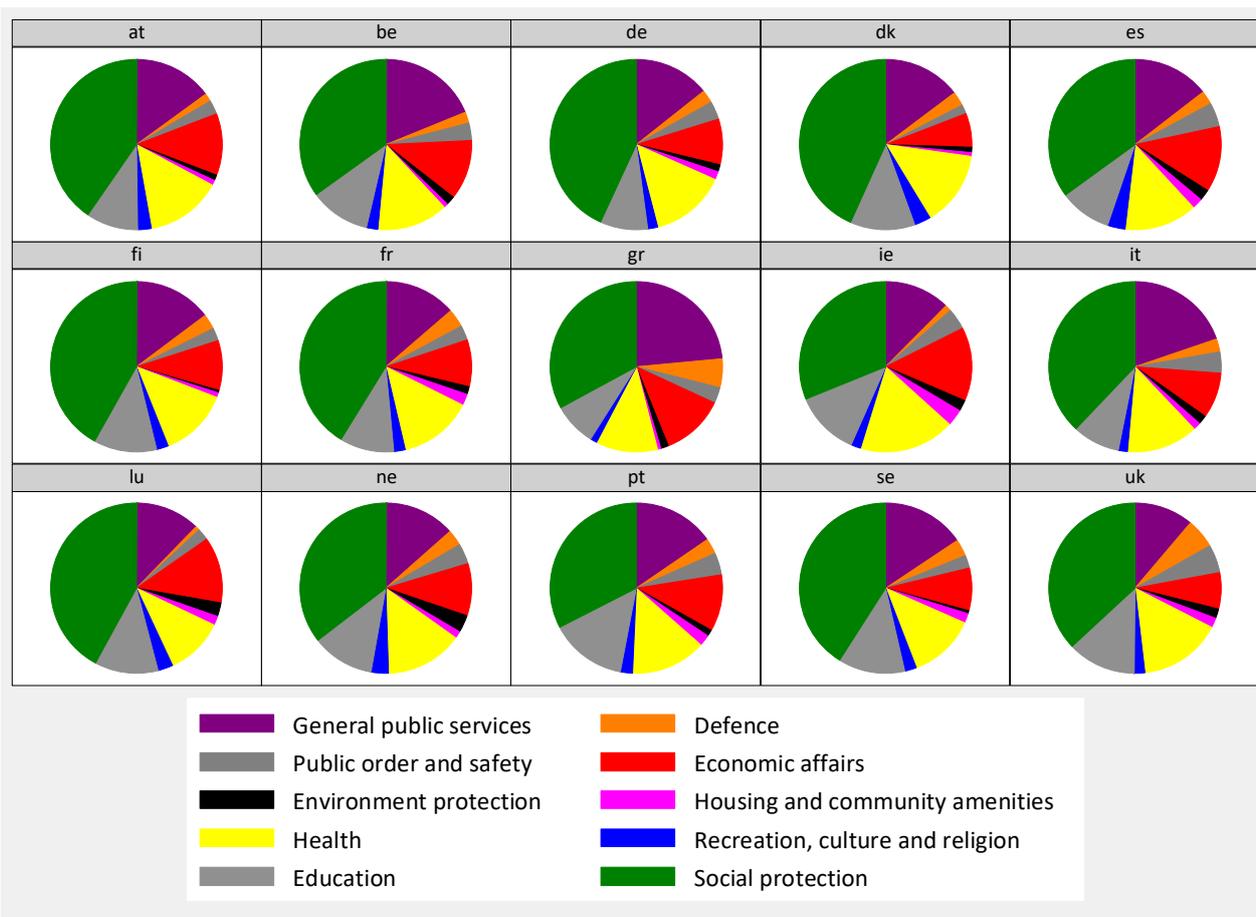
Disaggregated expenditure data follow the COFOG classification. We use the first digit, the higher hierarchical level. The list of Digit-1 functions with a concise description is reported in the following Table 1.

*Table 1 – COFOG classification: Overview of divisions and groups*

#	Government broad objective (functions)	Sub-items
01	<b>General public services</b>	Executive and legislative organs, financial and fiscal affairs, external affairs; foreign economic aid; general services; basic research; R&D related to general public services; general public services n.e.c.; <b>public debt transactions</b> , transfers of a general character between different levels of government.
02	<b>Defence</b>	Military defence; civil defence; foreign military aid, R&D related to defence; defence n.e.c.
03	<b>Public order and safety</b>	Police services; fire-protection services; law courts; prisons; R&D related to public order and safety; public order and safety n.e.c.
04	<b>Economic affairs</b>	General economic, commercial and labour affairs; agriculture, forestry; fishing and hunting; fuel and energy; mining, manufacturing and construction; transport; communication; other industries, R&D related to economic affairs; economic affairs n.e.c.
05	<b>Environmental protection</b>	Waste management; water waste management; pollution abatement; protection of biodiversity and landscape; R&D related to environmental protection.
06	<b>Housing and community amenities</b>	Housing development; community development; water supply; street lighting; R&D related to housing and community amenities; housing and community amenities n.e.c.
07	<b>Health</b>	Medical products, appliances and equipment; outpatient services; hospital services; public health services; R&D related to health; health n.e.c.
08	<b>Recreation, culture and religion</b>	Recreational and sporting services; cultural services; broadcasting and publishing services; religious and other community services, R&D related to recreation, culture and religion; recreation; culture and religion n.e.c.
09	<b>Education</b>	Pre-primary, primary, secondary and tertiary education, post-secondary non-tertiary education, education non definable by level, subsidiary services to education, R&D; n.e.c.
10	<b>Social protection</b>	Sickness and disability; old age; survivors; family and children; unemployment; housing; R&D; social protection and social exclusion n.e.c.
<i>Total Public Expenditures</i>		

Figure 4 shows the amount of each function over the total, yearly figures for the 1995-2016 period are averaged over the entire period. Pie charts show strong similarities in the structure of public expenditures across the Euro Area countries. *Social protection* is the function of government which absorbs the by-far largest amount of resources, *health*, *economic affairs* and *general public services* follow.

Figure 4 – Government Expenditures by Function, average of yearly figures over the 1995-2016 period.



Public Expenditures change year by year mainly in accordance to the budget law approved at the end of the previous year. Even though expenditures are very much persistent, variations emerge when considering a very long time span as we do (namely, 20 years). In the following Table 2 we show the amount of government expenditures by function in four multi-year periods in order to show their variation. The periods are defined as follow:

- *period 1* from 1996 to 2000,
- *period 2* from 2001 to 2005,
- *period 3* from 2006 to 2010,
- *period 4* from 2011 to 2015,

so we consider 4 five-year periods. Table 2 reports EU15 averages in order to provide a compact display.

