The Journal of Economic Asymmetries 12 (2015) 1–21

Contents lists available at ScienceDirect

The Journal of Economic Asymmetries

www.elsevier.com/locate/jeca

Sustainability of budget deficits and public debts in selected European Union countries ☆

Simon Neaime *

Department of Economics, Institute of Financial Economics, American University of Beirut, Beirut, Lebanon

ARTICLE INFO

Article history:
Received 28 July 2014
Received in revised form 12 September 2014
Accepted 15 October 2014
Available online 23 December 2014

Keywords:
Debt
Budget deficits
Sustainability
European Union

ABSTRACT

This paper presents a thorough empirical analysis of fiscal developments in the European Union over the past three decades. After an evaluation of major fiscal and financial developments in France, Germany, Greece, Ireland, Italy, Portugal and Spain, the paper uses the Present Value Constraint (PVC) framework to analyze whether European Union's debts and deficits are sustainable. It is shown that some EU's countries could be heading towards a debt and fiscal crisis, which could degenerate into a banking crisis similar to the 2001 Argentinean crisis, unless timely fiscal adjustment/austerity measures are introduced in the near future.

1. Introduction

The last two decades have witnessed a dramatic and fundamental shift in the expenditure and taxation policies of many developed economies. Balanced budgets have virtually disappeared, and government deficit financing has prevailed. This resulted into the numerous debt crises that have been registered since the early 2000s. Those recent debt and financial crises and their respective negative spillover effects on several emerging economies have brought forward the potential damage on the world economy emanating from weak financial and public sectors' finances. Policy makers and academics have thus been recently devoting efforts in trying to predict financial and debt crises before they occur given the potential damage on the world economy, in general, and on the emerging economies, in particular, that are seldom exposed to various domestic fiscal, financial, and external imbalances. These efforts are primarily devoted to first assess the soundness of the financial/public sectors, and then attempt to forecast whether budget deficits and public debts are sustainable. In the instance where debt is not sustainable, then reforming fiscal/financial policies through the introduction of various austerity measures will be a must in avoiding fiscal, financial and banking crises.

However, the timing of the introduction of the various austerity measures remains a concern, given the recessionary environment that the European Union (EU) has been experiencing since the 2008 United States (US) financial crisis. It is believed that the newly introduced fiscal adjustment measures would keep the EU countries in recession which will further worsen the existing debt burden and hamper any future effort to grow out of the accumulated public debt through

☆ A paper prepared for presentation at the 12th Biennial Athenian Policy Forum Conference on: "Economic and Financial Asymmetries, National Debts and Government Policies". Ryerson, University, Toronto, Canada, June 12–13, 2014. Financial support from the Institute of Financial Economics of the American University of Beirut is greatly acknowledged. The author is grateful to Constantine Angyridis, two anonymous referees, the Editor and Managing Editor of the Journal, and to Rawan Nassar and Nasser Badra for superb research assistance.

* Tel.: +9 613 829944; fax: +9 611 744484.
E-mail address: sn01@aub.edu.lb.

http://dx.doi.org/10.1016/j.jeca.2014.10.002
1703-4949/

higher real Gross Domestic Product (GDP) growth rates. Moreover, it should be noted that the accumulated EU's national debts are the result of both economic but more importantly of political/institutional factors. Therefore, austerity measures alone may not resolve the current fiscal problems but should be accompanied with other political/institutional corrective measures.

In the wake of the recent EU debt crises, the 2008 US financial crisis and the worldwide triple dip recession of the past five years, the solvency of some EU countries has become a major source of concern for the EU, endangering its financial/economic integration efforts, and the successful monetary unification through the introduction of the euro currency. It is well known that Greece, Portugal, Ireland, Italy and Spain have been running budget deficits for the past two decades averaging between 10 and 15 percent of GDP, resulting in a EU's public debt averaging above 110 percent of GDP in 2013.

As a result, policy makers have introduced various austerity measures in order to curb and limit further deteriorations in the EU's fiscal position, despite genuine fear that these measures could collapse aggregate demand, worsen the already high unemployment rates, and further lower prices. If domestic prices decline through aggressive wage and income cuts as dictated by the various austerity programs, the respective real exchange rate will depreciate so as to make domestic goods more competitive internationally. While this policy may improve the external deficits of Greece, Portugal, Spain and Italy, it is expected to lead to painful domestic adjustment measures, as a significant number of domestic firms will likely shut down, worsening further the EU's unemployment rates. Furthermore, deflation would also worsen the real burden of the EU's national debt.

With the above in mind, and in light of the various austerity programs that have been introduced recently, this paper will attempt to assess the sustainability of the EU's current fiscal policies, and evaluate whether they are violating the inter-temporal budget constraint for the public sector. Broadly speaking, such a constraint stipulates that a fiscal policy is sustainable when it is expected to generate sufficient net revenues in the future to repay the accumulated debt and its service. However, a fiscal policy becomes unsustainable if the government intends to finance its future interest expenses by issuing further debt, and is unable to generate adequate revenues even via seigniorage.

The macroeconomic literature analyzing public sector's fiscal and financial vulnerabilities have considered closely the issue of fiscal/financial sustainability. Fiscal sustainability can be determined in various ways, and the literature is rich in studies trying to assess the financial vulnerability of the public sector. This paper will make use of the Present Value Constraint (PVC) framework to look at the issue of fiscal sustainability in the EU's countries of France, Germany, Greece, Ireland, Italy, Portugal and Spain. With the exception of perhaps Germany, all remaining six countries have recently introduced various austerity measures to tackle their budget deficits and debt burdens.

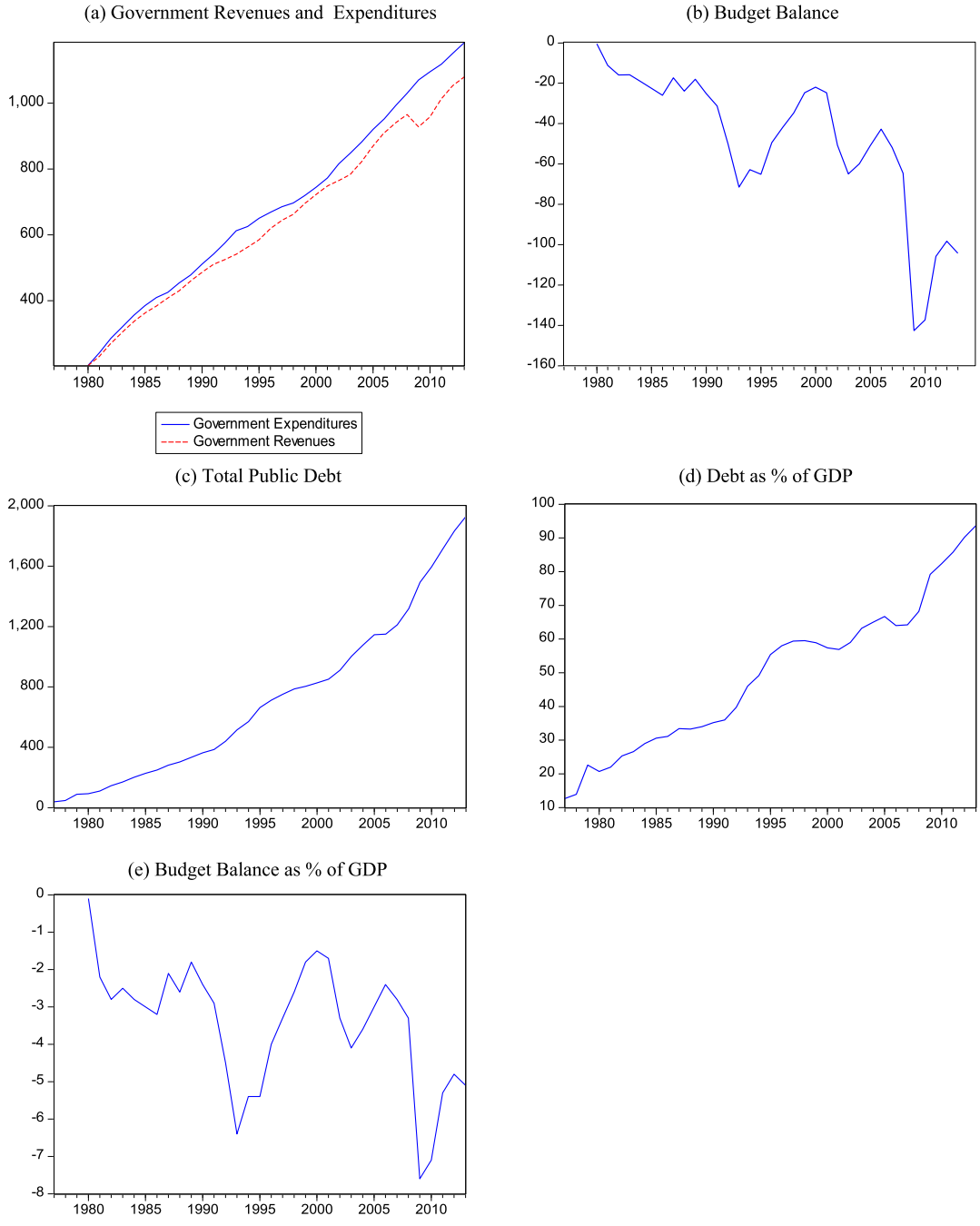
The rest of the paper is divided as follows. In the next section we review the macroeconomic developments in France, Germany, Greece, Ireland, Italy, Portugal and Spain over the past three decades with a close look at the development of fiscal and other macroeconomic variables. After a literature review, Section 3 explores empirically the issue of public debt sustainability in the above EU countries using the PVC framework. Section 4 concludes the paper with some policy implications.

2. Fiscal and macroeconomic developments in the European Union: 1977–2013

In this section, we overview the recent macroeconomic developments in the EU's countries of France, Germany, Greece, Ireland, Italy, Portugal and Spain over the period 1977–2013. We highlight the dynamics of the following fiscal variables: government spending and revenues, fiscal deficits, and public debts. The yearly fiscal data are from the following reliable sources: Euromonitor International from national statistics, Eurostat, Organization for Economic Co-operation and Development (OECD), and the International; Monetary Fund (IMF's) World Economic Outlook (WEO). We gather data on government revenues and expenditures, budget balance, and government total debt.

Figs. 1–7 highlight the major fiscal developments in the EU's selected sample countries over the period 1977–2013. For all the countries in the sample there exists a steady increase in government revenues since the late 1970s, accompanied by a steady increase in government spending inclusive of debt service. However, Greece, Ireland and Spain have been experiencing a decrease in government revenues with a clear widening gap between both government expenditures and revenues since the 2008 US financial crisis. Another key variable for analyzing debt sustainability is the fiscal deficit. A steady increase in the budget deficit would increase the likelihood of debt becoming unsustainable and would contribute to the worsening of the management of public debt. Moreover, a continuous increase in the fiscal deficit through insufficient tax revenues or increased government expenditures or debt service would render debt unsustainable by (1) increasing the real interest rate, (2) reducing the rate of growth of real GDP, and (3) through increasing the overall level of debt. Germany and Italy's deficits appear to be oscillating between 0 and 4 percent of GDP, since the late 1990s, pointing to relatively sustainable and sound fiscal policies (Figs. 2 and 5). In France, the deficit is slightly higher hovering between 2 and 7 percent of GDP over the same period (Fig. 1). Wider budget deficits are registered in Greece, reaching 15 percent of GDP in 2010 during the Greek fiscal crisis, 29 percent in Ireland over the same year, and 10 percent for Portugal (see Figs. 3, 4, and 6 respectively). While Ireland and Spain's budget deficits have been close to zero since the early 1980s, they experienced a huge deterioration in 2010, reaching a low of euros 50 and 120 billion in 2010 respectively (Figs. 4 and 7).

