Macroeconomics and Politics in the Accumulation of Greece's Debt: An econometric investigation, 1975-2009

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ABSTRACT

This paper focuses on an econometric investigation of the macroeconomic and political factors that contributed to Greece's excessive debt accumulation and its failure to adequately address its fiscal imbalances, from the restoration of democracy in 1974 till the crisis of 2009. The econometric investigation is based on a model in which two political parties alternate in power, and in which governments choose primary expenditure and taxes to minimize deviations from politically determined expenditure and tax targets, subject to a debt accumulation equation. The model predicts a political equilibrium in which primary expenditure and taxes follow feedback rules which go in the direction of stabilizing the debt to GDP ratio. However, this stabilization incentive is weaker in election years. The model also predicts potential partisan differences in the evolution of primary expenditure and taxes, due to the different preferences of political parties. Estimates of government reaction functions to public debt for the period 1975-2009 suggest a rather weak stabilizing reaction of primary deficits to public debt. This stabilizing reaction disappears in election years, which are characterized by strong fiscal expansions. We find no evidence of partisan differences in the reaction of primary deficits to inherited debt, but we do find evidence of lower primary deficits in the post-1992 Maastricht treaty period. Overall the model accounts for the accumulation of Greece's government debt in terms of the trend increase in primary expenditure, the positive shocks to primary expenditure in election years and the weak stabilizing reaction of government revenue, due to tax smoothing.

Keywords: macroeconomics and politics, government debt, primary deficit, stabilization, elections, political parties, Greece

JEL Classification: E6, H6, C5

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1. Introduction

The Greek fiscal situation has been at the center of international attention since the end of 2009. The fiscal deficit of Greece increased significantly during the international crisis of 2008-09, which hit the Greek economy at its Achilles heel: the refinancing of its persistently high public debt.

In the circumstances that followed the international financial crisis, the refinancing of the debt became problematic, and spreads over the German benchmark rates started to widen. Greece found itself at the center of a wave of criticism by the international press, international organizations, rating agencies and the European Commission. Despite the fact that the fiscal situation in 2009 had worsened throughout Europe and the rest of the world, Greece was the first sovereign to find itself in the middle of a confidence crisis which finally forced it to resort to a special fund set up by the European Union and adopt a fiscal consolidation program supervised by the IMF, the EU Commission and the European Central Bank.

Greece had experienced a steep rise in its government debt to GDP ratio during the 1980s. The government debt to GDP ratio rose from about 20% of GDP in the late 1970s to about 100% of GDP in the early 1990s.

Since then, government debt had been stabilized at about 100% of GDP and Greece appeared to have had no problems refinancing its debt until the end of 2008. Nevertheless, Greece's high government debt and deficits had persisted as significant problems throughout the period. Although there were short periods of significant deficit reduction, there were many instances of relapse, especially around election years. Given this experience, Greece appears as a suitable candidate to test theories of the macroeconomics and politics of debt accumulation.[1]

This paper provides such a systematic examination and test.

Section 2, contains a brief historical account of how the sovereign debt of Greece was accumulated and then stabilized relative to GDP. This account highlights the economic and political background behind the rapid accumulation of government debt in the 1980s, the inadequately implemented convergence programs of the 1990s and Greece's fiscal relapses and failures in implementing the Stability and Growth Pact after it was admitted into the euro area.

Section 3 briefly surveys theoretical models that address the political and economic factors that lead to excessive government debt accumulation and delayed fiscal stabilizations. The literature focuses mainly on the "time inconsistency problems" characterizing ex ante and

[1] A number of papers have explored Greece's turbulent macroeconomic experience, in order to test theories of credibility and politics. Alogoskoufis and Philippopoulos (1992), Alogoskoufis (1995) and Alogoskoufis, Lee and Philippopoulos (1998) explored the relationship between credibility, politics, inflation and exchange rate regimes. Alogoskoufis and Christodoulakis (1991), Alogoskoufis (1995) and Lockwood, Philippopoulos and Tzavalis (2001) explored issues of government debt sustainability and the relationship between politics, debt accumulation and international institutions, while Alogoskoufis (2011) and Arghyrou and Tsoukalas (2011) have used debt and balance of payments crisis models to provide interpretations of the Greek debt crisis.

ex post government policies, as well as on political factors, related to the incentives of incumbent governments to resort to excessive debt accumulation. The role of partisan preferences and the role of elections, as well as the strategic interactions between governments also play a key role in this literature.

