The Sustainability of the Greek Public Debt: A Theoretical Approach with Empirical Data

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ABSTRACT

Highly indebted countries like Greece, Portugal and Spain are easily thought to be blamed for the eurozone's instability. In this paper we examine the nature of Greece's debt-to-GDP ratio in terms of economic theory, and we try to propose new ides in order to overcome this issue. A closer view is cast on Germany and the UK in order to notify any similarities or differences with Greece's case. It turns out that all of the three countries experienced severe increase of their debt-to-GDP ratios after 2008, but for different reasons. In the case of Greece, it was the buy-back deal of 2012 for the government bonds that was thought it could rescue, for now, the downfall of Greek trustworthiness. Is this really the case or this debt buy-back is a success only for the banking sector?

JEL classification: *E61, E62, E66, F34.*

Keywords: *Greek debt, Buy-back deal of government bonds, Long-run stability.*

1. INTRODUCTION

How unique is the case of Greece in terms of debt-to-GDP ratio during the crisis' years? In many European economies we have witnessed continuous calls for expansionary monetary and fiscal policies to lessen the adverse effects of the global crisis. So far, though, policy actions thought to be bold and risky have prevented the collapse of the crisis-stricken countries at the immeasurable cost of unjust social taxation measures, that deprive from the penniless and donate to the prosperous.

Greek bonds have become highly popular after the successful buy-back that was carried out during December 2012. This is justified from the 5% increase of the Greek 10 year bond. Apart from that, after the buy-back announcement from the Eurogroup, Greek bonds' profits rose by 36%. Moreover, their rates fell from 22,5% (mid-June, 2012) to 11,5% (mid-December, 2012). It is calculated that hedge funds currently hold 10-15 billion euros of Greek debt, while they are expanding their position by buying more Greek bonds, due to the profits the buy-back and their sell to the secondary market provide.

As far as fiscal policy is concerned, higher direct and indirect taxation in a combination with lower government spending, a model that is used currently form the Greek government, is thought to be a one-way road to approaching reduction of public deficit, and, in the longer run,

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development. Theoretically speaking, a lowering of taxation does cause balancing effects for the trade balance, by lowering private spending, and therefore, the need for imports. What happens, though, when an economy like Greece, does not export industrial, but only agricultural products and only some products of the secondary sector? It is widely believed that the market, in these cases, will absorb any disequilibrium and in the long-term, restore to its balance fairly orderly and swiftly. The EU holds this assumption as the cornerstone of the European architecture, which is depicted on the fact that it relies heavily on an independent central bank (ECB) focused almost exclusively on price stability, the Growth and Stability Pact and the liberalization of labor and product markets. As far as the governments are concerned, they can only be a source of instability. In addition to that, labor markets must become more flexible like the 'textbook' model in order to enhance the stability properties of the market mechanism.

The above view is currently falsified by the facts that countries like Greece face. The fake lowering of the trade deficit happened, not because of increased exports, but due to the lowering of imports, since the diminished base salary bottomed to €586 (gross). To add insult to injury, rising taxation made consumption give way to savings, thus, decreasing demand for domestic and foreign goods. As for the government's role, widespread skeptic whispers that are gradually turning into shouts, state that without supporting mechanisms that exist in other monetary unions, such as the stabilization and equalization functions that accompany a large federal budget, the euro would will, as it already does, face serious problems. As an answer, many European economists and the Commission itself would give a number of imaginative economic arguments of why the EU is different. Generally speaking, the euro area economic and financial architecture was based on the assumption that major economic shocks, endogenous to the system, were unlikely to hit the European economy and that, therefore, policy mechanisms for such an eventuality were unnecessary, if not positively detrimental. As in many walks of life, the danger is always in believing in one's own rhetoric (Tsakalotos, 2010). The rest of the paper is structured as follows: The second part consists of the current literature that deals with public debt issues, especially with debt sustainability and with signs of relationship between debt and other macroeconomic variables. Part 3 discusses the case of Greek debt sustainability in the light of the new buy-back deal that was proposed and decided at the end of 2012. Part 4 provides us with the methodology used in order to calculate a prediction of debt-to-GDP ratio for 2012 for Greece, Germany and the UK. The 5th part discusses the results achieved and displays all the necessary graphs in order to understand the similarities that the three economies have from 2008 onwards.