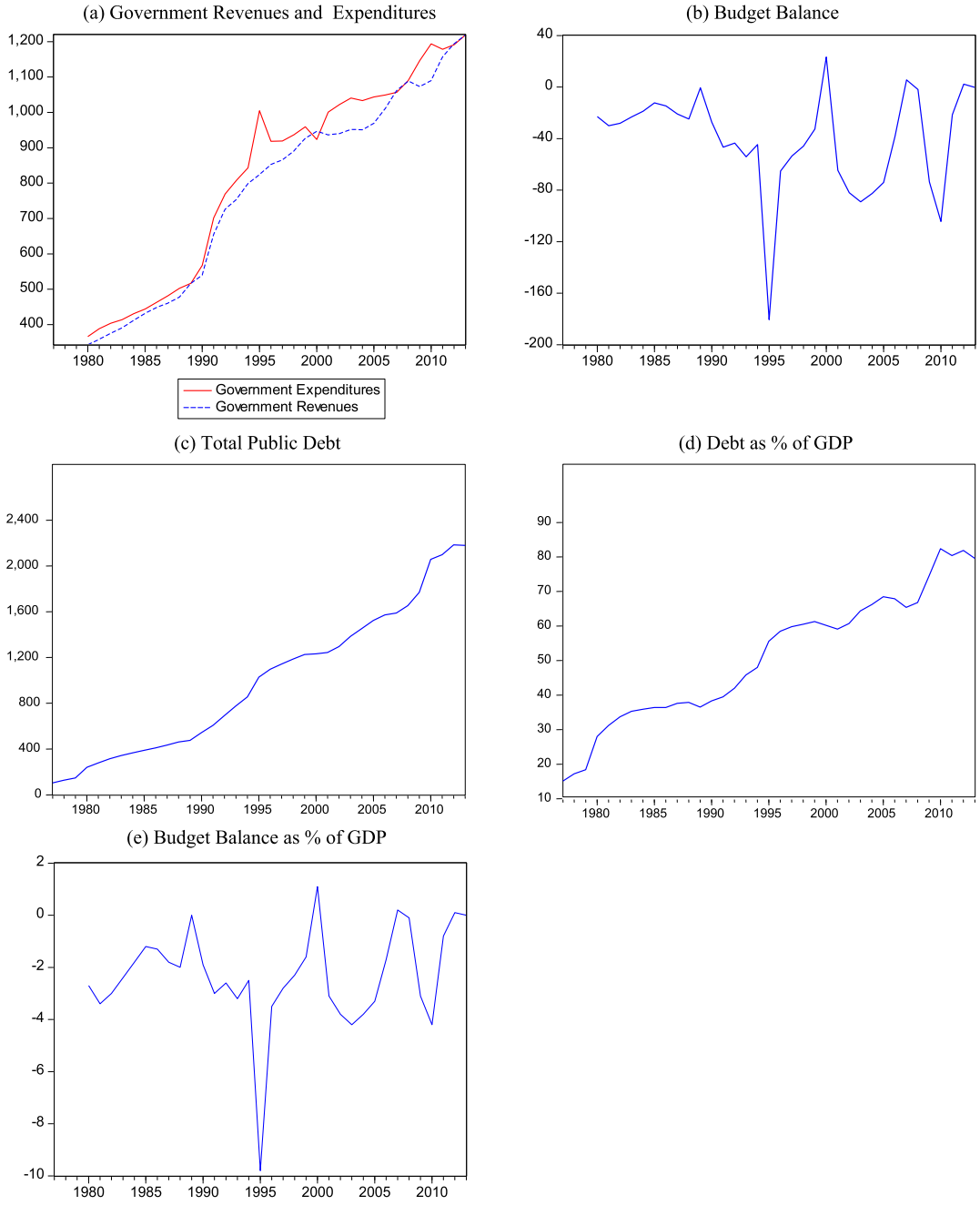
The accumulation of consecutive budget deficits, coupled with high interest rates, high levels of government spending with no adequate revenues led to the accumulation of a huge EU's public debt. Total public debts have been increasing for all EU's countries since 1977. While Ireland's debt was stable at around euros 40 billion in between 1980 and 2006,



Source: Euromonitor International from national statistics/Eurostat/OECD/International Monetary Fund (IMF), International Financial Statistics (IFS).
Notes: All figures are in euros billion unless otherwise indicated. Negative figures for the budget balance refer to a budget deficit, while positive figures refer to a budget surplus.

Fig. 1. Evolution of macroeconomic indicators in France, 1977–2013.

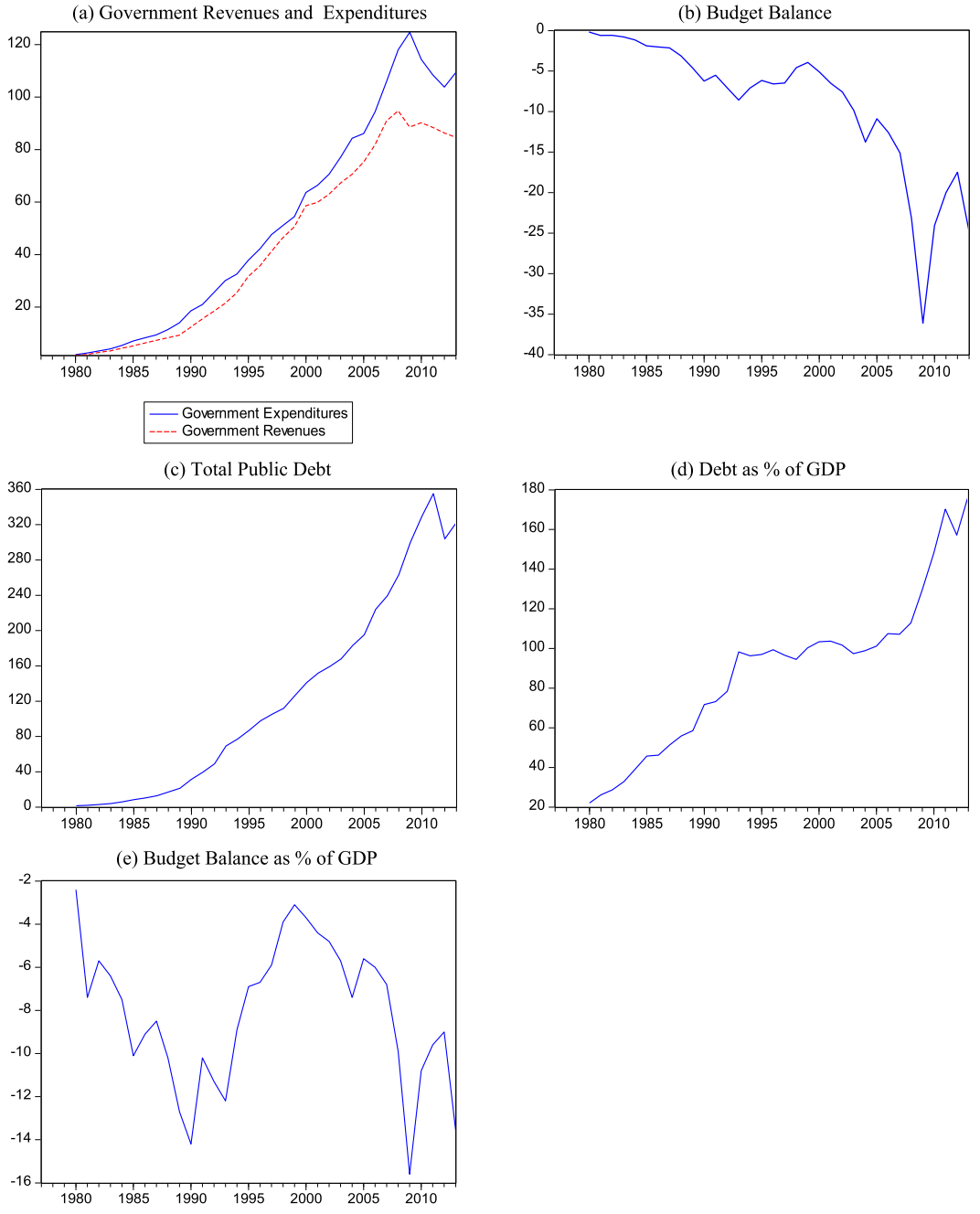
it experienced a sharp and steady increase since 2007, to reach euros 200 billion in 2013 (Fig. 4). France, Germany, Italy and Spain have the highest accumulated EU's debt in absolute terms, estimated at euros 1900, 2010, 2000, and 990 billion respectively (Figs. 1, 2, 5, and 7). It should be noted that Greece stands out in the EU with a sudden decline in public debt in 2011 after its 2010 debt crisis, from euros 325 billion in 2011 to euros 290 billion in 2013 (Fig. 3). This is partly due to the fact that the Greek Government has been converting a major portion of its domestic debt with high service costs



Source: Euromonitor International from national statistics/Eurostat/OECD/International Monetary Fund (IMF), International Financial Statistics (IFS).
Notes: All figures are in euros billion unless otherwise indicated. Negative figures for the budget balance refer to a budget deficit, while positive figures refer to a budget surplus.

Fig. 2. Evolution of macroeconomic indicators in Germany, 1977–2013.

and low maturity to a foreign debt with relatively lower interest rate costs and higher maturity, benefiting from concession loans it had received from the so-called Troika: the IMF, the EU, and the European Central Bank (ECB). In 2013, Germany enjoyed the lowest Debt to GDP ratio (75%), followed by France and Spain with a 90 percent ratio respectively (Figs. 1, 2, and 7). Greece's debt to GDP ratio is the highest among the seven EU countries standing at 170% of GDP, followed by that of Italy at 130%, with a 120% debt to GDP ratio for each of Ireland and Portugal respectively (Fig. 3–6).