Table 2 – Government Expenditures by Function, EU15 average, Entire and Sub Periods.

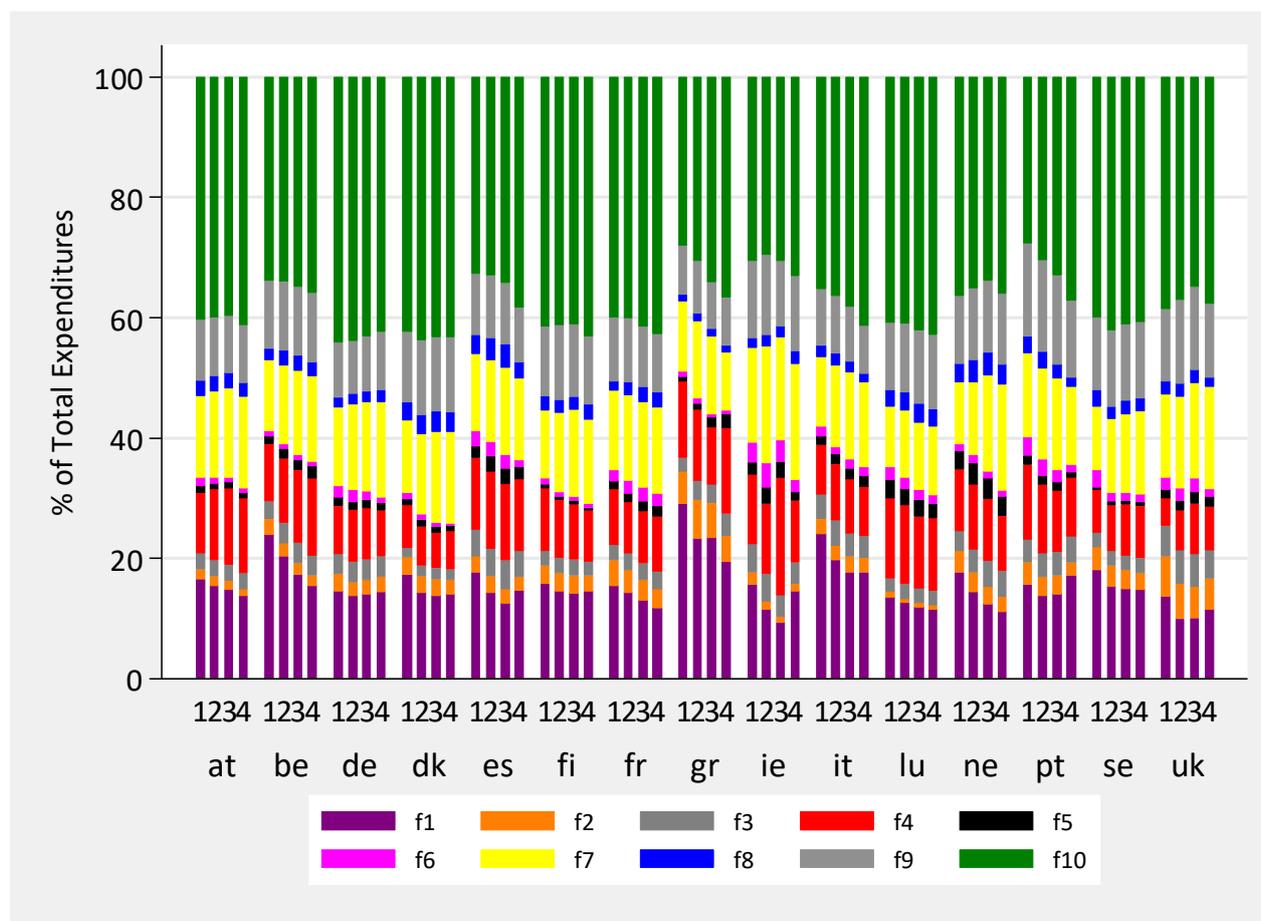
#	COFOG	Period ALL 1995-2016	Period 1 1996-2000	Period 2 2001-2005	Period 3 2006-2010	Period 4 2011-2015	Δ:P4-P1
f1	General public services	15.6	17.4	14.9	14.1	14.1	-3.3
f2	Defence	2.9	3.5	3.2	3.0	2.7	-0.8
f3	Public order and safety	3.3	3.0	3.2	3.3	3.2	0.2
f4	Economic affairs	10.0	8.1	8.5	8.8	8.5	0.4
f5	Environment protection	1.6	1.2	1.4	1.4	1.4	0.2
f6	Housing and community amenities	1.6	1.9	1.7	1.6	1.2	-0.7
f7	Health	13.7	12.1	13.6	14.5	14.7	2.6
f8	Recreation, culture and religion	2.4	2.3	2.3	2.4	2.3	0.0
f9	Education	11.2	10.9	11.3	11.2	10.9	0.1
f10	Social protection	37.8	39.6	40.1	39.7	40.8	1.2

Even though the EU15 aggregate is made of countries that differ in their expenditures structure, variations do emerge. First and foremost, the variation of "General Public Services" is remarkable: it goes from an average of 17.4 in 1996-2000 (period 1) to an average of 14.1 in 2011-2015 (period 4), this is likely explained through the decrease of the interest bill which is included into this function. Indeed, the period considered is commonly known for the decreasing trend of interest rates (see Section 2). The other functions of government to change the most are "Health", which achieves 14.7 from 12.1 percent, and "Social Protection", which increases from 39.6 to 40.8 percent. These two functions might be expanding because of the progressive ageing of the population along the period considered.

Figure 5 shows the amount of government expenditures by country and by function in the four periods introduced above; with respect to the previous Table 2, the figure adds the country dimension. The bars report the amount of each function over the total. The colour used for each function is the same as the one in the pie-charts in Figure 4. In accordance with Figure 4, social protection (f10) emerges as the by-far largest function in any country, general public services (f1) seems to follow, but this does not hold true in all countries at any period.

To appraise the size of the observed variations across periods, the largest and the smallest variations are reported for each function of government in Table 8 in the Appendix.

Figure 5 - Government expenditures by Function, Country and Period.



f1 "General public services", f2 "Defence", f3 "Public order and safety", f4 "Economic affairs", f5 "Environment protection", f6 "Housing and community amenities", f7 "Health", f8 "Recreation, culture and religion", f9 "Education", f10 "Social protection".