2. LITERATURE REVIEW

In their paper about public debt sustainability, Nicolescu Cr, Pirtea M., and Boþoc Cl. (2011) stress out that in many developed markets and in a few emerging markets, one should not forget that expansionary policies mitigated the adverse effects of the global crisis and very likely prevented a collapse of the global financial system and the world economy. It appears that a fiscal exit should take place only gradually. Future scenarios as well as debt target analysis highlight that public debt has become, or is at least at the risk of becoming, unsustainable in many developed markets but only in a few emerging markets. At least in theory, most emerging markets could afford to run looser fiscal policies, for instance by extending counter-cyclical fiscal policies in order to smooth the fall-out from the global crisis.

A very interesting analysis of the impact of news about Greek bailout on banks' stocks has been conducted by Mink M. and de Haan J. (2012). In their research they focused on 48 European banks which had taken part at the stress test performed by the Committee of European Bank Supervisors in July 2010. By isolating 20 stock days of *extreme* returns for these banks, the researchers tried to identify whether news about the economic situation in Greece in general and news about a Greek bailout in particular can lead to abnormal returns. Their findings are that, only news on a possible Greek bailout can be a signal of European governments' willingness in general to use public funds to combat financial crisis, and, therefore, lead to an impact on bank stock prices. In contrast, the price of sovereign debt of Portugal, Ireland, and Spain responds to both news about the economic situation of Greece and news about a Greek bailout.

Baum A., Checcherita-Westphal C., and Rother P. (2012) investigated whether there are any signs of relationship between public debt and economic growth. By focusing on 12 euro-area countries for the period 1990-2010, their results suggest that the short-run impact of debt on GDP growth is positive, but decreases to around zero and loses significance in cases where public debt-to-GDP ratios rise beyond 67%. Another significant finding is that long-term interest rate is subject to increased pressure when the public debt-to-GDP ratio is above 70%.

Arghyrou M. G. and Tsoukalas J. D. (2010) used insights from the literature on currency crises to offer an analytical treatment of the crisis in the market for Greek government bonds. Their argument is that the crisis itself and its escalating nature are very likely to be the result of: (a) steady deterioration of Greek macroeconomic fundamentals over 2001-2009 to levels inconsistent with longterm EMU participation; and (b) a double shift in markets' expectations, from a regime of credible commitment to future EMU participation under an implicit EMU/ German guarantee of Greek fiscal liabilities, to a regime of non-credible EMU commitment without fiscal guarantees, respectively occurring in November 2009 and February/March 2010. To minimise the risk of contagion of the present (2012) crisis and to avert future ones, the authors think that it is important for the EMU to undertake institutional reforms towards two directions. First, to prevent future crises, improve the effectiveness of fiscal supervision applied to individual EMU-member states. Second, for handling this crisis and future ones, minimise the risk of default risk. To achieve this, the EMU must develop a mechanism of emergency financing, with clear and transparent rules reassuring markets that no money will be lost on investments involving EMU government bonds.

In his paper Michelis L. (2011) examines eight suggested solutions to the Greek debt crisis and six political and institutional reforms in order to achieve a single objective: eliminate deviations from the EU benchmark and thus transform the country into a modern EU state. His final suggestion is that, in the absence of a national political consensus to tackle the debt crisis and implement political and institutional reforms, a new political force should be formed to accomplish these tasks.

3. GREEK PUBLIC DEBT ANALYSIS

It is widely believed that after the new sustainability package of 2011 Greece's debt looks much more controllable than before[1]. Control of the debt can be succeeded as long as the Greek

government achieves its fiscal adjustment targets. So far the evidence is that Greek political leaders are more than willing to take the extensive and unpopular austerity measures in order to do so.