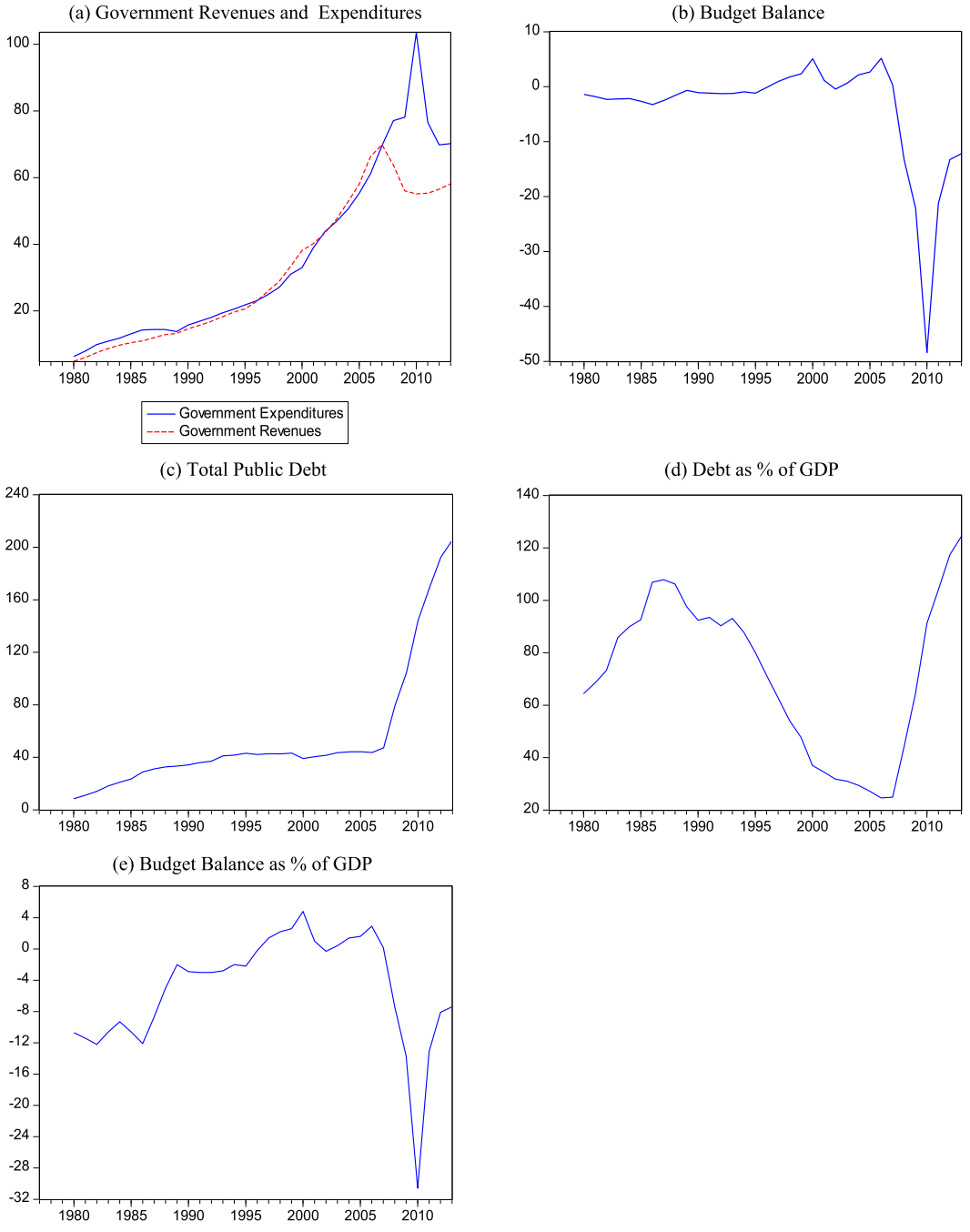
Source: Euromonitor International from national statistics/Eurostat/OECD/International Monetary Fund (IMF), International Financial Statistics (IFS).
Notes: All figures are in euros billion unless otherwise indicated. Negative figures for the budget balance refer to a budget deficit, while positive figures refer to a budget surplus.

Fig. 3. Evolution of macroeconomic indicators in Greece, 1977–2013.

3. The sustainability of public debt

3.1. Literature review

The macroeconomic literature has examined the issue of debt sustainability by assessing the likelihood that governments violate their intertemporal budget constraint through testing whether the time-series properties of fiscal data are consistent

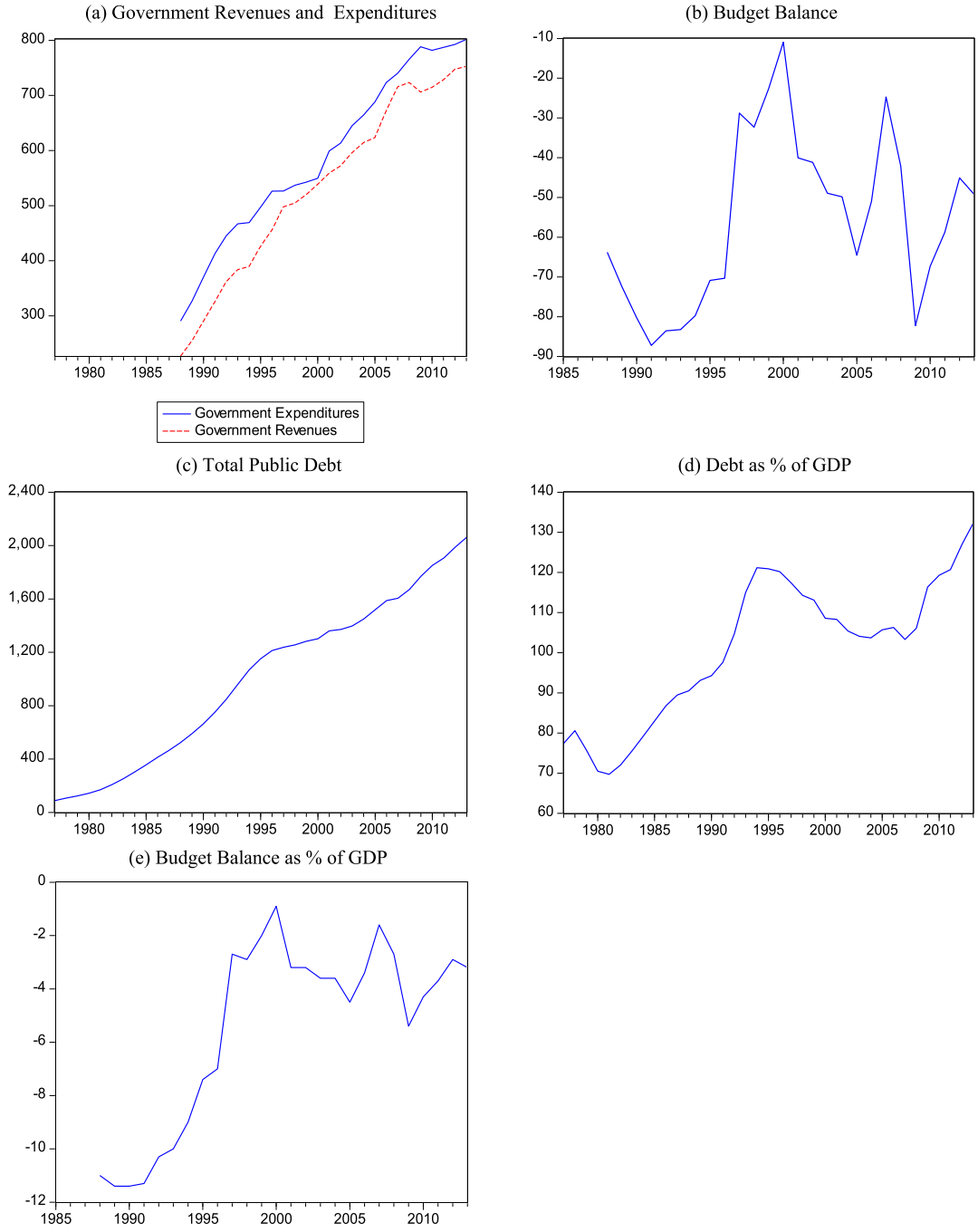


Source: Euromonitor International from national statistics/Eurostat/OECD/International Monetary Fund (IMF), International Financial Statistics (IFS).
Notes: All figures are in euros billion unless otherwise indicated. Negative figures for the budget balance refer to a budget deficit, while positive figures refer to a budget surplus.

Fig. 4. Evolution of macroeconomic indicators in Ireland, 1977–2013.

with the hypothesis that the expected present value of primary balances, discounted at the interest rate on public debt, equals initial debt. This is the methodology we follow in this paper.

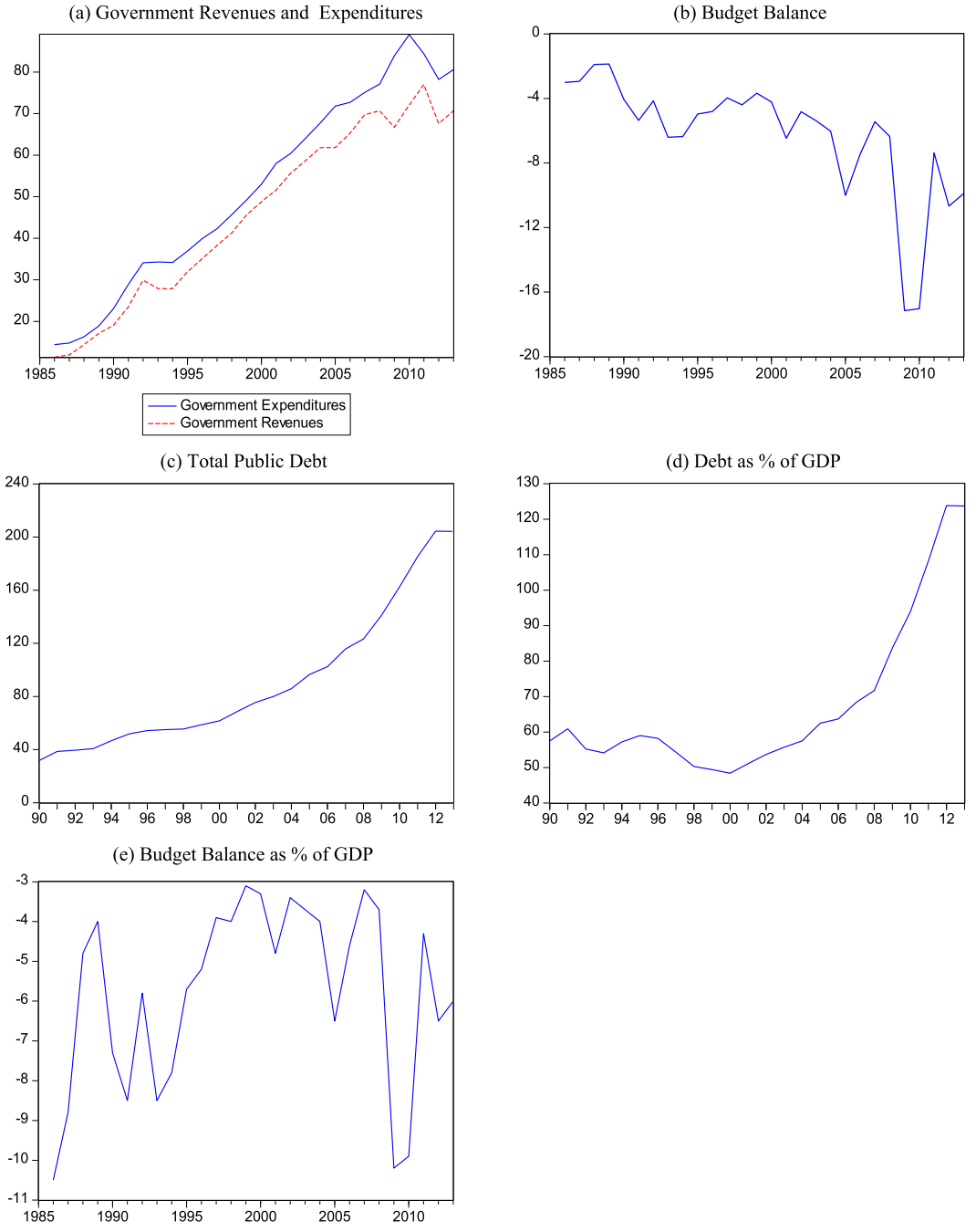
Another strand of the more recent literature dealing with the same issue follows a different approach based on a general equilibrium framework. This approach requires that sustainable fiscal policies be consistent with the general equilibrium conditions that link the government and the private sector. For instance, Chalk (2000) incorporates permanent fiscal deficits into an overlapping generation's model and argues that if the steady-state interest rate is less than the GDP growth rate,



Source: Euromonitor International from national statistics/Eurostat/OECD/International Monetary Fund (IMF), International Financial Statistics (IFS).
Notes: All figures are in euros billion unless otherwise indicated. Negative figures for the budget balance refer to a budget deficit, while positive figures refer to a budget surplus.