In section 4 we set up a political economy variant of the public debt model of Barro (1979), along the lines of Lockwood, Philippopoulos and Snell (1996). We extend the model, by allowing for the electoral effects highlighted by Rogoff and Sibert (1989), as well as for different discount factors for the two political parties, and analyze its predictions for the determination of government deficits and debt.

In section 5 we proceed to an econometric investigation of the predictions of the model for the case of Greece. We estimate the government reaction functions to public debt and examine how these reaction functions depend on economic and political factors.

Our estimates suggest the existence of weak debt stabilizing behavior by Greek governments, concentrated mainly in non-election years. The main instrument used for fiscal adjustment appears to have been increases in government revenue. We find evidence of significant increases in primary deficits during election years, as predicted by our model and other electoral cycle models. We also find some evidence that socialist governments are associated with higher primary expenditure and taxes, but no evidence of partisan differences in primary deficits. Our findings also suggest that Greece's convergence efforts in the post-1992 Maastricht treaty period and its participation in the euro area did result in a significant reduction in its primary deficit to

GDP ratio, which helped to stabilize public debt until 2008. We finally find that fluctuations in euro area GDP growth have a significant effect on Greece's primary deficit, a finding consistent with the existence of significant automatic stabilizers.

Overall, our findings suggest that the driving force behind the accumulation of Greece's high government debt has been the trend increase in primary expenditure and the further significant increases in primary expenditure during election years, coupled with the weakness of the debt stabilization efforts during non-election years, which relied on insufficient increases in government revenue. Greece's participation in the single currency project helped reduce its primary deficits and stabilize its already high debt to GDP ratio, but it did not shield Greece from the effects of electoral and international economic shocks. The fiscal destabilization of 2009 can be attributed to a combination of a deep international and European recession and another electoral fiscal shock.

The detailed conclusions are summarized in the last section of the paper.

2. Politics and Government Debt Accumulation in Greece, 1975-2009

One can usefully distinguish four discrete phases in the process of government debt accumulation from the restoration of democracy in 1974 to the Greek fiscal crisis of 2010. The first is the period of preparation for EEC entry. It is a relatively short period that lasted between 1975 and 1980, in which the government debt to GDP ratio remained stable. The second phase is the period of rapid debt

accumulation, during the 1980s. The third is the convergence period of the 1990s, during preparations for Greece's entry into the euro area. The fourth is the period of euro area participation, from 2000 until 2008, before the international financial crisis worsened, with the collapse of Lehman Brothers. Clearly, the international crisis ushered in a new fifth period for Greek macroeconomic policy, which is outside the scope of this paper.

The two parties alternating in power since the restoration of democracy in Greece were New Democracy (ND) and the Panhellenic Socialist Movement (PASOK). New Democracy positioned itself as the "pro-market" or "conservative" party and PASOK positioned itself as the "socialist" party. Initially the two parties had wide ideological differences on just about everything, including participation in the European Economic Community, which PASOK opposed. However, since the elections of 1993 there was a significant political convergence around the national target of participation in the euro area.

The timing of Greek elections and the political composition of Greek governments are summarized in Table 1. New Democracy was in government for a total of about 16 years and PASOK for a total of about 19 years. In the late 1980s there were two short lived coalition governments, one of which was a government of National Unity.

Macroeconomic policy in the first five years after the restoration of democracy, with New Democracy in government, was dominated by the goal of preparing Greece for EEC entry. The economy recovered quickly from the recession of 1974, unemployment was maintained at low levels, inflation decelerated and the current account was in surplus. Until

1981, the fiscal deficit was contained below 3% of GDP and public debt was only around 25% of GDP. The last part of this period was characterized by stagflation, caused by the second oil shock of 1979. Growth fell sharply from 7,2% in 1978 to only 0,7% in 1980. Inflation almost doubled to 22,5% in 1980, from 13,2% in 1978. Unemployment doubled from 1,9% of the labor force in 1978 to 4% in 1981.