It is important to focus on certain features of the Greek debt problem. First, there are relatively large privatizations planned that are believed they could reduce debt. Second, and most important, there exist large public financial assets that can lower net debt. Third, the PSI (Private Sector Involvement) program causes a misleading increase in gross debt that is counteracted by a corresponding rise in assets. And finally, only moderate interest rates will be imposed on the larger portion of the Greek debt, and this will make the burden somewhat lighter than might be expected. But how can someone from the Ministry of Finance explain the fact that extra borrowing, instead of covering past debt, goes to bank recapitalization, and especially to bond enhancement collateral?

On the other hand, the IMF and the European Commission have systematically been focusing on *gross* debt rather than *net* debt. On the contrary, the OECD reports numbers that show there are larger state assets that can make net debt significantly smaller. More specifically, it reported that at the end of 2010, Greece's gross public debt was €328 billion. General government *gross* debt was €339 billion and general government financial assets were €76 billion, thus placing *net* general gross debt at €263 billion (OECD, 2011). In addition to that, another major problem is that of the debt's composition. 'Official program debt (IMF and EU support) stood at €31 billion at end-2010 and will stand at €71 billion at end-2011. As of mid-June, debt held in purchases by the ECB (European Central Bank) through its Securities Markets Program has been estimated by Barclays Capital at €49 billion. Greek public sector funds held €30 billion; rest-of-world official institutions, mainly in Asia, €25 billion; and the Greek central bank, €13 billion. This places total public sector holdings at €188 billion (using the end-2011 figure for IMF-EU program), or 50,3% of end-2011 debt. Of the rest, eight Greek banks hold €32 billion. The half of total debt held by the private sector (including Greek banks) is broadly consistent with the €135 billion expected in the PSI' (Cline R. W., 2011).

Table 3.1
Greek Public Debt Indicators (% and billion euros)

Indicator	2010	2011	2012	2013	2014	2015	2017	2020
Gross debt/GDP	143	166	175	169	159	147	131	113
Net debt/GDP	no	121	119	113	102	88	81	69
Interest/GDP	5,5	7.2	7,5	7,6	7,2	6,6	5,9	5,2
Amortization/GDP	12	6,8	7,4	8,9	6,5	2,4	0,5	
Primary surplus/GDP	-4,9	-0,8	1,5	3,5	6,4	7,7	6,4	6,4
Real growth (percent)	-4,4	-3,8	0,6	2.1	2,3	2,7	3	3
Gross debt (bn €)	328	374	399	396	386	370	357	354
Official: Program"	31	104	160	197	210	199	139	189
Private and other official	297	270	239	199	177	171	167	165
Assets (bn €)	76	101	129	130	140	149	136	139
Privatization (bn €)	0	2,9	7,5	11	13,6	15,1	0	0
GDP (bn€)	230	225	228	235	243	251	273	313
Average interest rate (percent)	4,9	4,7	4,5	4,4	4,3	4,3	4,5	4,6

Source: IMF, EU, EFSF.

Table 3.1 depicts the course of Greek public debt before and after the official support package of July 2011. As we can see, debt peaks in 2012 at 175% of GDP, and it is expected to fall in 2020 to just 113%. PSI collateral is believed to enhance public assets from €76 billion to €149 billion in 2015. Another significant projection is that the rate of interest paid by the Greek economy is to be lowered, from 7.2% of GDP in 2011 to 5.2% by 2020. Obviously, all of the above figures (after 2012) are dynamic, since a successful reduction of debt-to-GDP ratio will only happen if the fiscal targets are achieved.

4. METHODOLOGY AND DATA

Since our main interest is public debt, it is useful to refer to several concepts of public debt mathematical equations that have been habitually used. Initially, the dynamics of debt accumulation can be described in absolute terms as:

$$D_{t+1} - D_t = r_{t+1} \times D_t - PB_{t+1} \tag{1}$$

where

D denotes a country's gross public debt stock,

r captures the *real* interest rate paid on public debt outstanding, and

PB^2 represents the government's primary balance, i.e. the government's fiscal balance before net debt interest payments.