Fig. 5. Evolution of macroeconomic indicators in Italy, 1977–2013.

then permanent deficits are indeed sustainable. He then calibrates the model using US data with plausible parameters of taste and technology to derive the theoretical limit to the maximal sustainable deficit implied by his model. Within the same framework, Mendoza and Ostry (2008) conduct a cross-country empirical analysis of fiscal solvency based on a dynamic stochastic general equilibrium model. The results show evidence of fiscal solvency, in the form of a robust positive conditional response of the primary balance to changes in public debt, in panels for emerging and industrial economies.

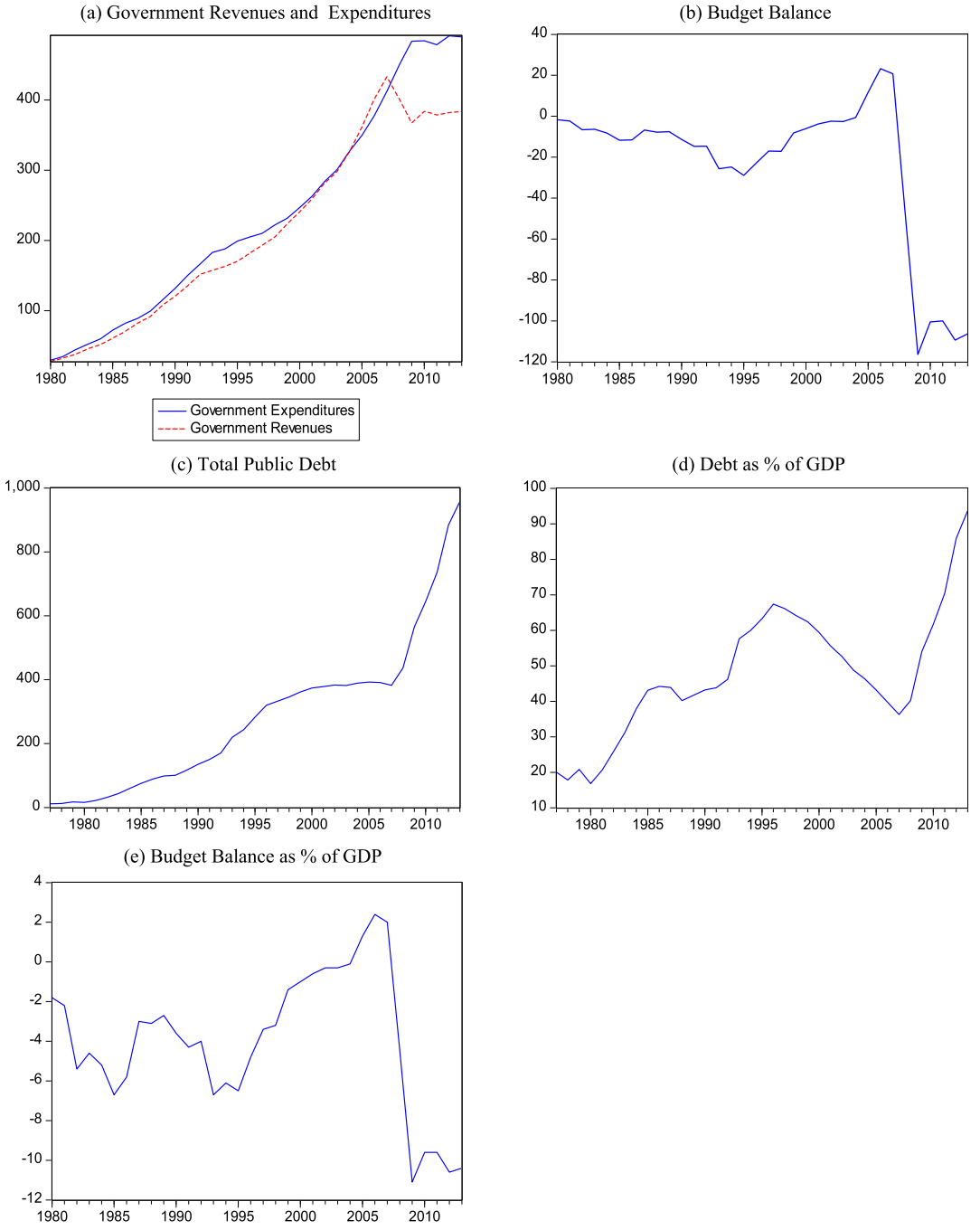


Source: Euromonitor International from national statistics/Eurostat/OECD/International Monetary Fund (IMF), International Financial Statistics (IFS).
Notes: All figures are in euros billion unless otherwise indicated. Negative figures for the budget balance refer to a budget deficit, while positive figures refer to a budget surplus.

Fig. 6. Evolution of macroeconomic indicators in Portugal, 1977–2013.

Using a stochastic model of sovereign default, Ghosh, Kim, Mendoza, Ostry, and Qureshi (2013) assumes that risk-neutral investors lend to a government with limited fiscal space, whereby its ability to increase primary balances cannot keep pace with rising debt. As a result, the government faces an endogenous debt limit beyond which debt becomes unsustainable. The model is then taken to the data for 23 developed economies over the period 1970–2007.

Bohn (2005) provides a slightly different framework that examines whether government policy is in line with fiscal solvency, in order to determine whether increases in public debt leads to increases in the government's primary fiscal



Source: Euromonitor International from national statistics/Eurostat/OECD/International Monetary Fund (IMF), International Financial Statistics (IFS).
Notes: All figures are in euros billion unless otherwise indicated. Negative figures for the budget balance refer to a budget deficit, while positive figures refer to a budget surplus.

Fig. 7. Evolution of macroeconomic indicators in Spain, 1977–2013.

balance (i.e., the balance net of interest payments on the debt). A positive conditional response of the primary surplus/GDP ratio to increases in the debt/GDP ratio means that, given the shocks occurring in the background, the fiscal authority reacts to positive changes in public debt by systematically raising the primary surplus. He showed that in a regression of the primary surplus against public debt, a positive regression coefficient on debt is sufficient to establish that fiscal policy is sustainable, i.e., it satisfies the government's intertemporal budget constraint.

Empirical studies on fiscal sustainability are numerous and have gained extreme importance after the latest financial and debt crises worldwide. As mentioned above, we study the time series properties of the fiscal variables of interest following the first strand of the empirical literature. This approach has proven to be elegant and robust as it uses actual fiscal variables and shies away from calibration empirical modelling. Two empirical frameworks have been used to test for fiscal sustainability. The first rests mainly on testing the stationarity of the various fiscal variables, while the second employs cointegration time series techniques and explores the existence of a long-run equilibrium relationship between the fiscal variables of interest.

Under the first framework, if the deficit series is non-stationarity, then it means that it is growing without bound over time, which means that subsequent debt will also grow without bound rendering fiscal policy unsustainable. This will also violate the Present Value Constraint and the No-Ponzi-Game (NPG) constraint. A stationary deficit means that the series is reverting to a certain mean overtime being in general close zero. If that were the case, then obviously fiscal policy and debt would be sustainable, since deficits will be under control. In the second framework, cointegration tests were used to explore whether there is a long-run relationship between government revenues and expenses. If such relationship exists, this means that the respective government is not spending without bound and is taking into account the amount of revenues it is generating. Subsequently, it will not have to resort to deficit financing to cover its expenses, and debt would be sustainable and will not grow without bound.

Empirical studies on developed economies are numerous and were initiated by the paper of Hamilton and Flavin (1986). Using yearly data for the US, covering the period 1962–1984, they tested the validity of the PVC, or equivalently the NPG condition, or the budget constraint.[1] In their study, if the government deficit and debt series are stationary then debt is sustainable which was the case for the US sample used. Using also yearly data for the US economy over a larger sample covering respectively the periods: 1890–1983 and 1960–1984, Trehan and Walsh (1988, 1991) studied the stationarity of the public deficit and debt, and concluded that since they were stationary for both sample periods, then debt is sustainable. Running the same empirical tests, Kremers (1988) used a different sample period: 1920–1985, and found debt to be sustainable until 1981.[2]

Within the same framework other researchers conducted stationarity tests on other countries to see whether debt is sustainable. For instance, Smith and Zin (1991) used Canadian monthly data for the period 1946–1984, and looked at the stationarity of the public debt and deficits and found that debt was not sustainable. For India, and using the same tests and the sample period 1970–1988 but yearly data, Buiter and Patel (1992) found that public debt in India was not sustainable. Using monthly data for Italy and the period 1979–1991, Baglioni and Cherubini (1993) found that debt is not sustainable. Caporale (1995) using annual data on some EU countries over the period 1960–1991 found that the Italian, Greek, Danish and German debts were not sustainable. Makrydakis (1999) using annual data for Greece over the period 1958–1995 also found that debt is not sustainable.

Other empirical studies have used cointegration techniques to test whether debt is sustainable. These cointegration techniques were used to test whether a long run relationship exists between government revenues and expenditures. If such relationship exits, then one can conclude that debt is sustainable. For the US Haug (1995) found that the US debt is sustainable. Using Quarterly US Data for the period 1947–1992, Quintos (1995) found that US debt was sustainable until 1980. Using EU data form 1692–1992, Ahmed and Rogers (1995) found that debt is sustainable. Payne (1997) used annual data for some G7 countries and found that debt is sustainable for Germany. Crowder (1997) used Quarterly US data and found debt to be sustainable until 1982. Athanasios and Sidiropoulos (1999) also used EU data over the period 1961–1994 and found debt to be unsustainable for Spain, Belgium, Greek, Italy and Portugal.

More recently, Neaime (2010, 2012a) analyzed the conduct of fiscal and financial policies and studied the sustainability of public debt in the Middle East and North Africa (MENA) in the post US financial crisis period. Using time series econometric tests and the PVC model, the empirical results show strong evidence of sustainability of fiscal policies in Tunisia given the country's fiscal discipline. The weak sustainability in Egypt is explained by the successful privatization plan introduced during the 1990s. Morocco's mixed results are explained by the recently introduced fiscal recovery reforms. The unsustainable debt and fiscal policies for Jordan and Turkey were explained by the size of the government causing major fiscal imbalances for Jordan's economy, and by the weakness of the financial and banking sectors in Turkey.[3]

3.2. Theoretical framework

Empirical studies dealing with the issue of debt sustainability start with the financing constraint of the government. This constraint relates the primary deficit plus nominal debt servicing to changes in outstanding debt. Specifically, the following dynamic equation relates the stock of debt in period t, B_t to last period's debt B_{t-1} plus debt service rB_{t-1}, and the primary

[1] Agenor and Montiel (1996) argued that the government is solvent if the present value of the future resources available to it for debt service at least equal to the face value of its initial debt stock (p. 123). Thus, satisfying the present value budget constraint, implying that the government is solvent.

[2] However, Wilcox (1989) found that debt was not sustainable over the 1960–1984 sample period.

[3] From a different perspective and using similar time series econometric techniques, Neaime (2012b) and Guyot et al. (2014) studied the implications of the US financial crisis on the emerging stock markets of the MENA region. His paper explores the global and regional financial linkages between MENA stock markets and the more developed financial markets, and the intra-regional financial linkages between MENA countries' financial markets.

surplus (Z). Z_t will be negative when it represents a deficit and will constitute an addition to the stock of debt, and will be positive when it represents a surplus

$$B_t = (1+r)B_{t-1} - Z_t.^{5} \tag{1}$$

B_t is the outstanding debt at the end of period t, and r equals the ex post return on government debt, and it is assumed to be constant.[6] Given the time paths for r and Z_t, the government financing constraint in (1) describes the time path of the stock of debt, i.e., the dynamics of debt accumulation or decumulation.[7]

Iterating Eq. (1) forward n periods and summing up we get

$$B_{t-1} = \sum_{j=0}^{n} \frac{R_{t+j}}{(1+r)^{j+1}} - \sum_{j=0}^{n} \frac{G_{t+j}}{(1+r)^{j+1}} + \frac{B_{n+1}}{(1+r)^{n+1}}, \tag{2}$$

where G is government expenditures defined to exclude interest payments, and R is government tax revenues.