## 4. Analysis

In this section we estimate the effect of the interest bill on the government's expenditures decision. The objective is to check whether or not the interest bill in year  $t$  ( $iBill_t$ ) has an effect on primary expenditures in year  $t+1$  ( $pExp_{t+1}$ ). The assumption is that the government observes the variables in year  $t$  and decides about year  $t+1$  expenditures. This time setting is also convenient to minimize simultaneity issues and reflects the fact that year  $t+1$  expenditures are authorized through the budget law approved in year  $t$ ; Presbitero et al. (2014) is an example using a similar time setting across budget variables.

The analysis is developed through the following regression analysis:

$$\Delta pExp_{i,t+1} = \beta_{0,i} + \beta_1 \cdot \Delta iBill_{i,t} + \sum_{m=2}^M \beta_m \cdot \Delta m_{i,t} + \varepsilon_{i,t}, \quad \text{Equation 2}$$

where  $\beta_1$  returns the aggregate across-countries effect of the interest bill (Table 4). We change  $\beta_1$  according to the objective of the estimation as follows:

- $\beta_1 \rightarrow \beta_{1,i}$  to estimate the aggregate by-country effect of the interest bill (Table 5),
- $\beta_1 \rightarrow \beta_{1,f}$  to estimate the by-function pooled effect of the interest bill (Table 6),
- $\beta_1 \rightarrow \beta_{1,i,f}$  to estimate the by-function and by-country effect of the interest bill (Table 7).

The different versions of the  $\beta_1$  coefficient are implemented through interaction terms that return non-linear estimations of the effect of the interest bill.

A set of M-1 control variables are included in the regression. All the control variables are inserted into the equation in a way that the coefficient obtained is interpretable in terms of elasticity; to wit, the dependent variable is log transformed as well as the independent variables that are not released in percentage terms from the source. All the variables are inserted in first-difference, the control variables included are listed in Table 3.

*Table 3– Control Variables*

Gross Domestic Product (GDP)	Log transformed, then first difference
Unemployment Rate (UNR)	First difference
Nominal Effective Exchange Rate (NEER)	Log transformed, then first difference
Structure of Population (POP65)	First Difference
General Election Dummy (election)	

GDP is to account for the business cycle and expenditure potential, the unemployment rate is introduced to account for the pressure on expenditures related to unemployed citizens, the NEER is to account for the cost variation of goods and services purchased abroad by public administrations, the structure of population should reflect the number of people who go on retirement, the election dummy is to account for the electoral cycle.<sup>5</sup>  $\beta_{0,i}$  are the country-specific fixed effects that should capture all the time-invariant characteristic of each country.

Our aim is to make an across-countries/across-functions comparison of the interest bill coefficients obtained. We first estimate Equation 2 by including  $\beta_1$  for the functions and

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<sup>5</sup> As abovementioned, the dependent variable, as well as the explicatives, are in first-difference and the regression therefore aims to explain the variation of primary expenditures. It goes without saying that explaining variables in first-difference is always much harder than explaining variables in level; this is evident when comparing measures of fit such as the R squared. However, first-differences are usually stationary series and therefore more convenient to use and to avoid spurious relations.

countries altogether in order to select the most appropriate specification, after that we will use the alternative interactions of  $\beta_{1,i,k}$  to obtain the coefficients of interest.

The following estimations are organized into two subsections, the first includes regressions for the components of public expenditures altogether (aggregate), the second includes regressions where we distinguish across components (by-function).

### *Aggregate Public Expenditures*

We start with the estimation for the countries (and functions) altogether. Alternative estimations including an increasing number of explicatives are in the following Table 4.

*Table 4 – Aggregate Analysis, Pooled Effect of the Interest Bill*

	1	2	3	4	5
	b/se	b/se	b/se	b/se	b/se
D.iBill	-0.076** (0.028)	-0.075** (0.026)	-0.076** (0.025)	-0.073** (0.021)	-0.071** (0.020)
D.gdp	0.218 (0.217)	0.086 (0.197)	0.108 (0.185)	0.054 (0.193)	0.059 (0.192)
D.unr		-0.005** (0.002)	-0.004* (0.002)	-0.005* (0.002)	-0.004* (0.002)
D.neer			0.191* (0.103)	0.159* (0.079)	0.175* (0.084)
D.pop65				-0.059** (0.025)	-0.058** (0.025)
election					-0.009* (0.004)
constant	0.014** (0.004)	0.017** (0.004)	0.016** (0.004)	0.028** (0.007)	0.030** (0.007)
N	300	300	300	300	300
i	15	15	15	15	15
R <sup>2</sup>	0.044	0.050	0.065	0.103	0.109
bic	-965.354	-961.610	-960.694	-967.549	-963.774
aic	-972.761	-972.722	-975.509	-986.067	-985.997

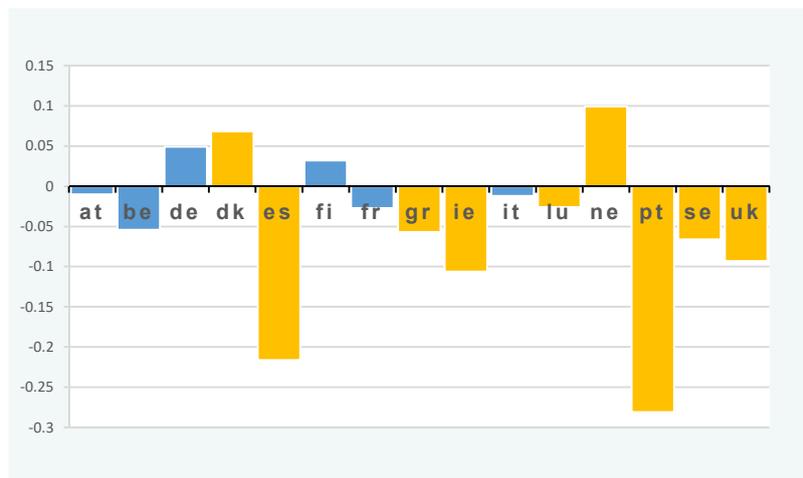
Panel fixed-effect estimation, robust s.e. computed. \* p<0.1, \*\* p<0.05.

Based on the Bayesian and Akaike information criteria (bic and aic at the bottom of the Table), the best fitting model is the one in column 4, this includes all the variables in Table 3 but the election dummy, which is not statistically significant anyway. We therefore select such specification as our benchmark. On the whole, the interest bill appears to play a negative effect: a 1% positive increase in the average change of the interest bill is associated to a 0.07% reduction of the average variation of primary public expenditures at the EU15 level. This estimate is robust to different specifications irrespective of the control variables included (columns 1-5).