We can also express the above equation in terms of GDP, in order to connect productivity with public (government) lending:

$$\frac{D_{t+1}}{Y_{t+1}} = (1 + r_{t+1}) \times \frac{D_t}{Y_t} \times \frac{Y_t}{Y_{t+1}} - \frac{PB_{t+1}}{Y_{t+1}} \tag{2}$$

where Y stands for GDP. By rearranging (2), we have:

$$d_{t+1} = \left(\frac{1 + r_{t+1}}{1 + g_{t+1}} \right) \times d_t - pb_{t+1} \tag{3}$$

where

d = public debt stock and

pb = the primary budget balance (both in percent of GDP).

g = annual real GDP growth rate

As shown in this last equation[3], current public debt stock depends on past year's debt stock as well as on current real interest rate, real GDP growth rate and primary balance. There is a positive relation between public debt stock and real interest rates, while on the other hand there is a negative relation among public debt stock, real GDP growth and primary balance of the same time period (i.e., $t + 1$). Therefore, any government should aim for a strong *real* GDP growth and low *real* interest rates in order to avoid a rise in future public debt.

It is obvious that highly indebted economies like Greece have to achieve more than stabilization of their current public debt-to-GDP ratios.

In order for a country to lower the current debt-to-GDP ratio over the next T years, the required permanent primary balance (rppb) is achieved as follows:

$$rppb = \frac{D_0 \times \left(\frac{1+r}{1+g}\right)^r - d^*}{\sum_{j=1}^{T-1}\left(\frac{1+r}{1+g}\right)^j} \tag{4}$$

where d^* = current debt-to-GDP ratio.

Our purpose here is to use all the given data in order to predict 2012 figures for debt-to-GDP ratio. At this stage we introduce data for Germany and the UK for two main reasons. First, in order to compare the debt-to-GDP figures among three different kinds of economies, and second, in order to include in our comparison the strongest member-state of the eurozone and a representative from the rest of the member-states that do not use the euro. Germany's economy is often used as an example-to-follow in terms of its economic growth and expansion of exports. The UK is a good example of a strong trade partner with a floating exchange rate for its national currency, subject to the laws of the market. We examine the same variables for all of the three economies. The variables we use are:

- **GDP at market prices** (data from 2003 to 2014 as predictions). It is calculated as the final result of the production activity of resident producer units.
- **Long term interest rates for government bonds** that are traded in the secondary market with a remaining maturity close to ten years. Data available from 2006 to 2012 from OECD database.
- **Real GDP growth rates**. Data available from 1996 to 2014 (as predictions).
- **Government deficit/surplus as percentage of GDP**. The government deficit/surplus is calculated as the net borrowing/net lending of general government. It is the difference between the revenue and the expenditure of the general government sector. At the national level, data for the general government sector are consolidated between sub-sectors. The debt of the euro area and EU aggregates is consolidated by removal of the loans that member-states have granted to other member-states.
- **Government gross debt** both in monetary value and as a % of GDP.

All data are deduced from Eurostat and OECD databases. For simplicity reasons, in order to incorporate both nominal values (such as GDP) and percentages in the same equation, we use the following equation (5) to calculate 2012 figures:

$$\frac{Debt_t}{GDP_t} = \left(1 + r_t - g_t\right) \times \frac{Debt_{t-1}}{GDP_{t-1}} - govdeficit_{t-1} \tag{5}$$