If the last term in (2) approaches zero as the number of periods increases, then the No-Ponzi-Game Constraint will be satisfied, i.e.,

$$\lim_{n\to\infty} \frac{B_{n+1}}{(1+r)^{n+1}} = 0. \tag{3}$$

The No-Ponzi-Game Constraint in (3), also known in the literature as the intertemporal solvency condition is stating that the present value of the government's debt in the indefinite future converges to zero. For this to occur, debt B in the numerator must grow more slowly than the rate of interest r. The government cannot finance interest payments on debt by continuously issuing new debt. This will happen when Eq. (3) is not violated, and Eq. (2) reduces to

$$B_{t-1} = \sum_{j=0}^{\infty} \frac{R_{t+j}}{(1+r)^{j+1}} - \sum_{j=0}^{n} \frac{G_{t+j}}{(1+r)^{j+1}}. \tag{4}$$

If we assume that public debt is growing over time at a constant rate δ to have $B_{t+j} = (1+\delta)B_{t+j-1}$, $\forall j$, we can rewrite Eq. (3) as follows

$$\lim_{n\to\infty} \left(\frac{1+\delta}{1+r}\right)^{n} B_0 = 0. \tag{5}$$

For Eq. (5) to converge to zero, δ should be less than r, i.e., the rate of growth of debt should be less than the real interest rate.

On the other hand, the literature relates the PVC to the accounting approach to assess fiscal sustainability by focusing on debt ratios to GDP.

We know that current period GDP, Y_t is equal to last period's GDP, Y_{t-1} plus Y_{t-1} times the GDP growth rate (g) as follows:

$$Y_t = (1+g)Y_{t-1}. \tag{6}$$

Therefore, expressing Eq. (1) as ratios to GDP would give:

$$\frac{B_t}{Y_t} = (1+r)\frac{B_{t-1}}{Y_t} - \frac{Z_t}{Y_t}. \tag{7}$$

Substituting (6) into (7) and solving for the debt to GDP ratio we get:

$$\frac{B_t}{Y_t} = \frac{(1+r)}{(1+g)}\frac{B_{t-1}}{Y_{t-1}} - \frac{Z_t}{Y_t}.$$

Rewriting we obtain:

$$b_t = \frac{(1+r)}{(1+g)}b_{t-1} - z_t, \tag{8}$$

[5] See Escolano (2010) for a similar specification of the financing constraint of the government.

[6] Eq. (1) may be interpreted in nominal or real terms. However, the empirical literature on debt sustainability suggest that the use of macroeconomic variables in real terms may be more robust, and empirical tests are more likely to be satisfied if one considers real debt (i.e. nominal debt divided by a price index such as the Consumer Price Index). Hence, r and Z_t may be interpreted as the real interest rate and real primary surplus.

[7] According to Eq. (1), If the government runs a primary surplus equal to zero ($Z_t = 0$), the stock of debt will grow at a rate equal to the interest rate: $\Delta B_t = rB_{t-1}$. If the government runs a primary deficit ($Z_t < 0$), the stock of debt will grow at a rate exceeding the interest rate. If the government runs a primary surplus ($Z_t > 0$), the stock of debt will grow more slowly than the interest rate. If the surplus more than offsets payments on existing debt (i.e. the conventional surplus, $Z_t + rB_{t-1}$ is positive), then the debt will actually shrink over time.

Table 1
Real GDP growth and real interest rates (in %), 2008–2013.

	2008	2009	2010	2011	2012	2013
Long term real interest rates (r)						
France	4.2	3.6	3.1	3.3	2.5	2.2
Germany	4	3.2	2.7	2.6	1.5	1.6
Greece	4.8	5.2	9.1	15.7	22.5	10.1
Ireland	4.5	5.2	5.7	9.6	6.2	3.8
Italy	4.7	4.3	4	5.4	5.5	4.3
Portugal	4.5	4.2	5.4	10.2	10.5	6.3
Spain	4.4	4	4.2	5.4	5.8	4.6
Real GDP growth rates (g)						
France	−0.1	−3.1	1.7	2	0	0.2
Germany	1.1	−5.1	4	3.3	0.7	0.4
Greece	−0.2	−3.1	−4.9	−7.1	−7	−3.9
Ireland	−2.2	−6.4	−1.1	2.2	0.2	−0.3
Italy	−1.2	−5.5	1.7	0.4	−2.4	−1.9
Portugal	0	−2.9	1.9	−1.3	−3.2	−1.4
Spain	0.9	−3.8	−0.2	0.1	−1.6	−1.2
$[r-g]$						
France	4.3	6.7	1.4	1.3	2.5	2
Germany	2.9	8.3	−1.3	−0.7	0.8	1.2
Greece	5	8.3	14	22.8	29.5	14
Ireland	6.7	11.6	6.8	7.4	6	4.1
Italy	5.9	9.8	2.3	5	7.9	6.2
Portugal	4.5	7.1	3.5	11.5	13.7	7.7
Spain	3.5	7.8	4.4	5.3	7.4	5.8

Source: Euromonitor International from national statistics/Eurostat/OECD/International Monetary Fund (IMF), World Economic Outlook (WEO).
Notes: The long term real interest rate is proxied by the secondary market yield on long term 10 years government bonds.

where small letters refer to ratios of the corresponding variable to GDP. Rearranging (8) and solving for z we get:

$$z_t = \frac{(1+r)}{(1+g)} b_{t-1} - b_t. \tag{9}$$

An important question is how can the EU's debt be stabilized within the context of the above specification? If debt is stable then debt would not grow overtime. That is

$$b_{t-1} = b_t. \tag{10}$$

Plugging (10) in (9), and solving we get

$$z_t = \frac{(r-g)}{(1+g)} b_{t-1}. \tag{11}$$

Given the fact that the EU's economies have been in a recession since the 2008 US financial crisis, the EU's growth rate of GDP (g) can safely be considered to be close to zero. The above expression can therefore be approximated as:

$$z_t = (r-g) b_{t-1}. \tag{12}$$

For the EU's debt to stop growing overtime Eq. (12) must hold. Therefore debt depends on the spread between the real interest rate r and the growth rate of GDP g. If $g > r$, then debt stabilizes even with a budget deficit (i.e., z is negative). If $r = g$, then debt stabilizes since the budget is balanced. If $r > g$, then debt will keep on growing over time even in the presence of a budget surplus, (i.e., z is positive).

Table 1 indicates that while long run real interest rates r have been increasing in the EU countries under investigation, during the 2008–2013 period, economic growth g is either close to zero or negative. As discussed above when $r > g$, then EU's debt will keep on increasing overtime even if the respective EU's governments produce a positive government budget in 2014 or 2015 as a result of the austerity measures that have been introduced. Therefore, EU's austerity measures will not only fail to reduce debt but will also have a negative impact on g, since higher debt levels will lead to a downgrading of EU's debt leading subsequently to even higher real interest rates. This would further increase $(r-g)$, making debt containment even more difficult. With the exception of Germany this is indeed the case for all the remaining EU countries under investigation (see Table 1). Policy makers need to be very careful since joint austerity measures can create a vicious circle whereby recessionary budgets, high interest rates and high levels of debt tend to reinforce each other.

A consistent debt containment policy should first ensure that the EU's respective countries real interest rate r is lower than the real GDP growth rate g ($g > r$).[8] This may be achieved through for instance the ECB lowering interest rates through the monetization of the EU's debt. Under this scenario, the ECB would issue euros to buy back European government bonds, mainly those of Greece, Italy, Portugal, and Spain. This would both decrease public debt pressures and boost investment and exports through lower real interest rates and a depreciated euro, improving subsequently the rate of growth of real GDP. However, this would imply a radical change in the ECB's current monetary policy focussing since its inception on targeting the rate of inflation. Another scenario, would be to increase the EU's real GDP growth rate (g) through the introduction of various stimulus packages to be financed by Eurobonds. This would insure the reduction of the EU's debt. A third scenario would be to adjust the budget balance. Accordingly, in the short run, the EU's governments could even maintain a moderate debt-decreasing deficit which would sustain economic growth in the short to medium run until the recession is officially over.

In short and as stated above, a consistent EU's anti-debt policy should first ensure that the EU's real GDP growth rate g is higher than the respective real interest rate r ($g > r$). In other words, the EU needs to recover from the current recession, and at the same time have the ECB lower the real interest rate through the various macroeconomic policy options discussed above. Table 1 indicates that under the current negative macroeconomic fundamentals, none of the EU's countries is following a debt reducing fiscal policy. That is a fiscal policy that lowers budget deficits and ensures that debt will not continue to grow without bounds in the future, rendering it unsustainable. The rate of growth of real GDP is lower than the real interest rates even for Germany, where real GDP growth rates are relatively higher than in the remaining EU countries. In the EU's countries which experienced debt crises, the real interest rate reached for instance 22.5% in Greece, and 10% in Portugal in 2012 (Table 1). Negative real GDP growth rates are registered in most EU countries under investigation and over the 2008–2013 period. For a more rigorous empirical assessment of the EU's debt sustainability, the next section studies the time series properties of the fiscal variables of interest within the PVC framework.

3.3. Econometric analysis and results

The econometric tests to be carried out rest on the two frameworks advanced in the literature, that is stationarity and cointegration tests. If the budget deficit is stationary, i.e., integrated of order zero, $I(0)$ then according to Trehan and Walsh (1988, 1991) this constitutes a sufficient condition to conclude that fiscal policy is sustainable. That is, the government deficit will not grow without bound, and the actual deficit will asymptotically converge to zero over time. The convergence to zero of the government deficit means that the PVC or the intertemporal solvency condition in (4) is actually satisfied. In fact, an equivalent empirical test would be to test for the existence of unit roots in the government expenditures (inclusive of debt service: $G_t + r_t B_{t-1}$) and revenues series. If the two series do not contain a unit root, then the budget deficit will be integrated of order zero and the intertemporal solvency condition (4) will be satisfied pointing to the sustainability of fiscal policy. According to Hakkio and Rush (1991), if the two series contain a unit root (i.e., are integrated of order 1) then one must search for a long-run equilibrium relationship between them. If such relationship does not exist, debt would be unsustainable.

We establish stationarity or non-stationarity of the individual fiscal series by applying both the Phillips–Perron (PP) and Augmented Dickey–Fuller (ADF) unit root tests. The following regressions are estimated

$$\Delta X_t = \beta_1 + \beta_2 X_{t-1} + \sum_{i=1}^{k} \delta_i \Delta X_{t-i} + \varepsilon_t, \tag{13}$$

where Δ is the first-difference operator; (X_t) represents respectively the following fiscal time series for the seven EU countries: G (government spending); R (government revenues), (BB) Budget Balance, and Debt, as well as the ratio of these variables to GDP; β_i, δ_i, are constant parameters; and ε_t is a stationary stochastic process. The number of lags (k) will be determined based on the Akaike Information Criterion (AIC) for the ADF tests and the Newey-West Information Criterion for the PP tests.