PASOK won a landslide victory in October 1981, after Greece's EEC entry, which it had been opposing. In electoral 1981, which was also a year of world recession, the fiscal deficit rose from 2,6% of GDP in 1980 to 9% in 1981. Fiscal deficits remained high throughout the 1980s, and within a few years public debt had exploded. High inflation also developed into a persistent problem for the Greek economy, accommodated by a loose monetary and exchange rate policy. The economy stagnated, as economic growth fell to almost zero for most of the 1980s and unemployment increased further.

The evolution of Greek public debt is depicted in Figure 1. As can be seen from this chart, public debt rose from about 20% of GDP in the early 1980s to almost 100% of GDP in the early 1990s. In addition, a large part of the debt of public sector entities and large government guarantees had not been recorded in official figures, and were only incorporated into official figures between 1990 and 1993.

In the 1990s, public debt was stabilized at slightly below 100% of GDP, as a process of fiscal adjustment which started in 1990 was pursued throughout the 1990s, in the context of the convergence programs of the Greek economy.

Following the adoption of the euro, public debt rose above 100% of GDP in electoral 2000, and hovered around the 100% of GDP mark until 2008.

When the international financial crisis hit Greece in late 2008, the government debt to GDP ratio was at 99%, versus 70% for the average of the Euro Area.

During the 1980s government deficits remained persistently high. The governments of Andreas Papandreou followed an expansionary fiscal policy, financed through internal and external debt as well as inflows from the EEC. In the ten years between 1981 and 1990, the general government deficit was at more than 9% of GDP on average, something that had never happened before for such a long period.

The evolution of the government deficit to GDP ratio is depicted in Figure 2, which also depicts the primary deficit. It is impressive how the deficit of the general government widened during the 1980s. Originally, this was due to high primary deficits, which were the initial source of fiscal destabilization. Primary deficits widened in the 1980s, as government revenue failed to keep pace with rises in primary expenditure. The evolution of government revenue and primary expenditure as a share of GDP is depicted in Figure 3. After some time, interest payments took over as an additional destabilizing source. The debt to GDP ratio increased and interest payments on the high and rising debt also rose relative to GDP. It is worth noting that both nominal and real interest rates rose in the second part of the 1980s, because of gradual financial liberalization. This had an additional effect on the deficit, but probably made debt financing easier, as Greek bonds became more attractive to domestic and international bondholders.

A second reason for the rapid rise in the government debt to GDP ratio during the 1980s was the slowdown in economic growth, which had an additional adverse effect on the process of debt accumulation (see Figure 4 which depicts the growth rate of GDP of Greece and the Euro Area). The expansionary fiscal policy failed to revive economic growth, and the 1980s were characterized by many years of economic stagnation or very low growth.

Apart from high deficits and the slowdown in economic growth, there was an additional reason for the rise in the public debt to GDP ratio. Government guarantees for loans of both private and public enterprises and organizations, as well as agricultural cooperatives rose significantly during this period. By 1989, these guarantees had risen to 32% of GDP. In the next three years, half of those had to be paid out by the government and caused an additional increase in public debt.

The third phase in the process of debt accumulation in Greece is the convergence period of the 1990s. This effectively started in 1990, when New Democracy under Constantine Mitsotakis was elected after three successive elections and two short-live coalition governments. The Mitsotakis government initiated a process of fiscal consolidation, mainly based on revenue increases, and a program of privatizations and liberalization of the economy. In 1992 Greece signed the Maastricht Treaty and its first convergence program was approved in 1993. The high primary deficit of 1989 was gradually reduced, and by 1994 Greece had achieved a primary surplus. In October 1993 early elections took place after the Mitsotakis government lost its parliamentary majority. PASOK was reelected and remained in government throughout the rest of the

1990s and beyond. The PASOK government remained committed to the goal of preparing Greece for entry into the euro area. Early elections took place in 1996, and PASOK was reelected under the leadership of Constantine Simitis. A new convergence program had been adopted in late 1994, which led to Greece's eventual admission in the euro area in June 2000. In the 1994-1999 period the primary surplus remained roughly constant relative to GDP, although both revenue and primary expenditure rose significantly relative to GDP.