5. RESULTS AND DISCUSSION

The following Graph 5.1 depicts the course of Greece's debt and real GDP growth rate in the last 16 years. It is obvious that until 2007, debt-to-GDP ratio had a rather stable course, not
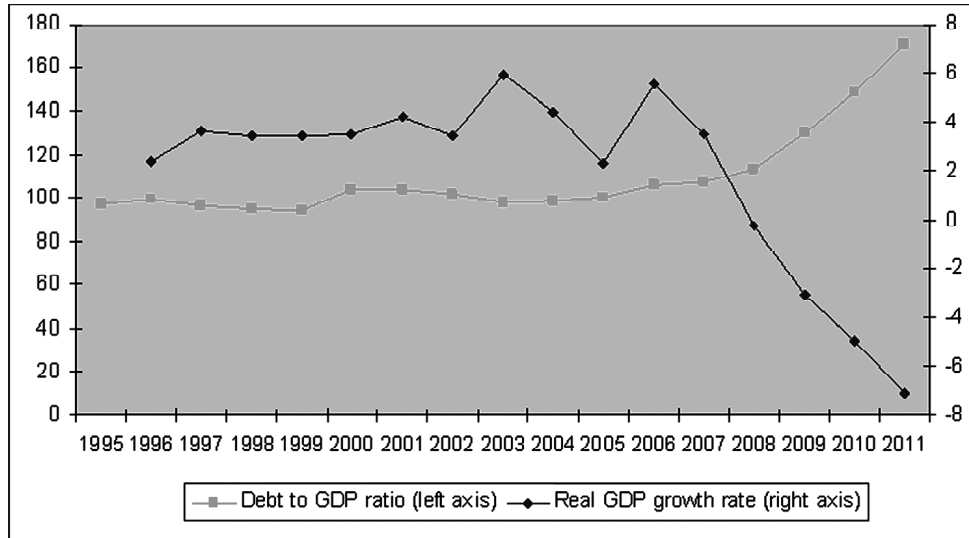
Graph 5.1: Greece's Debt-to-GDP and Real GDP Growth Rate

going higher than 107%. In the beginning of 2008 we see a clear upward trend that skyrocketed debt to as high as 170% in just 4 years' time. To make things even worse, GDP growth rate in the same period (from 2006 onwards) began to decline, from 5,5% (2006) to -7,1% (2011). The rising of the debt-to-GDP curve can be explained not only from the latter fact, but also from the fact that debt kept accumulating after the new 'rescuing' packages from the IMF-ECB-EC (the *troika*).
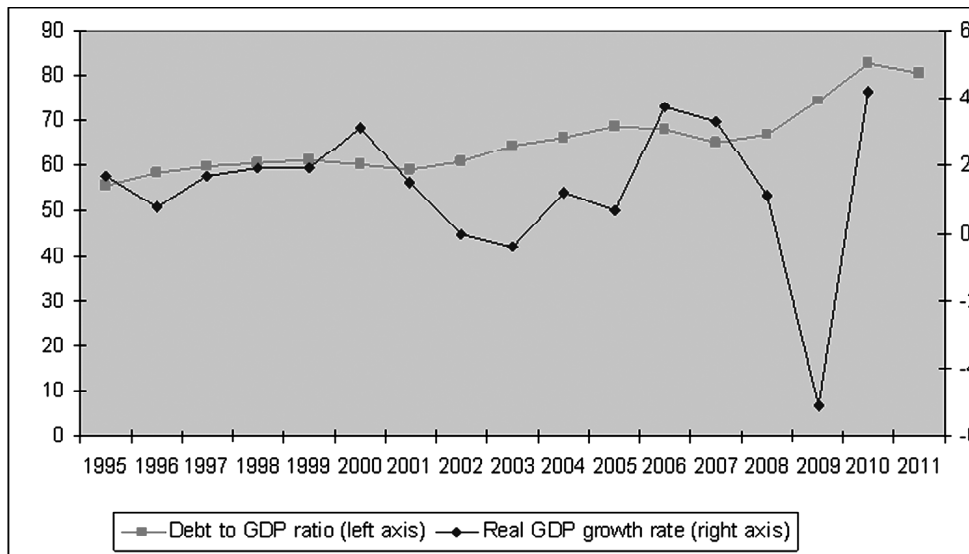
Graph 5.2: Germany's Debt-to-GDP and Real GDP Growth Rate

Looking at Graph 5.2, we see that Germany also experienced a similar trend in debt-to-GDP and GDP growth rate figures. A substantial difference is that its debt was always controllable (debt-to-GDP was moving with a stable trend, close to GDP growth rate). After 2009 we notice an increased GDP output in market values in an attempt to satisfy net export demands from both EU and non-EU countries. By having troublesome co-countries in the eurozone, Germany managed to reconfirm itself as the ultimate leader in European exports, already being positively affected by a randomly devalued euro.