Although we expected them positively signed, unemployment and population exert a statistically-significant negative effect at the 10%. We did not have an expectation on the sign of the effective exchange rate, it turns out significant and positive at the 10%. The GDP coefficient turns out correctly signed, in the sense that one expects a positive effect of year  $t$  GDP on year  $t+1$  expenditures, but surprisingly it is not significant in any of the specifications tested.

The by-country effect ( $\beta_{1,i}$ ) is obtained through interaction terms, the estimation output is in Table 5, column 1 reports the benchmark estimation, column 2 is for robustness based on the specification in Table 4 – column 1. The plot of the country coefficients is in Figure 6. It clearly shows that *iBill* is negatively signed for eleven countries out of fifteen and it is statistically significant for seven out of those eleven.

Figure 6 – *iBill* effect by country (Table 5)



Yellow bars are for stat-significant coefficients.

Table 5 – Aggregate Analysis, Effect of the Interest Bill by Country

	1		2	
	b	se	b	se
D.iBill_at	-0.01	-0.037	-0.094**	-0.013
D.iBill_be	-0.054	-0.032	-0.009	-0.007
D.iBill_de	0.049	-0.07	-0.061	-0.043
D.iBill_dk	0.068**	-0.025	0.006	-0.035
D.iBill_es	-0.216**	-0.055	-0.284**	-0.061
D.iBill_fi	0.032	-0.059	-0.037	-0.039
D.iBill_fr	-0.027	-0.024	0.032	-0.033
D.iBill_gr	-0.057**	-0.017	-0.008	-0.019
D.iBill_ie	-0.106*	-0.056	-0.141*	-0.068
D.iBill_it	-0.012	-0.008	-0.014	-0.009
D.iBill_lu	-0.026**	-0.006	-0.013**	-0.003
D.iBill_ne	0.099**	-0.026	0.182**	-0.035
D.iBill_pt	-0.281**	-0.023	-0.295**	-0.026
D.iBill_se	-0.066**	-0.014	-0.031*	-0.017
D.iBill_uk	-0.093**	-0.007	-0.086**	-0.009
D.gdp	0.028	-0.229	0.116	-0.282
D.unr	-0.003	-0.003		
D.neer	0.165*	-0.081		
D.pop65	-0.058**	-0.024		
constant	0.030**	-0.008	0.019**	-0.006
N	300		300	
i	15		15	
R <sup>2</sup>	0.131		0.081	
bic	-982.731		-983.013	
aic	-997.546		-986.717	

Panel fixed-effect estimation, robust s.e. computed. \* p<0.1, \*\* p<0.05.

More in details, the effect is significantly negative (at 5-10%) in Portugal, Spain, Ireland, the UK, Sweden, Greece and Luxemburg (in order of intensity). Such a negative effect is particularly strong in Portugal and Spain. Differently, the Netherlands and Denmark exhibit statistically positive coefficients.

When considering the countries for which the effect is negative, we could split them into groups, the difference lying on the possible explanation of such a negative effect. That is: Portugal and Greece might exhibit it because of their relaxed fiscal stance during the period of decreasing interest rates (1995-2006) and their need for correction during and after the Euro Area debt crisis. Spain and Ireland mainly for their need of correction during and after the Euro Area debt crisis, since they exhibit a sound budget stance (decreasing PPE) before the Global Financial Crisis/Great Recession (2007-09). The last group includes the UK, Sweden and Luxembourg. Apart from Luxembourg, which represents a peculiar case,

Sweden and the United Kingdom might be considered countries that exhibit such a negative effect more for their general responsible attitude towards budget equilibrium than for their need to consolidate. Their consolidation effort in the limited period of the Euro Area debt crisis might help to explain their coefficient but definitely at a much smaller extent with respect to Ireland and Spain.

On the other side, the Netherlands and Denmark stand out. Perhaps, they exhibit a significantly positive effect because these are countries that do not counterbalance the interest bill and in this case the positive coefficient just signal association.

It does not go unnoticed that the interest bill effect is not significant for countries as Italy or Belgium, which have high debt-to-GDP ratios. Particularly Italy, which faces enduring challenges in the management of its debt, represents a case difficult to explain since it is known to maintain a primary surplus in order to counterbalance the effect of the interest bill on its overall budget.

When comparing the by-country coefficients in Figure 6 with the values of the interest bill in GDP terms in Figure 2, no correlation seems to hold. That is, in those countries where an effect emerges, as appearing from the estimation output in Table 5, it is not the level of the interest bill *per se* that makes such a relationship to emerge.

### *By Function of Government*

Public authorities usually do not target indiscriminately all the sectors of public spending for fiscal consolidations (Castro 2007): some sectors are more likely targeted than others. Which functions of government are selected for correction may depend on different factors. The political faith of the government in place plays a role; for instance, some parties might care more about the social consequences of expenditure-based fiscal consolidations (Agnello et al. 2016). Alternatively, if it is a specific function of government that causes disequilibrium, then such a function could be targeted for correction. Furthermore, the government might opt for *una-tantum* corrections and consequently select some functions or, alternatively, opt for a structural correction and therefore choose other functions. Actually, there is also to notice that weak governments could opt to target all the sectors indiscriminately and implement so-called “linear cuts”.

To understand which sectors of public spending are more responsive to an interest bill variation, public expenditures is now disaggregated into the function of government (COFOG classification, see Table 1). The by-function analysis in this section is developed on functions 2-10, that is, on all functions but the one including the interest bill.<sup>6</sup>

The estimation of the pooled effect of the interest bill by-function of government is reported in the following Table 6. The estimation is delivered by using the specification selected in the previous sub-section (Table 4 - column 4) and it is directly comparable with that one, which represents the across-functions average. The estimated coefficients by function 2-10 of government are plotted in Figure 7.

At the EU15 level, the effect of the interest bill is negative for all the functions of government, but it is not statistically significant for function 4 “Economic Affairs” and function 10 “Social protection”. The latter is likely to be very stable regardless of the interest bill evolution. Function 6 “Housing and communities amenities” and function 5 “Environment protection” are the most responsive.