To determine the order of integration of the series, model (13) is modified to include second differences on lagged first and k lags of second differences. That is,

$$\Delta^2 X_t = \lambda_1 \Delta X_{t-1} + \sum_{i=1}^{k} \mu_i \Delta^2 X_{t-i} + \varepsilon_{1t} \tag{14}$$

where, $\Delta^2 X_t = \Delta X_t - \Delta X_{t-1}$, λ_i, μ_i, are constant parameters; and ε_{1t} is a stationary stochastic process. The k lagged difference terms are included so that the error terms ε_t and ε_{1t} in both equations are serially independent. Eqs. (13) and (14) are also estimated with a time trend. The unit root test results are reported in the Appendix. Based on the ADF and PP

[8] If g is higher than r, then permanent deficits would be even an acceptable short term solution (see Chalk, 2000). Governments cannot run any Ponzi scheme and simply wait to outgrow its liabilities. Deficits are sustainable only if they are not too large.

tests, the null Hypothesis of non-stationarity ($H_0 : \lambda_1 = \beta_2 = 0$) for France, Greece, Italy, Ireland Portugal, and Spain's budget balances (or deficits) could not be rejected indicating that the series are non-stationary when the variables are defined in levels (Tables A.1, and A.3–A.7). But first-differencing the series removes the non-stationary component, and the null hypothesis of non-stationarity is clearly rejected at the 5% significance level suggesting that our variables are $I(1)$. However, the ADF and PP tests are pointing towards the stationarity of Germany's budget balance (Table A.2).

Equivalently, 4 also tests for the existence of unit roots in the government expenditures (inclusive of debt service: $G_t + r_t B_{t-1}$) and revenues series. As argued before, if the two series contain a unit root, then again the intertemporal solvency condition (4) will not be satisfied, reconfirming that fiscal policy is not sustainable. France's revenue and government expenditure series are both non-stationary (Table A.1). The same is true for Germany, Greece, Portugal, and Spain (Tables A.2, A.3, A.6, and A.7). Italy exhibits a stationary government revenue series based on the PP test. With a constant, the same series is non-stationary (Table A.5). Ireland exhibits a stationary revenue series based on the ADF test (Table A.4). The debt series are non-stationary for Germany and Greece. The unit root tests are pointing to stronger non-stationarity $I(2)$ for the debt series of France, Ireland, Italy, Portugal, and Spain. When taken as ratios to GDP most $I(2)$ series become non-stationary $I(1)$ series.

We can therefore conclude that in general, all the fiscal variables seem to be non-stationary $I(1)$ series with few exceptions where the fiscal variables are $I(2)$. When we consider the series as ratios to GDP, we have approximately the same results confirming our earlier empirical findings of non-stationarity.[9] According to Trehan and Walsh, the non-stationarity of the budget balance and debt series constitutes a sufficient condition to conclude that with the exception of Germany, fiscal policy in the EU's countries under investigation is unsustainable. That is, the respective government deficit will grow without bound, and the actual deficit will not asymptotically converge to zero over time. The non-convergence to zero of the government deficit means that the PVC or the intertemporal solvency condition in (4) is actually violated.

According to Hakkio and Rush (1991), if the government expenditures and revenues series contain a unit root (i.e., are integrated of order 1) then one must search for a long-run equilibrium relationship between them. We next use the Johansen (1997) efficient maximum likelihood test to test for the existence of a long-run relationship between government revenues and expenditures. If such relationship exists than one can conclude that fiscal policy in the EU is sustainable. The basic notion behind cointegration postulates that even though two or more non-stationary time series are drifting far apart overtime, the series might eventually converge in the long run. This long run relationship is called the cointegrating relationship (Aroskar, Sarkar, & Swanson, 2004). The cointegration tests to be used in this paper are based on maximum likelihood estimation that proposes two distinct tests for determining likelihood ratios, including the trace and maximum eigenvalue statistics. The trace test determines r cointegrating vectors' null hypothesis alongside the substitute n cointegrating vectors' hypothesis. If the value of r is 0, then one can conclude that a long-run relationship does not exist between the non-stationary variables, hence no cointegration exists (Osterwald-Lenum, 1992). Maximum eigenvalue test determines r cointegrating vectors' null hypothesis alongside alternative hypothesis of $(r + 1)$ cointegrating vectors. The Johansen test starts with a vector autoregression (VAR) of the order p represented as:

$$x_t = \mu + A_1 x_{t-1} + \cdots + A_p x_{t-p} + \varepsilon_t \tag{15}$$

where x_t represents $(n \times 1)$ integrated variables' vector generally represented as $I(1)$ while ε_t represents an $(n \times 1)$ innovations vector. The two likelihood ratio tests include the trace test and the maximum eigenvalue statistics, and are defined in Eqs. (16) and (17) respectively (Lüutkepohl, Saikkonen, & Trenkler, 2002).

$$J_{Trace} = -S \sum_{t-r+1}^{n} \ln(1 - \hat{\beta}_i) \tag{16}$$

$$J_{Max} = -S \ln(1 - \hat{\beta}_{r+1}) \tag{17}$$

In Eqs. (16) and (17), S determines the sample size, while $\hat{\beta}_i$ shows the ith biggest canonical correlation. The advantage associated with this model is that it can be used in the estimation of several cointegration relationships (Lai & Lai, 1991).

Tables 2–8 report the cointegration tests for the seven EU countries. Greece and Italy stand alone with no cointegration between the government expenditure and revenue series whether considered in their levels or as ratios to GDP pointing to unsustainable fiscal policies in both countries (Table 4 and 6). Tables 2, 5, and 7 depict one co-integrating vector at both levels of significance between government spending and revenues, when considered in levels and as ratios to GDP, and the null hypothesis of no-cointegration is rejected for France, Ireland and Portugal, pointing to a long run relationship between the government expenditure and revenues series. Tables 3 and 8 indicate no long-run relationship between the two series as ratios to GDP for Germany and Spain. Therefore, according to our cointegration analysis, we can safely conclude that Italy and Greece's fiscal policies are on a non-sustainable path, since government spending and revenues are drifting too far apart and do not seem to converge to a long-run equilibrium relationship.

[9] Only few exceptions are noted as follows: Germany's debt to GDP ratio is stationary in both the PP and ADF tests with a constant and time trend. France's time series become stationary under the PP test with a constant. The same is true for Portugal where the debt to GDP series is stationary under the PP and ADF tests with a constant and no time trend.

Table 2
Cointegration tests: France.

Hypothesis (R and G)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	13.79*	12.32	16.36	10.58	11.22	15.09
$r \leq 1$	$r = 2$	3.21	4.13	6.94	3.21	4.13	6.94
Hypothesis (R and G/GDP)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	13.39*	12.32	16.36	13.35*	11.22	15.09
$r \leq 1$	$r = 2$	0.04	4.13	6.94	0.04	4.13	6.94

Source: Author's estimates.
Notes: The Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix and on the λ-Max-Eigen Statistic. The former test does not allow for a linear deterministic trend in the data, but with a constant; r represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes no linear deterministic trend in the data, but with no constant. ** denotes significance at the 1% level, while * denotes significance at the 5% level. Data sample used: 1977–2013.

Table 3
Cointegration tests: Germany.

Hypothesis (R and G)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	14.95*	12.32	16.36	10.84	11.22	15.09
$r \leq 1$	$r = 2$	4.11	4.13	6.94	4.11	4.13	6.94
Hypothesis (R and G/GDP)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	8.32	12.32	16.36	8.26	11.22	15.09
$r \leq 1$	$r = 2$	0.06	4.13	6.94	0.06	4.13	6.94

Source: Author's estimates.
Notes: The Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix and on the λ-Max-Eigen Statistic. The former test does not allow for a linear deterministic trend in the data, but with a constant; r represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes no linear deterministic trend in the data, but with no constant. ** denotes significance at the 1% level, while * denotes significance at the 5% level. Data sample used: 1977–2013.

Table 4
Cointegration tests: Greece.

Hypothesis (R and G)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	10.79	15.49	25.3	10.13	14.26	24.21
$r \leq 1$	$r = 2$	0.67	3.84	10.83	0.67	3.84	10.83
Hypothesis (R and G/GDP)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	4.20	15.49	25.3	3.47	14.26	24.21
$r \leq 1$	$r = 2$	0.73	3.84	10.83	0.73	3.84	10.83

Source: Author's estimates.
Notes: The Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix and on the λ-Max-Eigen Statistic. The former test does not allow for a linear deterministic trend in the data, but with a constant; r represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes no linear deterministic trend in the data, but with no constant. ** denotes significance at the 1% level, while * denotes significance at the 5% level. Data sample used: 1977–2013.

One important question within this context: Have the successive Greek governments, in the last 37 years, violated the no Ponzi Game condition by accumulating a euros 360 billion pile of debt? The most important factors behind Greece's fiscal unsustainability can be summarized as follows: (1) The servicing of a huge debt, which is rendering government expenditure exceed by far government revenues; (2) The large expansion of the public sector with a main motive to "buy" votes and get re-elected; (3) The generous salaries, pensions, and retirement packages of public employees, and the mismanagement of the public enterprises; (4) Political corruption: Politicians pocket large sums of money in the form of bribes through the awarding of governments contracts; (5) A rampant tax evasion and corruption among tax officials with estimated cost euros 15 billion per year; (6) The frequent changes of the tax code which translate into an inherent weakness of the Greek taxation system; And (7) The size of the shadow economy estimated at about 25% of GDP.

The above factors led to the 2010 Greek debt crisis. Back then, the Troika offered a bailout package to Greece in order to avoid a total domestic financial collapse, on the one hand, and financial contagion across the EU, on the other. The belief was that if Greece defaults on its debt obligations, then international investors may expect a similar default from Italy,

Table 5
Cointegration tests: Ireland.

Hypothesis (R and G)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	42.10**	15.49	25.3	41.75**	14.26	24.21
$r \leq 1$	$r = 2$	0.35	3.84	10.83	0.35	3.84	10.83
Hypothesis (R and G/GDP)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	15.94*	15.49	25.3	14.85*	14.26	24.21
$r \leq 1$	$r = 2$	1.10	3.84	10.83	1.10	3.84	10.83

Source: Author's estimates.
Notes: The Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix and on the λ-Max-Eigen Statistic. The former test does not allow for a linear deterministic trend in the data, but with a constant; r represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes no linear deterministic trend in the data, but with no constant. ** denotes significance at the 1% level, while * denotes significance at the 5% level. Data sample used: 1977–2013.

Table 6
Cointegration tests: Italy.

Hypothesis (R and G)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	9.44	15.49	25.3	5.16	14.26	24.21
$r \leq 1$	$r = 2$	4.28*	3.84	10.83	4.28*	3.84	10.83
Hypothesis (R and G/GDP)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	7.66	15.49	25.3	5.36	14.26	24.21
$r \leq 1$	$r = 2$	2.30	3.84	10.83	2.30	3.84	10.83

Source: Author's estimates.
Notes: The Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix and on the λ-Max-Eigen Statistic. The former test does not allow for a linear deterministic trend in the data, but with a constant; r represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes no linear deterministic trend in the data, but with no constant. ** denotes significance at the 1% level, while * denotes significance at the 5% level. Data sample used: 1977–2013.

Table 7
Cointegration tests: Portugal.

Hypothesis (R and G)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	29.7**	15.49	25.3	27.50**	14.26	24.21
$r \leq 1$	$r = 2$	2.22	3.84	10.83	2.22	3.84	10.83
Hypothesis (R and G/GDP)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	17.12*	15.49	25.3	15.02*	14.26	24.21
$r \leq 1$	$r = 2$	2.10	3.84	10.83	2.10	3.84	10.83

Source: Author's estimates.
Notes: The Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix and on the λ-Max-Eigen Statistic. The former test does not allow for a linear deterministic trend in the data, but with a constant; r represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes no linear deterministic trend in the data, but with no constant. ** denotes significance at the 1% level, while * denotes significance at the 5% level. Data sample used: 1977–2013.