The following Graph 5.3 depicts the case of the UK for the same variables.
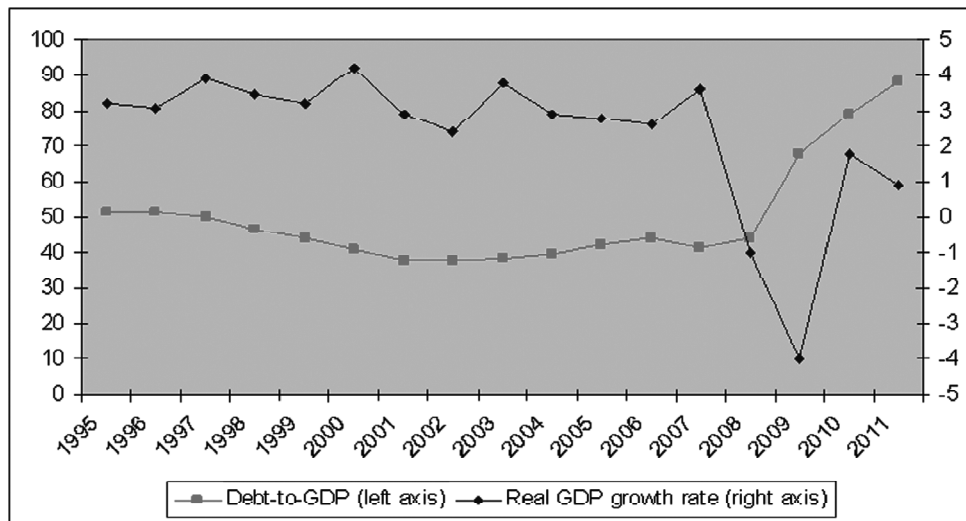
Graph 5.3: UK's Debt-to-GDP and Real GDP Growth Rate

UK's public sector net debt was £1.068 billion at the end of October 2012, equivalent to 67,9% of GDP. Debt was stable enough for the decade 1995-2005. Since 2008, as we can clearly see in Graph 5.3, national debt has increased sharply because of: a) economics recession (lower tax receipts, higher spending on unemployment benefits). The recession particularly hit stamp duty (falling house prices) income tax and lower corporation tax, b) these cyclical factors have exposed an underlying structural deficit, and c) financial bailout of Northern Rock, RBS, Lloyds and other banks. Many economists suggest that UK's debt situation can be improved through economic expansion, which improves tax revenues and reduces spending on benefits like Job Seekers Allowance. However, the economic slowdown which has occurred since 2010 risks pushing the UK bank into a double dip recession and therefore further squeeze on tax revenues. Another measure would be to improve performance of banks so as to increase prospect of regaining financial sector intervention; finally, the government cut spending and raise taxes (e.g. VAT) in order to improve public finances. However, the big issue is the extent to which these spending cuts could reduce economic growth and therefore hamper attempts to improve tax revenues.

The following Graph 5.4 shows a comparison for the 1995-2011 period for all of the three economies.
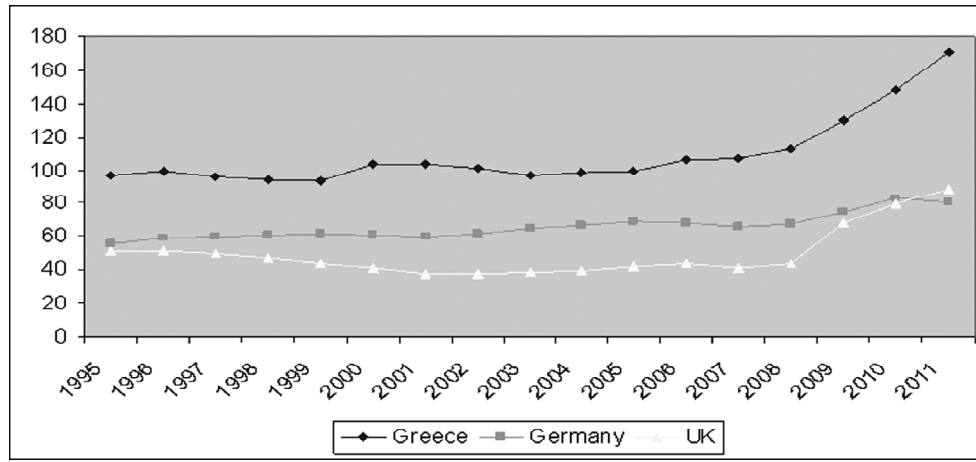
Graph 5.4: Debt to GDP Ratio-a Comparison