The 1990-999 period can be seen in retrospect as the decade of fiscal convergence in Greece. It spanned three governments. One ND government, under Constantine Mitsotakis, and two PASOK governments, under Andreas Papandreou and Constantine Simitis respectively.

An inspection of Figures 2 and 3 reveals that we can distinguish two sub-periods of fiscal adjustment in the decade of convergence, 1990-1999. During the first five years 1990-1994, fiscal adjustment was based on the creation of large primary surpluses. During the five years 1995-1999, there was no further adjustment in the primary surplus, and the further reduction of the general government deficit was achieved through the reduction of nominal interest rates that gradually adapted to expectations of lower inflation. Actual inflation kept falling and Greece was coming closer and closer to its target of participation in the euro area. In addition, as can be seen in Figure 4, during the 1990s the growth rate of GDP gradually rose, making an additional contribution to the stabilization of the government debt to GDP ratio. Greece was finally

accepted in the euro area in 2000, having marginally met the nominal convergence criteria of the Maastricht treaty.

We finally turn to the fourth period, the period of Greece's participation in the euro area from 2000 until 2008, when the international financial crisis peaked with the collapse of Lehman Brothers.

As can be seen from Figures 2 and 3, Greece's fiscal deficit started widening immediately after the country's accession to the euro area. The main reason was the fall in government revenue relative to GDP since 2000, as primary expenditure continued its inexorable rise (see Figure3). By 2004, the primary surplus had been transformed into a significant primary deficit, and the deficit of the general government had climbed to 7.6% of GDP, versus the 3% envisaged in the Stability and Growth Pact. 2004 was an election year, associated with a change in government. The new government of Costas Karamanlis completed the preparations for the Olympic Games, and afterwards embarked in a program of gradual fiscal consolidation and structural reforms, that resulted in a significant reduction of the deficit of the general government. Growth was strong and unemployment on a downward path during this period. However, fiscal slippages appeared again in 2007, another election year, and the deficit continued its upward trend even after the reelection of the Karamanlis government. 2009 was a year of world recession and political instability in Greece, which resulted in early elections and the return of PASOK, under George Papandreou. The deficit of the general government almost doubled compared to 2008.

When the financial crisis hit the international economy, Greece was still plagued by significant fiscal imbalances which worsened during the

crisis. Despite efforts to address the situation since the early 1990s, public debt had been stabilized at a high level relative to GDP, and the fiscal situation remained fragile, probably the most serious problem of the Greek economy.

In the rest of this paper we shall provide an econometric investigation of the economic and political causes of these developments. As a prelude to this econometric investigation we shall first briefly survey the recent theoretical literature on the macroeconomics and politics of public debt accumulation. This will help inform the predictions of our model and provide richer interpretations of our econometric results.

3. The Macroeconomics and Politics of Public Debt Accumulation

Modern macroeconomics has a number of alternative explanations for the process of public debt accumulation.

The simplest explanation relies on a representative household economy, in which all agents are the same. In a representative household economy, the theory of optimal taxation prescribes tax smoothing over time. Because taxes are distortionary, they should not be changed in order to finance temporary or cyclical changes in the government budget. Debt financing should be used in the case of temporary and exceptionally high government expenditure, such as during a war, or when tax receipts are temporarily low, such as during a recession (see Barro 1979, Lucas and Stokey 1983). Of course, permanent rises in government spending, such as those required for a bigger welfare state,

ought to be financed through higher taxes, even if taxes are distortionary.