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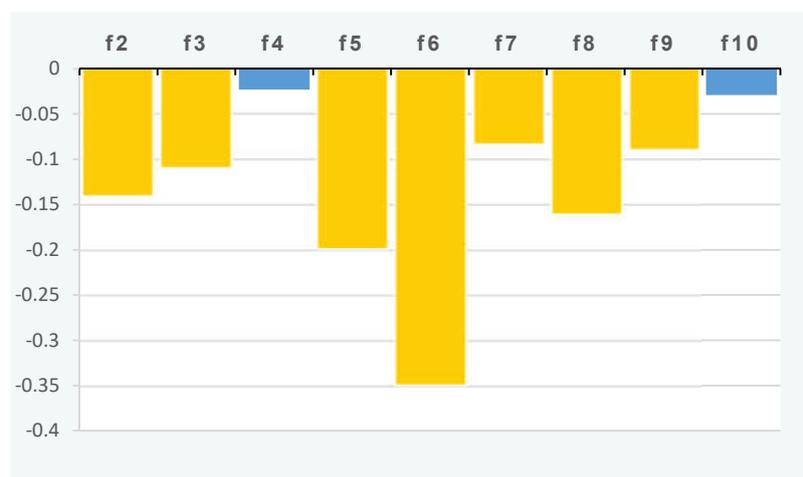
<sup>6</sup> It is to notice that primary public expenditures studied in the previous sub-section is not the direct summation of the functions 1-10 in Table 1 (that would be Total Public Expenditures) because that sum includes the interest bill, which falls into function 01 “General Public Services”; while primary public expenditures is total expenditures less the interest bill.

Table 6 – By-Function Analysis, Pooled Effect of the Interest Bill

By-Function →	f2	f3	f4	f5	f6	f7	f8	f9	f10
D.exp <sub>t+1,f</sub>	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
D.iBill	-0.141** (0.052)	-0.110** (0.028)	-0.023 (0.076)	-0.199** (0.073)	-0.349** (0.110)	-0.084** (0.025)	-0.161** (0.032)	-0.090** (0.042)	-0.029 (0.023)
D.gdp	-0.372 (0.662)	0.330 (0.193)	-0.250 (0.411)	0.859** (0.225)	0.481 (0.437)	0.385 (0.257)	0.173 (0.295)	0.180 (0.191)	-0.091 (0.202)
D.unr	-0.020* (0.010)	-0.007* (0.003)	-0.002 (0.012)	-0.002 (0.008)	-0.022 (0.015)	-0.012** (0.004)	-0.014** (0.005)	-0.007** (0.003)	-0.008* (0.004)
D.neer	-0.194 (0.133)	-0.045 (0.086)	0.510 (0.367)	0.077 (0.148)	-0.083 (0.246)	0.060 (0.082)	-0.012 (0.114)	0.051 (0.066)	0.089 (0.081)
D.pop65	0.004 (0.028)	-0.036 (0.022)	-0.112 (0.077)	-0.065* (0.032)	-0.042 (0.063)	-0.045** (0.016)	-0.057 (0.038)	-0.035* (0.017)	-0.040** (0.018)
constant	0.006 (0.017)	0.022** (0.006)	0.039** (0.016)	0.010 (0.007)	-0.020 (0.018)	0.027** (0.006)	0.024** (0.010)	0.019** (0.004)	0.032** (0.005)
N	290	290	290	290	290	290	290	290	290
R <sup>2</sup>	0.054	0.197	0.013	0.097	0.059	0.316	0.131	0.188	0.110
bic	-480.3	-965.1	-34.5	-423.8	-40.1	-1031.3	-652.3	-1068.8	-1128.1
aic	-498.6	-983.4	-52.9	-442.1	-58.4	-1049.7	-670.6	-1087.2	-1146.5

Panel fixed-effect estimation, robust s.e. computed. \* p<0.1, \*\* p<0.05.

Figure 7 – Interest Bill effect by Function of Government.



f2 "Defence", f3 "Public order and safety", f4 "Economic affairs", f5 "Environment protection", f6 "Housing and community amenities", f7 "Health", f8 "Recreation, culture and religion", f9 "Education", f10 "Social protection". Yellow bars are for stat-significant coefficients.

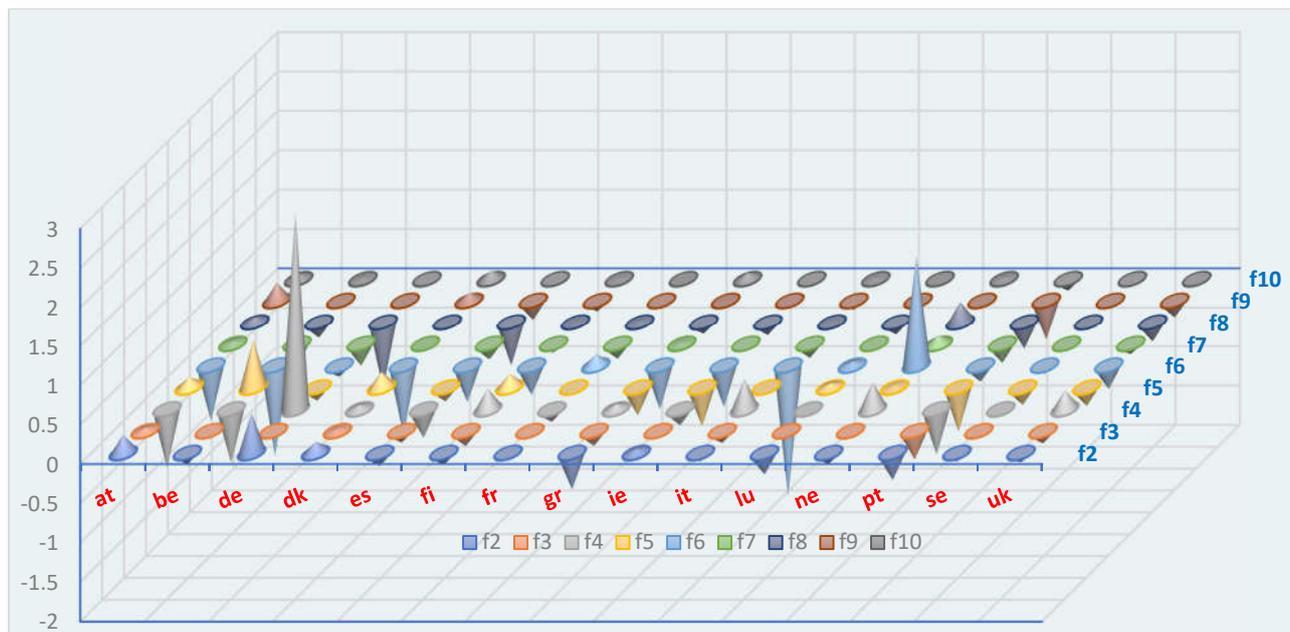
The last estimation is to deliver estimates of the effect of the interest bill by function and by country. This is in Table 7 in which significantly-negative coefficients are in bold-purple font, while significantly-positive coefficients are in bold-blue font. The coefficients are plotted in Figure 8 for an enhanced display.