The following Table 5.5 includes all the data used in order to predict the debt-to-GDP ratio figure for 2012 following the methodology discussed. The analogy of debt to GDP is bound to reach 211,28% if there is no reduction in long terms government bond rates the country is about to pay and if the GDP growth rates continue to be so low as -6%. Even though Greek bonds' rates fell from 22,5% (mid-June, 2012) to 11,5% (mid-December, 2012), we are using an average percentage for the whole 2012.

Table 5.5
Evidence from the Greek Economy

	debt to GDP ratio	GDP (market values, millions of €)	long term interest rates (%/annum)	real GDP growth rates	govern deficit as % of GDP
1995	97				
1996	99,4			2,4	
1997	96,6			3,6	
1998	94,5			3,4	
1999	94			3,4	
2000	103,4			3,5	−3,7
2001	103,7			4,2	−4,5
2002	101,7			3,4	−4,8
2003	97,4	172431,1		5,9	−5,6
2004	98,6	185265,6		4,4	−7,5
2005	100	193049,7		2,3	−5,2
2006	106,1	208621,8	4,07	5,5	−5,7
2007	107,4	223160,1	4,50	3,5	−6,5
2008	112,9	233197,7	4,80	−0,2	−9,8
2009	129,7	231081,2	9,091	−3,1	−15,6
2010	148,3	222151,5	15,76	−4,9	−10,7
2011	170,6	208531,7	15,75	−7,1	−9,4
2012	211,3*	195018,6*	23,39* (average)	−6*	
2013		184510,1*	−4,2*		
2014		184953,4*	0,6*		

*estimates

A very important deal was made between the Greek government and the private sector that holds its bonds in 2012. The new buyback deal that was announced in December 2012 is considered already a success for some and an utter failure by others. It is estimated that about €30 billion worth of Greek government bonds are about to be bought back from the government at 33% of their nominal value. Having said that, the Greek banking sector that holds as much as almost half of them (around €15 billion) will suffer a severe loss in future earnings, but only in the long run. Having no alternative, they will have the chance to sell their devalued government bonds, which are valued only at 30% of their nominal value, at 33% of their nominal value. Thus, this difference of 3% will provide them with €500 million profits. In addition to that, they have the opportunity not to pay any taxes for the next 30 years, as long as they cannot cover the losses form the PSI buy-back. In this way, the Greek banks will be able to minimize future taxation liabilities, therefore technically maximize their profits, by about €4 billion in the near future. This whole scenario is another perfect reason for Greek banks to merge and form an oligopolistic banking sector with very few, but very powerful players. The new Greek debt-to-GDP ratio, therefore, will surely be lower than the calculated 211,28% at Table 5.5, but with an upward trend close to 185% of GDP if we take into account the fact that long term government bond rates will be sold at about 17% of their nominal price, and not 23% as the OCED predicted.

Tables 5.6 and 5.7 display debt and GDP values for the German and the UK economy correspondingly, with debt-to-GDP ratio of 2012 being predicted according to the methodology adopted.

Table 5.6
Evidence from the German Economy

	debt to GDP ratio	GDP (market values, millions of €)	long term interest rates (%/annum)	real GDP growth rates	govern deficit as % of GDP
1995	55,6			1,7	−9,5
1996	58,5			0,8	−3,4
1997	59,8			1,7	−2,8
1998	60,5			1,9	−2,3
1999	61,3			1,9	−1,6
2000	60,2			3,1	1,1
2001	59,1			1,5	−3,1
2002	60,7			0	−3,8
2003	64,4	2147500		−0,4	−4,2
2004	66,2	2195700		1,2	−3,8
2005	68,5	2224400		0,7	−3,3
2006	68	2313900		3,7	−1,6
2007	65,2	2428500	4,22	3,3	0,2
2008	66,8	2473800	3,98	1,1	−0,1
2009	74,5	2374500	2,74	−5,1	−3,1
2010	82,5	2496200	2,61	4,2	−4,1
2011	80,5	2592600	2,61	3	−0,8
2012	81,9*	2645863*	1,51*	0,8*	
2013		2704080*	0,8*		
2014		2800888*	2*		