However, such dynamic optimal fiscal plans have been shown to suffer from the time inconsistency problem, meaning that a some point in time the government may have an incentive to deviate from its pre-announced ex ante optimal tax policy (Kydland and Prescott 1977, Calvo 1978). For example, consider a policy maker (social planner) who after a war (or a recession) is faced with tackling (reducing) a high public debt that was accumulated during the war (or the recession). The ex-ante optimal policy, on which the accumulation of debt was based, is to create surpluses by reducing expenditure and increasing revenue. However, she has at least three other options. First, to default on the debt. Second, to impose an extraordinary tax on the wealth of bondholders. Third, to generate unexpected inflation and monetize the debt. These options may appear ex post to imply smaller social costs than the reduction of primary government expenditure or the rise of other more distortionary taxes. Thus, what was optimal ex ante, before the accumulation of public debt, may not appear optimal ex post, after public debt has accumulated. This is how the time inconsistency problem arises. If the policy maker succumbs to the temptation of the options of default, a capital levy or monetization, she may lose reputation with bondholders and find it extremely difficult to borrow in the future. If she sticks to the ex-ante optimal policy, she does not lose reputation, but she may incur heavy social and political costs in trying to stabilize or reduce the debt that was accumulated.

Things become more complicated once we leave the world of representative households. If various groups of economic agents have conflicting objectives, then distributional and political considerations will arise. These richer political economy models help explain why public debt may also increase for reasons not related to wars or recessions.

Consider a simple example highlighted by Alesina (1988). He assumes that there are three groups of agents: “rentiers” (who hold public debt), “entrepreneurs” (who hold equity in firms) and “workers” (who hold human capital). Obviously in reality there is a continuum between these three groups, as each household may hold different amounts of each particular form of capital.

The three groups will obviously favor different solutions to the public debt problem. “Rentiers” will oppose default or inflation and will favor reductions in government expenditure or taxes on firms and workers. The “entrepreneurs” will favor debt default and inflation as well as taxes on labor. “Workers” will favor default, taxes on capital and inflation, provided their real wages are protected from inflation.

The debt stabilization policies that will actually be followed will be the outcome of a political struggle among these three groups.

One potential solution is offered by Downsian median voter models (see Downs 1957). In such models, politics converges to the preferences of the median voter. If the median voter is a “worker”, a democratic government will tend to favor default, capital taxation and inflation. If “rentiers” and “entrepreneurs” prevail, in the sense of the median voter model, labor taxes will be increased and social expenditure reduced.

However, median voter equilibria exist under very restrictive conditions. If every group can block the preferences of the other two, but is unable to impose its own preferred solution, then public debt will not be tackled and will continue accumulating well after the war or the initial recession.

Such models provide an explanation as to why we have been observing a bias towards excessive fiscal deficits and rises in debt to GDP ratios in peacetime. Governments are reluctant and hesitant in taking decisions that would stabilize public debt, for fear of alienating one or more of the political groups that stand to lose from an adjustment program. Such decisions are even more difficult in electoral periods. Models of this form are analyzed in the new political economy literature.

Let us first consider electoral factors. The basic idea is that before the election, decision makers attempt to use fiscal policy in order to positively influence voters and thus maximize their chance of staying in power. This is called the opportunistic or electoral incentive. Contrary to what is generally believed, providing theoretical interpretations of such electoral fiscal cycles is not straightforward under the assumption of rational expectations. The question that arises is why rational voters would want to reward a government that causes a pre-election budget cycle, when they know that this is for opportunistic reasons. Rogoff and Sibert (1988) and Rogoff (1990) provide a neat theoretical explanation based on asymmetric information between governments and voters and how governments can exploit this asymmetry. In their model the effectiveness of government cannot be directly observed by voters. Voters simply observe an electoral improvement in their economic condition, which may result from an increase in government spending or

tax cuts. They do not know during the election whether this improvement is artificial and temporary or the result of an effective economic policy. Voters will thus rationally attribute part of the economic improvement they observe to the effectiveness of government policy, and thus the popularity of the government will increase. Consequently, the ruling party has every incentive to increase public spending and reduce taxes before the election in order to maximize its popularity. Models of asymmetric information can thus explain the expansion of fiscal deficits during elections. Even if voters know that the government has an electoral incentive to reduce taxes and increase public spending, they rationally attribute only part of the economic improvement observed to the opportunism of incumbent governments, while another part is attributed to the effectiveness of government policy.