Table 7 – By-Function Analysis, Country Effect of the Interest Bill

By-Function →	f2	f3	f4	f5	f6	f7	f8	f9	f10	#/#
D.exp <sub>t+1,f</sub>	b	b	b	b	b	b	b	b	b	#/#
D.iBill_at	<b>0.234**</b>	0.045	<b>-0.737**</b>	<b>0.132**</b>	<b>-0.696**</b>	0.036	0.074	<b>0.234**</b>	<b>0.066**</b>	<b>2/4</b>
D.iBill_be	-0.137	-0.053	<b>-0.680**</b>	<b>0.610**</b>	<b>-1.150**</b>	<b>-0.284**</b>	<b>-0.198**</b>	-0.030	0.022	<b>4/1</b>
D.iBill_de	<b>0.508**</b>	-0.051	<b>2.518**</b>	<b>-0.166**</b>	-0.139	<b>-0.278**</b>	<b>-0.849**</b>	-0.031	-0.073	<b>3/2</b>
D.iBill_dk	<b>0.148*</b>	0.030	0.056	<b>0.199**</b>	<b>-0.870**</b>	-0.003	-0.016	<b>0.104**</b>	<b>0.108**</b>	<b>1/4</b>
D.iBill_es	-0.166	<b>-0.141**</b>	<b>-0.361**</b>	-0.176	<b>-0.460**</b>	<b>-0.198**</b>	<b>-0.549**</b>	<b>-0.240**</b>	-0.08	<b>6/0</b>
D.iBill_fi	-0.150	<b>-0.188**</b>	0.267	<b>0.175**</b>	<b>-0.371**</b>	-0.107	0.010	<b>-0.129**</b>	0.013	<b>3/1</b>
D.iBill_fr	-0.066	<b>-0.066**</b>	<b>-0.158**</b>	-0.099	0.146	<b>-0.191**</b>	0.018	<b>-0.065**</b>	-0.002	<b>4/0</b>
D.iBill_gr	<b>-0.460**</b>	<b>-0.184**</b>	0.068	<b>-0.356**</b>	<b>-0.556**</b>	0.018	<b>-0.147**</b>	0.004	<b>0.080**</b>	<b>5/1</b>
D.iBill_ie	0.055	<b>-0.088*</b>	<b>-0.201*</b>	<b>-0.488**</b>	<b>-0.524**</b>	-0.074	<b>-0.164**</b>	-0.027	-0.073	<b>5/0</b>
D.iBill_it	<b>-0.103**</b>	<b>-0.148**</b>	<b>0.392**</b>	<b>-0.060**</b>	<b>-1.658**</b>	<b>-0.178**</b>	0.007	<b>-0.108**</b>	<b>0.017*</b>	<b>6/2</b>
D.iBill_lu	<b>-0.270**</b>	<b>-0.012**</b>	<b>-0.057**</b>	<b>0.055**</b>	<b>0.048**</b>	<b>-0.023**</b>	<b>-0.156**</b>	<b>-0.009*</b>	-0.007	<b>6/2</b>
D.iBill_ne	-0.134	-0.023	<b>0.351**</b>	0.026	<b>1.404**</b>	<b>0.107**</b>	<b>0.263**</b>	-0.024	0.021	<b>0/4</b>
D.iBill_pt	<b>-0.342**</b>	<b>-0.359**</b>	<b>-0.575**</b>	<b>-0.561**</b>	<b>-0.202**</b>	<b>-0.241**</b>	<b>-0.335**</b>	<b>-0.499**</b>	<b>-0.145**</b>	<b>9/0</b>
D.iBill_se	<b>-0.105**</b>	<b>-0.045**</b>	-0.095	<b>-0.220**</b>	<b>-0.101**</b>	<b>-0.052**</b>	<b>-0.059**</b>	<b>-0.053**</b>	<b>-0.066**</b>	<b>8/0</b>
D.iBill_uk	<b>-0.115**</b>	<b>-0.154**</b>	<b>0.245**</b>	<b>-0.231**</b>	<b>-0.296**</b>	<b>-0.129**</b>	<b>-0.245**</b>	<b>-0.208**</b>	<b>-0.083**</b>	<b>8/1</b>
<b>#/#</b>	<b>6/3</b>	<b>10/0</b>	<b>7/4</b>	<b>7/5</b>	<b>11/2</b>	<b>9/1</b>	<b>9/1</b>	<b>8/2</b>	<b>3/4</b>	
D.gdp	-0.445	0.312	-0.540	0.731**	0.394	0.407	0.185	0.199	-0.083	
D.unr	-0.025*	-0.007	0.000	-0.001	-0.02	-0.010**	-0.011	-0.006*	-0.007	
D.neer	-0.165	-0.058	0.535	0.130	-0.236	0.037	-0.019	0.048	0.100	
D.pop65	-0.017	-0.038*	-0.122	-0.065*	-0.023	-0.041**	-0.046	-0.035*	-0.038*	
constant	0.013	0.024**	0.052**	0.018**	-0.021	0.027**	0.024**	0.021**	0.032**	
N	290	290	290	290	290	290	290	290	290	
R <sup>2</sup>	0.083	0.235	0.043	0.136	0.096	0.347	0.170	0.315	0.146	
bic	-495.1	-984.8	-49.0	-442.4	-57.4	-1050.4	-671.2	-1124.1	-1145.6	
aic	-509.7	-999.5	-63.7	-457.1	-72.0	-1065.1	-685.9	-1138.8	-1160.3	

Panel fixed-effect estimation, robust s.e. computed. \* p<0.1, \*\* p<0.05. Rows and Columns #/# report the number of significantly negative and significantly-positive interest-bill coefficients by country and by function respectively.

Figure 8 – Interest Bill Effect by Function and Country (Table 7)



In reading the estimation output of Table 7 we keep the countries as perspective (rows in the shaded part of the table) and we use the aggregate (across-functions) estimation output in Table 5 as reference. That output suggested a significantly negative effect of the interest bill in Portugal, Spain, Ireland, the UK, Sweden, Greece and Luxemburg (in order of intensity); differently, the Netherlands and Denmark exhibited statistically positive coefficients.