Table 8
Cointegration tests: Spain.

Hypothesis (R and G)		λ-trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	34.22**	15.49	25.3	33.79**	14.26	24.21
$r \leq 1$	$r = 2$	0.43	3.84	10.83	0.43	3.84	10.83
Hypothesis (R and G/GDP)		λ-Trace statistics	Critical values		λ-Max-Eigen statistic	Critical values	
Null	Alternative		5%	1%		5%	1%
$r = 0$	$r \geq 1$	12.66	15.49	25.3	11.90	14.26	24.21
$r \leq 1$	$r = 2$	0.76	3.84	10.83	0.76	3.84	10.83

Source: Author's estimates.
Notes: The Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix and on the λ-Max-Eigen Statistic. The former test does not allow for a linear deterministic trend in the data, but with a constant; r represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes no linear deterministic trend in the data, but with no constant. ** denotes significance at the 1% level, while * denotes significance at the 5% level. Data sample used: 1977–2013.

Spain, Portugal, Ireland and even perhaps from France. This would subsequently result in higher long term interest rates and a lower value of the Italian, Spanish, and Portuguese T-bills. Long-term real interest rates in Italy are currently above 4.3%; In Ireland above 3.8%; In Portugal above 6%; And in Greece above 10%. Lower values of Italian, Portuguese and Spanish T-bills would trigger a banking crisis in the EU, as other European banks are holding these government assets. Austerity measures have been introduced in these latter countries at the cost of triggering an additional recession, eventhough lower import demand would spread the crisis to other EU countries (including France and Germany).

4. Conclusion and policy recommendations

This study has evaluated the fiscal developments in the EU since the mid-1970s. After highlighting the major monetary and fiscal developments, the paper used the PVC framework to study the issue of debt and fiscal sustainability in a sample of selected EU countries. The empirical section of the paper has tested the PVC by studying the time series properties of the fiscal variables of interest. Unit root tests have revealed that with the exception of Germany and for all the EU countries under investigation, budget deficits are unsustainable. There is therefore a need for immediate fiscal reforms through austerity measures to be introduced in a timely manner so that these observed deficits don't translate into worsening a public debt situation which can qualify as being unsustainable even for Germany.

Cointegration tests on the PVC of the EU's countries have shown that fiscal policies are strongly sustainable in each of Germany and France. For Ireland, Italy, Spain and Portugal, fiscal policies were sustainable during the 70s and 80s. However, both the government expenditures and revenues series started to drift apart right after the 2008 US financial crisis. Therefore, these countries will need to tackle the deficits in their budgets through austerity measures so that public debts remain under control. Greece and perhaps Italy stand alone with unsustainable fiscal policies. The Greek government remains in a very tight spot, having to implement the various stabilization/austerity programs, fight a deep recession, and at the same time deal with a public debt that has become unsustainable. Some academics believe that the recent austerity measures introduced in several EU's countries including France have worsened the economic situation in the EU.

Given the current recessionary environment in the EU, it is difficult to design a credible fiscal consolidation scheme for growth and development on the one hand, and for debt and deficit reduction on the other, that could be implemented swiftly and effectively. Yet the fiscal situation is not hopeless. No doubt, the various stabilization programs will help EU's countries over time to grow out of debt and modernize; with an efficient and fiscally responsible public sector, a credible tax system, more competitive labour markets and a competitive economy internationally. The adoption of the EU's Fiscal Compact[10] in 2013 is for sure one step in the right direction. The treaty establishes a mechanism by which EU's member states have to meet certain fiscal targets within certain timelines. However, Eichengreen and Panizza (2014) have recently argued, quite convincingly, that the fiscal adjustment outlined in the treaty is extremely ambitious if one uses the history of past consolidations as a guide.

The European debt crisis is the result of not only economic but also the result of political and institutional deficits, which have been developing over the past few decades. The first best solution for Greece is to remain in the euro zone by satisfying its agreements with the Troika; all the other alternatives are inferior and dangerous, not only for Greece but for the euro zone itself. No doubt, the economic and political reforms will make the EU economies more efficient and competitive; but the recessionary environment has not been conducive in the advancement of these economies.

The macroeconomic literature argues that monetizing the debt would lead to more money in circulation and would therefore lead to higher inflation rates. However, it is well known that in a recessionary environment economic agents tend to hold cash rather than allocate it for consumption. For instance, during the 2008 global financial crisis, European private banks piled up liquidity without resorting to a credit expansion or to money creation. There exists, therefore, a clear wedge between the monetary base and the money supply in the EU. This means that euro currency printing by the ECB will most likely not lead to more money in circulation in the real sector, and subsequently will not cause inflation rates to increase.

Moreover, some policy makers have argued that if EU's inflation increases by more accommodative ECB's monetary policies, Germany will become less competitive internationally and vis-a-vis its European partner countries. This will, however, help Greece, Portugal, Spain, and Italy reduce their trade deficits relative to Germany. But an important question here would be: will Germany inflate its economy? Or will it allow the ECB to inflate prices in the EU countries? This seems to be an implausible outcome. Germany would most likely not inflate its economy to help EU countries in the periphery of the euro zone and jeopardize its comparative advantage relative to the rest of the world, unless forced to under the threats of an overall European debt crisis.

There are political and economic issues associated with the ECB's issuance of Eurobonds. The lack of a European political union poses a serious constraint on the issuance of Eurobonds. The EU is not a "transfer union" and none of the large EU countries would want to become one. Since this would mean that the more affluent EU states would subsidize the poorer EU countries of the periphery. Thus, the issuance of Eurobonds at this stage of European integration is politically not feasible. Eurobonds may also be economically distorting since they will involve having the same interest rate across all the EU members of the euro zone regardless of their macroeconomic conditions.

[10] Formally known as the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union.

Austerity measures need as much as possible not target aggregate demand in the short run in order not to worsen the existing recessionary environment in the EU. France's austerity measures are targeting the supply side of the economy except for the increase in the Value Added Tax (VAT) to 7% in the service and renovation sectors. Other measures introduced in 2012 not targeting aggregate demand include: (1) A dividend tax increase from 19% to 24%; (2) Lower subsidies to the real estate sector; (3) A 20% decrease in sustainable investment tax benefits for corporations; (4) Lower fiscal spending: Increase in minimum legal retirement age to 62 in 2017 (rather than 2018); 500 million euros decrease in public spending; Reorganization of the social security services; A real estate sales of public properties in the amount of euros 500 million/year, and lower financing for political parties. These austerity measures were considered as a carefully designed austerity plan, since tax increases are targeting capital rather than labour, with a subsequent lower impact on aggregate demand and GDP growth rates. The tax increases are affecting sectors that are not prone to international competition such as the real estate sector. Only the VAT increase will have an inflationary effect that would impact consumption and subsequently aggregate demand and growth. However, in general these austerity measures have been carefully designed so as to minimize their negative macroeconomic impact on the country's economy. Italy, Ireland, Spain, and Portugal will need to move in the same direction in order to reposition their economies back on a sustainable fiscal path.

Finally, Jean–Claude Trichet was replaced by Mario Draghi as Governor of the European Central Bank in November 2011. His first decision was to decrease the ECB's long run interest rate to 1.25 per cent on November 3rd 2013; a step in the right direction. From a debt-reduction point of view and given the EU's growth prospects, the optimal interest rate is probably closer to zero; an interest rate policy that has been implemented by the US Federal Reserve since the outbreak of the 2008 US financial crisis.

Appendix A

Table A.1
Unit root tests: France.

	G	G/GDP	R	R/GDP	BB	BB/GDP	Debt	Debt/GDP	Mackinnon's CVs	
									5%	10%
Cst										
PP	0.12	−2.19	0.04	−1.68	−1.20	−2.82*	4.50	0.93	−2.95	−2.62
PP FD	−3.24**	−5.42**	−6.75**	−6.64**	−5.9**		−2.24	−3.44**	−2.96	−2.62
Cst & TT										
PP	−1.60	−3.13	−2.48	−2.98	−2.26	−2.92	0.79	−1.49	−3.55	−3.21
PP FD	−3.21*	−5.32**	−6.56**	−6.51**	−6.6**	−5.72**	−3.12	−3.38	−3.56	−3.21
Cst										
ADF	0.53	−2.16	−0.13	−1.76	−1.62	−2.61	2.14	0.25	−2.96	−2.62
ADF FD	−3.28**	−5.42**	−4.91**	−6.64**	−4.6**	−4.91**	−2.33	−3.52*	−2.96	−2.62
Cst & TT										
ADF	−1.59	−2.99	−4.03**	−2.98	−3.14	−3.10	−0.08	−2.38	−3.56	−3.21
ADF FD	−3.28*	−5.32**		−6.53**	−4.5**	−4.80**	−3.36*	−3.57**	−3.56	−3.21

Source: Author's estimates.
Notes: PP is the Phillips–Perron unit root test and ADF is the Augmented Dickey-Fuller test. FD is the First Difference; R is government revenues; G represents government spending; BB is the Budget Balance; CVs are the Critical Values. The unit root tests are performed assuming the presence of either a Constant (Cst), or a Constant and Time Trend (TT) in the series. The numbers of lags used are the proper lag lengths based on the Akaike Information Criterion (AIC). A * denotes rejection of the null hypothesis of non-stationarity at the 10% level of significance, while a ** denotes a stronger rejection at the 5% level.

Table A.2
Unit root tests: Germany.

	G	G/GDP	R	R/GDP	BB	BB/GDP	Debt	Debt/GDP	Mackinnon's CVs	
									5%	10%
Cst										
PP	−0.83	−2.18	−0.35	−1.41	−3.5**	−3.78**	1.33	−0.47	−2.62	−2.95
PP FD	−5.88**	−7.08**	−3.70**	−7.01**			−3.9**	−3.53**	−2.62	−2.96
Cst & TT										
PP	−1.64	−2.36	−1.64	−2.00	−3.4**	−3.80*	−1.90	−2.29*	−3.21	−3.55
PP FD	−5.83**	−7.18**	−3.64**	−6.92**			−3.9**		−3.21	−3.56
Cst										
ADF	−0.83	−2.26	−0.31	−1.51	−3.7**	−3.88**	1.40	−0.49	−2.62	−2.96
ADF FD	−5.87**	−6.94**	−3.74**	−7.02**			−4.0**	−3.91**	−2.62	−2.96
Cst & TT										
ADF	−1.59	−2.36	−1.99	−2.01	−3.6**	−3.88*	−2.90	−3.35*	−3.21	−3.56
ADF FD	−5.83**	−6.87**	−3.68**	−6.92**			−4.20*		−3.21	−3.56

Source: Author's estimates.
Notes: See Table A.1.

Table A.3
Unit root tests: Greece.

	G	G/GDP	R	R/GDP	BB	BB/GDP	Debt	Debt/GDP	Mackinnon's CVs	
									5%	10%
Cst										
PP	0.12	−0.42	−0.35	−0.35	−0.15	−2.31	1.12	0.39	−2.62	−2.95
PP FD	−2.82*	−6.76**	−3.03**	−5.56**	−6.3**	−6.19**	−5.1**	−5.49**	−2.62	−2.96
Cst & TT										
PP	−2.14	−3.18	−1.83	−2.05	−2.40	−2.28	−2.08	−1.41	−3.21	−3.55
PP FD	−2.74	−6.59**	−2.90	−5.47**	−7.7**	−6.42**	−5.5**	−5.48**	−3.21	−3.56
Cst										
ADF	−0.35	−0.68	−0.76	−0.34	−0.07	−2.28	1.06	0.45	−2.62	−2.96
ADF FD	−3.22**	−6.51**	−3.10**	−5.56**	−1.21	−5.87**	−5.1**	−5.41**	−2.62	−2.96
Cst & TT										
ADF	−2.96	−3.18	−1.65	−1.88	−2.78	−2.24	−2.11	−1.12	−3.21	−3.56
ADF FD	−3.17	−4.88**	−3.00	−5.46**	−2.13	−5.70**	−3.6**	−5.42**	−3.21	−3.56

Source: Author's estimates.
Notes: See Table A.1.