The model of Rogoff and Sibert to electoral cycles has been enriched by the introduction of partisan differences. Alesina and Tabellini (1990) and Persson and Svensson (1989), introduced partisan differences and the possibility of issuing debt, in order to develop a theory of electoral cycles based on the strategic use of debt.

The basic idea of models based on partisan differences is that policy makers belong to political parties which have different ideological premises and which strive to meet the aspirations of different constituencies. Thus, a “socialist” government would be aiming for a larger public sector than a “conservative” or “free market” government. “Socialists” would tend to favor more the role of the public sector, while “free market” parties would tend to rely more on the private sector.

“Socialists” would be less averse to high income and wealth taxes than “free market” advocates, having a stronger faith in the redistributive role of taxes. This somewhat stylized and over-simplified distinction is not far from the preferences of voters and parties in most mixed economies, and is a key characteristic of partisan models.

Every government knows that, with some probability, voters will replace it at some future election. If it can the control a "state variable", such as public debt, it will try to use it strategically to influence the future choices of its successors in the direction of its own preferences or in the direction of the preferences of its constituents. Of course, in order for this to be possible government debt must not be neutral. For example, if taxation is distortionary, a change in the time path of public debt will have permanent effects on the economy, and even effects that cannot be fully reversed by future governments.

Persson and Svensson (1989) show that an increase in public debt from a "conservative" government can be an equilibrium strategy, as it binds its successors to restrain primary public spending in the future. Thus, if a “conservative” government were to cut taxes today and increase public debt, this puts pressure on its “socialist” successors to limit future primary expenditure along with a future increase in taxes. The intertemporal distribution of the tax burden may not be optimal, but the future path of fiscal policy will be nearer to the objectives of the “conservative” incumbent. When the ideological differences between political parties are large, then there is a trend for an increase in government debt, even by “conservative” governments.

A related idea of Tabellini and Alesina (1990) is that governments disagree on the composition of public spending. Again we have an increasing trend in public deficits as the government borrows to increase the type of spending it prefers, knowing that future spending cuts or tax increases to service the debt will come from everywhere.

Another strand of the literature focuses on the fact that elections result in "myopic" behavior on the part of incumbent governments. If governments do not care about the state of the economy in case they are not reelected, in election years they will be more reluctant to incur the costs associated with adjusting government expenditure and taxes, as they discount the future benefits in terms of lower public debt more heavily. Lockwood, Philippopoulos and Snell (1996) and Lockwood, Philippopoulos and Tzavalis (2001) set up and estimate models of this nature, based on Barro (1979). Their model combines both electoral and partisan factors. Their models are based on the shorter horizon that governments have at election times, which result in a weakening of the incentive to stabilize public debt. The model presented in the present paper derives directly from theirs, but extends it to allow for additional electoral effects of the Rogoff and Sibert variety.

A related set of considerations applies for models that directly try to explain why governments delay adopting effective fiscal adjustment programs. See Alesina and Drazen (1991) and Velasco (1999).

This literature concludes that political institutions matter for the accumulation of public debt. Elections, political instability and wide ideological differences between the main political parties, result in greater deficits and debt. A further significant insight from this literature

is that binding one's hand, through participation in international institutions that limit the use of deficits and debts in financing government expenditure will result in more effective fiscal adjustment. The Maastricht treaty and the Stability and Growth Pact of the euro area can in this sense be seen as commitment mechanisms for effective fiscal adjustment[2].

4. A Model of Macroeconomics, Politics and Debt Stabilization

In this section we set up a model of the macroeconomics and politics of debt stabilization. The model is a linear quadratic variant of the model of Barro (1979), as it has been generalized to include partisan and electoral factors by Lockwood, Philippopoulos and Snell (1996) and Lockwood, Philippopoulos and Tzavalis (2001).