**Portugal** confirms a negative effect in all the functions (average -0.362, standard deviation 0.155, variation coefficient 0.43) and this is particularly high in f4, f5.<sup>7</sup> The negative effect for **Spain** derives from six functions (average -0.324, standard deviation 0.159, variation coefficient 0.49), it is therefore less widespread than in Portugal and it is particularly high in f8, f6. **Ireland** exhibits a negative effect in five functions (average -0.293, standard deviation 0.199, variation coefficient 0.68), particularly high in f6, f5. The **United Kingdom** and **Sweden** exhibit a pattern close to Portugal's, namely, the negative effect emerges in almost all functions of government (UK: average -0.182, standard deviation 0.073, variation coefficient 0.40. SE: average -0.087, standard deviation 0.058, variation coefficient 0.66). **Greece** counterbalances the interest bill in five functions (average -0.34, standard deviation 0.175, variation coefficient 0.51), the effect is high in f6, f2. **Luxemburg**

<sup>7</sup> Average and standard deviation are calculated only using the statistically-significant coefficients. The variation coefficient is obtained as the ratio between the standard deviation and the mean, it informs about dispersion around the mean.

exhibits a significantly-negative effect in six functions of government (average -0.087, standard deviation 0.104, variation coefficient 1.19) and the higher correction is in f2.

The other countries alternate positive and negative coefficients and do not exhibit any clear pattern. Interesting to note that some countries, which did not exhibit a significant effect in the aggregate estimation (Table 5), show some very high coefficients in specific functions. For instance, **Italy** exhibits the highest negative coefficient across all the country-function combinations in f6 while all the others (apart for f4) are quite small. Then, the aggregate estimation in Table 5 might be misleading in the sense that Italy does counterbalance, but concentrating the correction in very few, if not just one, sectors. The same applies to **Belgium**, which shows an effect of the interest bill particularly in f8.

If we take the functions of government as perspective (columns), f6 “Housing and community amenities” and f3 “Public order and safety” are those responding more uniformly (negatively) across countries; nonetheless, also some other functions (particularly f7 “Health” and f8 “Recreation, Culture and Religion”) respond.

Conclusions are not straightforward since a clear, unanimous pattern does not emerge. Nonetheless, it seems unquestionable that the interest bill plays a significantly negative effect in the majority of the cases (countries-functions) considered. Importantly, in the case of social protection, as well as for some other functions, an alternative explanation of the missing effect of the interest bill is also possible. That is, some functions are very persistent and change their evolution only very slowly (to wit, in  $t+2$ ,  $t+3$ , ...) even when the decision about correction has been taken and implemented.<sup>8</sup>

## 5. Conclusions

Public debt is at the centre of the economic debate, its amount conditions economic policy wherever a limit to the amount sustainable is perceived to exist or when budget equilibrium is an economic policy objective. In the introduction to our analysis we have explained why a negative relationship from the interest bill to public expenditures might exist. The research presented in this paper aimed to judge the existence of such a relationship.

On the whole, we have found evidence of a negative effect of the interest bill on public expenditures at the aggregate EU15 level (Table 4). At the country level, such a result is

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<sup>8</sup> This applies very much to pension expenditures in which new rules motivated by year- $t$  interest bill might impact on expenditures only some years in the future.

supported by at least half of the countries used for the analysis (Table 5). Even though country-function estimates of the effect (Table 7) confirm the evidence by country at a large extent, those alert about heterogeneity across countries. That is, some countries counterbalance the interest bill dynamics spreading across all functions of government, others concentrate on some few functions. This last statement seems true also for countries that seem not to counterbalance on the basis of the aggregate (across-functions) estimation.

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# Appendix

Figure 9. Market Yield of the 10-year benchmark bond.

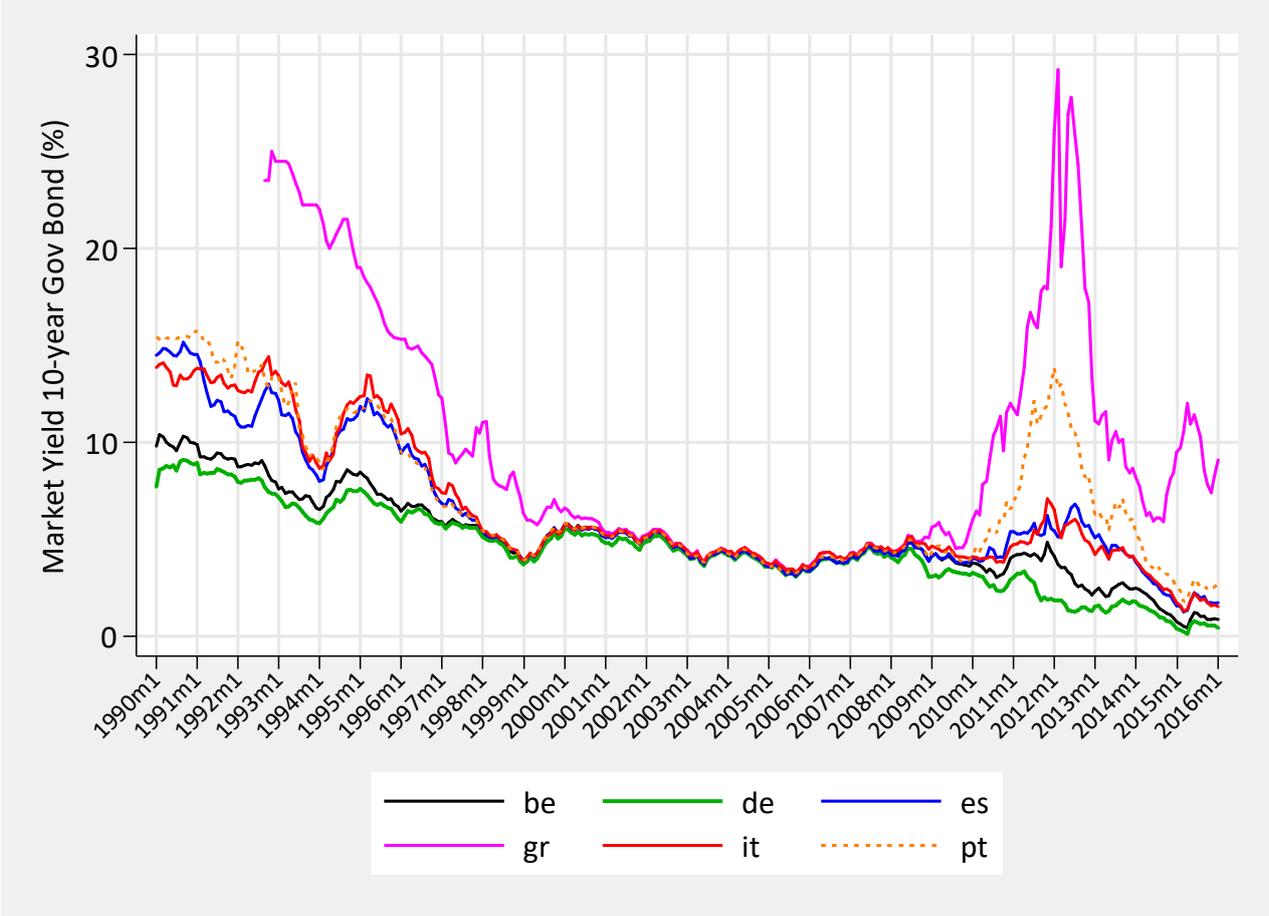


Table 8 –Variation across periods of each expenditure by function over the total,  
largest positive and negative variations only are reported.