Table A.4
Unit root tests: Ireland.

	G	G/GDP	R	R/GDP	BB	BB/GDP	Debt	Debt/GDP	Mackinnon's CVs	
									5%	10%
Cst										
PP	−0.50	−1.93	−0.55	−1.18	−2.21	−2.23	2.78	−1.18	−2.62	−2.95
PP FD	−6.73**	−6.02**	−2.28	−5.07**	−6.3**	−5.88**	−1.89	−2.05	−2.62	−2.96
Cst & TT										
PP	−2.14	−1.95	−1.75	−3.20	−2.58	−2.10	0.90	−0.79	−3.21	−3.55
PP FD	−6.63**	−6.08**	−2.23	−5.01**	−6.5**	−6.62**	−2.27*	−2.13	−3.21	−3.56
Cst										
ADF	−0.60	−1.93	−3.93**	−1.09	−2.14	−2.14	0.86	−2.62	−2.62	−2.96
ADF FD	−6.73**	−5.94**		−5.07**	−5.1**	−5.58**	−2.41	−2.05	−2.62	−2.96
Cst & TT										
ADF	−2.20	−1.95	−5.37**	−3.18	1.54	−2.06	−3.18	−2.14	−3.21	−3.56
ADF FD	−6.63**	−5.87**		−5.01**	2.61	−4.26**	−2.97*	−2.20	−3.21	−3.56

Source: Author's estimates.
Notes: See Table A.1.

Table A.5
Unit root tests: Italy.

	G	G/GDP	R	R/GDP	BB	BB/GDP	Debt	Debt/GDP	Mackinnon's CVs	
									5%	10%
Cst										
PP	−2.36	−1.46	−3.60**	−2.47	−2.04	−1.54	−0.79	−1.25	−2.62	−2.99
PP FD	−3.52**	−4.89**		−4.86**	−4.9**	−4.78**	−2.24	−2.27	−2.62	−2.99
Cst & TT										
PP	−2.14	−1.67	−1.18	−2.54	−2.10	−1.33	−1.88	−1.47	−3.21	−3.60
PP FD	−3.92**	−4.83**	−4.07**	−4.83**	−4.8**	−4.93**	−2.18	−2.19	−3.21	−3.61
Cst										
ADF	−2.61	−1.35	−2.53	−2.47	−1.97	−1.54	−0.55	−1.63	−2.62	−2.99
ADF FD	−3.52**	−4.89**	−3.39**	−4.86**	−4.8**	−4.78**	−2.21	−2.31	−2.62	−2.99
Cst & TT										
ADF	−1.97	−1.49	−1.35	−2.54	−2.10	−1.33	−2.59	−1.98	−3.21	−3.60
ADF FD	−3.92**	−4.83**	−4.43**	−4.83**	−4.7**	−4.9**	−2.15	−2.26*	−3.21	−3.62

Source: Author's estimates.
Notes: See Table A.1.

Table A.6
Unit root tests: Portugal.

	G	G/GDP	R	R/GDP	BB	BB/GDP	Debt	Debt/GDP	Mackinnon's CVs	
									5%	10%
Cst										
PP	−1.61	−1.47	−2.27	−2.02	−2.47	−3.08**	3.88**	2.68	−2.62	−2.99
PP FD	−2.97*	−3.70**	−5.61**	−10.63**	−11.2**			−2.32	−2.62	−2.99
Cst & TT										
PP	−1.35	−2.36	−1.50	−4.94**	−3.39*	−3.01	0.02	0.85	−3.21	−3.60
PP FD	−3.18	−3.57*	−9.37**			−10.32**	−2.53	−3.17	−3.21	−3.61
Cst										
ADF	−1.33	−0.78	−1.51	−0.68	−2.49	−3.13**	3.88**	−0.02	−2.62	−2.99
ADF FD	−5.64**	−5.10**	−1.93	−4.42**	−6.09**			−2.35	−2.62	−2.99
Cst & TT										
ADF	−3.89**	−2.21	−0.34	−4.93**	−3.93**	−3.06	−1.16	0.85	−3.21	−3.61
ADF FD		−4.87**	−2.45*			−2.56	−3.09	−3.19	−3.21	−3.62

Source: Author's estimates.
Notes: See Table A.1.

Table A.7
Unit root tests: Spain.

	G	G/GDP	R	R/GDP	BB	BB/GDP	Debt	Debt/GDP	Mackinnon's CVs	
									5%	10%
Cst										
PP	0.66	−2.11	−0.57	−2.95**	−0.89	−1.51	2.28	−1.18	−2.62	−2.95
PP FD	−2.94*	−4.14**	−3.33**		−3.4**	−4.08**	−2.11	−2.32	−2.62	−2.96
Cst & TT										
PP	−1.85	−2.11	−1.86	−2.05	−1.52	−1.52	0.39	−1.76	−3.21	−3.55
PP FD	−2.24	−4.11**	−3.27*	−5.41**	−3.43*	−3.98**	−2.58	−2.29*	−3.21	−3.56
Cst										
ADF	−0.48	−2.29	−0.84	−2.97**	−1.71	−2.07	1.06	−1.57	−2.62	−2.96
ADF FD	−2.94*	−4.08**	−3.39**		−4.5**	−4.15**	−2.21	−2.27	−2.62	−2.96
Cst & TT										
ADF	−2.35	−2.28	−3.34*	−2.09	−2.30	−2.02	−4.5**	−3.32	−3.21	−3.56
ADF FD	−2.21	−4.04**	−2.34	−5.26**	−4.6**	−4.12**		−2.29*	−3.21	−3.56

Source: Author's estimates.
Notes: See Table A.1.

References

Agenor, P., & Montiel, P. (1996). *Development macroeconomics* (second edition). Princeton University Press.

Ahmed, S. & Roger, J. H. (1995). Government budget deficits and trade deficits: are present value constraints satisfied in long-term data? International Finance Section Discussion Paper #494, Washington, D.C.: Federal Reserve Board.

Aroskar, R., Sarkar, S. K., & Swanson, P. E. (2004). European Foreign exchange market efficiency: evidence based on crisis and non-crisis periods. *International Review of Financial Analysis*, *13*(3), 333–347.

Athanasios, P., & Sidiropoulos, M. (1999). The sustainability of fiscal policies in the European Union. *International Advances in Economic Research*, *5*(3), 289–307.

Baglioni, A., & Cherubini, U. (1993). Intertemporal budget constraint and public debt sustainability: the case of Italy. *Applied Economics*, *25*, 275–283.

Bohn, H. (2005). The sustainability of fiscal policy in the United States. Working Paper Series No. 1446. Center for Economic Studies and Ifo Institute.

Buiter, W., & Patel, R. (1992). Debt, deficits, and inflation: an application to the public finances of India. *Journal of Public Economics*, 172–205.

Caporale, G. (1995). Bubble finance and debt sustainability: a test of the government's intertemporal budget constraint. *Applied Economics*, *27*, 1135–1143.

Chalk, N. (2000). The sustainability of bond-financed deficits: an overlapping generations approach. *Journal of Monetary Economics*, *45*(2), 293–328.

Crowder, W. (1997). The long-run fisher relation in Canada. *Canadian Journal of Economics*, *30*(4), 1124–1142.

Eichengreen, B., & Panizza, U. (2014). A surplus of ambition: can Europe rely on large primary surpluses to solve debt problems? NBER Working Paper Series, W20316.

Escolano, J. (2010). *A practical guide to public debt dynamics, fiscal sustainability, and cyclical adjustment of budgetary aggregates*. Fiscal Affairs Department: International Monetary Fund.

Ghosh, A., Kim, J., Mendoza, E., Ostry, J., & Qureshi, M. (2013). Fiscal fatigue, fiscal space and debt sustainability in advanced economies. *The Economic Journal*, *123*, 4–30.

Guyot, A., Segot, T. L., & Neaime, S. (2014). *Foreign shocks and international cost of equity destabilization: evidence from the MENA region. Emerging markets review, Vol. 18*. Elsevier (pp. 101–122).

Hakkio, C. S., & Rush, M. (1991). Is the budget deficit too large? *Economic Inquiry*, *29*, 429–445.

Hamilton, J. D., & Flavin, M. (1986). On the limitations of government borrowing: a framework for empirical testing. *The American Economic Review*, *76*(4), 808–819.

Haug, A. (1995). Cointegration and government borrowing constraints: evidence for the United States. *Journal of Business and Economic Statistics*, *9*(1), 97–101.

Johansen, S. (1997). Likelihood-based inference in cointegrated vector autoregressive models. *Scandinavian Journal of Economics*, *99*, 351–354.

Kremers, J. M. (1988). Long-run limits on the US federal debt. *Economics Letters*, *28*, 259–262.
Lai, K. S., & Lai, M. (1991). A cointegration test for market efficiency. *The Journal of Futures Markets*, *11*(5), 567–575.
Lüutkepohl, H., Saikkonen, P., & Trenkler, C. (2002). Maximum eigenvalue versus trace tests for the cointegrating rank of a VAR process. *Econometrics Journal*, *4*(2), 287–310.
Makrydakis, S. (1999). Consumption-smoothing and the excessiveness of Greece's current account deficits. *Empirical Economics*, *24*, 183–209.
Mendoza, E., & Ostry, J. (2008). International evidence on fiscal solvency: is fiscal policy "responsible"? *Journal of Monetary Economics*, *55*(6), 1081–1093.
Neaime, S. (2010). *Sustainability of MENA public debt and the macroeconomic implications of the US financial crisis. Middle East Development Journal*, *2*, 177–201. World Scientific, Singapore.
Neaime, S. (2012a). The global financial crisis and the euro Mediterranean partnership. In *Europe and the Mediterranean economy* (pp. 116–131). United Kingdom: London School of Economics and Routledge Press (Taylor and Francis).
Neaime, S. (2012b). The global financial crisis, financial linkages and correlations in returns and volatilities in emerging MENA Stock markets. *Emerging Markets Review*, *13*(2), 268–282. Elsevier.
Osterwald-Lenum, M. (1992). A note with quantiles of the asymptotic distribution of the maximum likelihood cointegration rank test statistics. *Oxford Bulletin of Economics and Statistics*, *54*(3), 461–472.
Payne, J. (1997). International evidence on the sustainability of budget deficits. *Applied Economics Letters*, *4*, 775–779.
Quintos, C. E. (1995). Sustainability of the deficit process with structural shifts. *Journal of Business and Economic Statistics*, *13*, 409–417.
Smith, G. W., & Zin, S. E. (1991). Persistent deficits and the market value of government debts. *Journal of Applied Econometrics*, *6*, 31–44.
Trehan, B., & Walsh, C. E. (1988). Common trends, inter-temporal budget balance, and revenue smoothing. *Journal of Economic Dynamics and Control*, *12*, 425–444.
Trehan, B., & Walsh, C. E. (1991). Testing intertemporal budget constraints: theory and applications to U.S. federal budget and current account deficits. *Journal of Money, Credit, and Banking*, *23*(2), 206–223.
Wilcox, D. (1989). The sustainability of government deficits: implications off the present-value borrowing constraint. *Journal of Money, Credit, and Banking*, *21*(3), 291–306.