*estimates

Table 5.7
Evidence from the British Rconomy

	debt to GDP ratio	GDP (market values, millions of €)	long term interest rates (%/annum)	real GDP growth rates	govern deficit as % of GDP
1995	51,2			3,2	−5,9
1996	51,3			3,1	−4,3
1997	49,8			3,9	−2,2
1998	46,7			3,5	−0,1
1999	43,7			3,2	0,9
2000	41			4,2	3,6
2001	37,7			2,9	0,5
2002	37,7			2,4	−2,1
2003	38,4	1642504		3,8	−3,4
2004	39,4	1768015		2,9	−3,5
2005	42,1	1846607		2,8	−3,4
2006	43,9	1955550		2,6	−2,7
2007	41,3	2063476	5,01	3,6	−2,8
2008	43,7	1809578	4,59	−1	−5,1
2009	68,1	1573465	3,611983	−4	−11,5
2010	79,1	1709607	3,120425	1,8	−10,2
2011	88,4	1750396	2,87	0,9	−7,8
2012	97,9*	1913070*	1,76*	−0,3*	
2013		1995930*		0,9*	
2014				2*	

*estimates

According to the Maastricht Treaty (and to the mainstream macroeconomic theory), should any government followed an expansionary fiscal policy it would not be able to improve its debt/ GDP ratio figures due to the 'crowding out' effect. If we apply this logic to our example, an increase in government spending, or a reduction in taxation (or both simultaneously) in a certain status of the Greek economy would move the IS curve to the right. The new *excess demand* that would be created would *lower* current money value. For the new equilibrium conditions (supply-demand) to be satisfied, interest rates should be increased, and this would result in a 'crowding out' effect for marginal (private) investment plans. In other words, since the Greek government is borrowing at increasingly high interest rates in order to finance its deficit, private capital investments will continue to turn their attention elsewhere. This fact holds both for a floating and for a fixed exchange rate regime, as experience has shown. This 'crowding out' effect cannot be avoided in the case of Greece, since it cannot increase money supply simply like that (that would move the LM curve to the right, thus eliminating this effect and restoring interest rates back at their primary level). The main macroeconomic problem for Greece is that GDP tends fall in market values. Should the Greek economy become more productive, high interest rates in government bonds would not pose any threat, nor would debt/GDP ratios.

In order for the Greek economy to return to stability in the long run, it must focus on raising effective demand and private investment. During 2009-2010 the new presidency of the USA applied the Keynesian approach of dealing with economic recessions. That is, they

increased government spending and reduced taxation, especially for the low class. In combination with the implementation of low interest rates by the Fed, the US economy shows remarkable signs of recovery. Of course, the case in the eurozone is somewhat different. The ECB is not the Fed; it represents 17 countries with different economic priorities and interests. An important factor that should not be underestimated is the fact that any case of boosting private consumption in the eurozone will be severely opposed by an increase in private saving. Consumers are now aware that any acts of returning to economic stability can only be temporary, and therefore, they will try to prepare themselves for the next round of recession (or even for the next economic crisis). Where should governments, then, turn their eyes to? An increase in private investment, government spending and net exports should do the work as well. But the latter requires an increased GDP output, while the second suggestion will only worsen government deficit $(G_t - T_t)$.

Notes

1. The *Economist*, in September 17th 2011, judged that 'Greece, which is unambiguously insolvent, ought to have a hard but orderly write-down'. (page 11).

2. Many economists use $G_t - T_t$ (government spending – taxation) instead of primary balance, which is more accurate.

3. Another common equation for analyzing current public debt is: $\frac{B_t}{Y_t} = (1 + r - g)\,\frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t}$

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