COFOG 99	#	P1	P2	$\Delta=P2-P1$		P3	$\Delta=P3-P2$		P4	$\Delta=P4-P3$	
General public services	1	23.90	20.23			17.16	<b>-3.07</b>	<b>BE</b>	15.50		
General public services	1	14.55	13.82	<b>-0.72</b>	<b>DE</b>	14.10	<b>0.28</b>	<b>DE</b>	14.43		
General public services	1	28.97	23.30	<b>-5.67</b>	<b>GR</b>	23.40			19.44	<b>-3.95</b>	<b>GR</b>
General public services	1	15.61	11.47			9.20			14.58	<b>5.38</b>	<b>IE</b>
Defence	2	5.50	6.38	<b>0.88</b>	<b>GR</b>	5.75	<b>-0.63</b>	<b>GR</b>	4.44	<b>-1.31</b>	<b>GR</b>
Defence	2	1.97	1.46			0.98			1.08	<b>0.10</b>	<b>IE</b>
Defence	2	1.06	0.62			0.78	<b>0.16</b>	<b>LU</b>	0.80		
Defence	2	6.57	5.76	<b>-0.82</b>	<b>UK</b>	5.39			5.11		
Public order and safety	3	2.12	3.29	<b>1.17</b>	<b>GR</b>	3.24			3.46		
Public order and safety	3	4.85	4.42	<b>-0.43</b>	<b>IE</b>	3.72	<b>-0.70</b>	<b>IE</b>	3.62		
Public order and safety	3	3.22	3.90			4.17	<b>0.27</b>	<b>NE</b>	4.11		
Public order and safety	3	3.89	4.09			4.03			4.40	<b>0.38</b>	<b>PT</b>
Public order and safety	3	5.11	5.71			5.45			4.85	<b>-0.60</b>	<b>UK</b>
Economic affairs	4	9.96	11.84	<b>1.88</b>	<b>AT</b>	12.80			12.57		
Economic affairs	4	12.82	11.67	<b>-1.15</b>	<b>GR</b>	9.46	<b>-2.20</b>	<b>GR</b>	14.32	<b>4.86</b>	<b>GR</b>
Economic affairs	4	11.49	11.65			19.63	<b>7.98</b>	<b>IE</b>	10.23	<b>-9.40</b>	<b>IE</b>
Environment protection	5	0.86	1.08			1.65	<b>0.58</b>	<b>GR</b>	2.35	<b>0.69</b>	<b>GR</b>
Environment protection	5	1.98	2.76	<b>0.78</b>	<b>IE</b>	2.47	<b>-0.29</b>	<b>IE</b>	1.57	<b>-0.90</b>	<b>IE</b>
Environment protection	5	3.06	2.73	<b>-0.34</b>	<b>LU</b>	2.75			2.44		
Housing and community amenities	6	3.22	4.05	<b>0.83</b>	<b>IE</b>	3.74			2.01	<b>-1.73</b>	<b>IE</b>
Housing and community amenities	6	1.62	1.19			1.50	<b>0.30</b>	<b>IT</b>	1.35		
Housing and community amenities	6	3.22	2.66			2.00	<b>-0.66</b>	<b>PT</b>	1.13		
Housing and community amenities	6	2.81	1.56	<b>-1.25</b>	<b>SE</b>	1.40			1.46	<b>0.06</b>	<b>SE</b>
Health	7	13.43	14.21	<b>0.78</b>	<b>AT</b>	14.78			15.13		
Health	7	11.65	12.95			12.83			9.68	<b>-3.15</b>	<b>GR</b>
Health	7	15.75	19.41	<b>3.66</b>	<b>IE</b>	17.01	<b>-2.40</b>	<b>IE</b>	19.30	<b>2.29</b>	<b>IE</b>
Health	7	10.44	12.20			15.96	<b>3.76</b>	<b>NE</b>	17.59		
Recreation, culture and religion	8	1.67	1.77			1.76			2.09	<b>0.33</b>	<b>DE</b>
Recreation, culture and religion	8	3.22	3.48			3.79	<b>0.31</b>	<b>ES</b>	2.70	<b>-1.09</b>	<b>ES</b>
Recreation, culture and religion	8	3.03	3.73	<b>0.70</b>	<b>NE</b>	3.70			3.32		
Recreation, culture and religion	8	2.81	2.68			2.27	<b>-0.40</b>	<b>PT</b>	1.73		
Recreation, culture and religion	8	2.79	1.89	<b>-0.90</b>	<b>SE</b>	2.12			2.19		
Education	9	10.20	9.78	<b>-0.42</b>	<b>AT</b>	9.57			9.65		
Education	9	12.97	13.37			10.85	<b>-2.52</b>	<b>IE</b>	12.50	<b>1.65</b>	<b>IE</b>
Education	9	11.33	11.50			12.23	<b>0.72</b>	<b>LU</b>	12.28		
Education	9	15.49	15.45			14.69			12.78	<b>-1.91</b>	<b>PT</b>
Education	9	12.06	13.87	<b>1.82</b>	<b>UK</b>	13.68			12.31		
Social protection	10	44.16	43.95			43.22			42.45	<b>-0.77</b>	<b>DE</b>
Social protection	10	27.88	30.53			34.18	<b>3.65</b>	<b>GR</b>	36.66		
Social protection	10	27.61	30.29	<b>2.68</b>	<b>PT</b>	33.07			37.07	<b>4.01</b>	<b>PT</b>
Social protection	10	38.49	36.99	<b>-1.50</b>	<b>UK</b>	34.95	<b>-2.04</b>	<b>UK</b>	37.60		

Note: the  $\Delta$  columns report the difference between two subsequent periods, only the largest and the smallest variations are reported for each function along with the country in which that variation takes place. The values generating that variation are also reported for completeness. For instance: the largest variation for the function "social protection" between P1 and P2 amounts to 2.68 and occurred in Portugal, that variation is generated by the difference between 30.29 (p2) and 27.61 (p1).