Our starting point is the process of public debt accumulation. To the extent that there is a government deficit, public debt increases to finance this deficit. The relationship between deficits and debt accumulation is given by,

$$B_t - B_{t-1} = rB_{t-1} + G_t - T_t \qquad (1)$$

where, B is public debt, r is the real interest rate of government bonds, G is the primary expenditure of the general government, and T is total

[2] The literature on the politico-economic causes of high deficits and debts grew exponentially in the 1990s. An early survey is in Alesina and Perotti (1995). A comprehensive analysis of the main models is in Persson and Tabellini (2000). See among others the papers by Cukierman and Meltzer (1989), Alesina and Tabellini (1990), Aghion and Bolton (1990), Alesina and Drazen (1991), Tabellini (1991), Velasco (1999). Many cross country studies have also emerged, focusing on the association between political institutions and debt. See among others Roubini and Sachs (1989) and Grilli, Masciandaro and Tabellini (1991).

revenue of the general government. All variables are defined in real terms.

Equation (1) simply states that the government deficit leads to a rise in government debt. The government deficit consists of the difference between total government expenditure and total government revenue. Total government expenditure consists of interest payments on the debt plus primary (i.e. net of interest) government expenditure.

Dividing equation (1) by GDP, we get the corresponding equation for the evolution of the government debt to GDP ratio.

$$b_t - b_{t-1} = \frac{r-\gamma}{1+\gamma} b_{t-1} + g_t - \tau_t \qquad (2)$$

γ is the growth rate of GDP, b is the government debt to GDP ratio, g is the ratio of primary government expenditure to GDP and τ is the ratio of total government revenue (taxes) to GDP.

From (2), the government debt to GDP ratio follows,

$$b_t = R b_{t-1} + g_t - \tau_t \qquad (3)$$

Where

$$R = 1 + \frac{r-\gamma}{1+\gamma}$$

If the real interest rate on government debt exceeds the GDP growth rate, R will be greater than unity, and the debt accumulation process will be unstable. One way to stabilize the process would be for the ratio of primary government expenditure to GDP and/or the ratio of total government revenue to GDP to react to the size of the government debt to GDP ratio. For example, if primary government expenditure is

reduced relative to GDP and if total revenue is increased relative to GDP as government debt increases, then the debt accumulation process can be stabilized. We shall term this the debt stabilization objective, as this ensures that debt is sustainable. This will turn out to be one of the key objectives of fiscal policy in our model.

We assume that there are two political parties, Conservative (c) and Socialist (s). In an election year, the incumbent party has an exogenous probability 0<q<1 of being reelected for the following year. Therefore in an election year there is uncertainty over whether the party will remain in power for the next period.

The two political parties have different targets for primary government and taxes, which are based on their ideological preferences. The "conservative" party generally aims for lower government spending and taxes than the "socialist" party. The per period loss function of party i=(c,s) is given by,

$$L_t^i = \theta^i \left(g_t - \bar{g_t^i}(j) \right)^2 + \left(\tau_t - \bar{\tau_t^i}(j) \right)^2 \quad \text{when in government} \qquad (4)$$

$$L_t^i = 0 \quad \text{when in opposition}$$

where θ is the weight given by each party to deviations in primary government expenditure from target, relative to deviations in tax and revenue targets. g-bar and τ-bar are exogenous party specific targets for primary government expenditure and taxes respectively, and j=(n,e) is an index of non-election and election years respectively. In line with the political economy literature we shall assume that socialists (s) aim for higher primary government expenditure and taxes than conservatives

(c). Along with Lockwood et al (1996) we also assume that socialists may assign higher costs to deviations from their expenditure targets, as they attach a higher weight to government expenditure. In addition, both types of administration are assumed to have higher primary expenditure targets and lower revenue targets in election years than in non-election years. This latter effect we shall term the Rogoff-Sibert effect.

$$\bar{g}_t^s(j) \geq \bar{g}_t^c(j),$$

$$\bar{g}_t^i(e) \geq \bar{g}_t^i(n)$$

$$\bar{\tau}_t^s(j) \geq \bar{\tau}_t^c(j) \qquad (5)$$

$$\bar{\tau}_t^i(e) \leq \bar{\tau}_t^i(n)$$

$$\theta^s \geq \theta^c$$

In addition, we shall assume that the targets for primary government expenditure and taxes relative to GDP for both parties, are consistent with a target government debt to GDP ratio. From (3), this implies that the target debt to GDP ratio for each party solves the stochastic difference equation,

$$\bar{b}_t^i = \bar{g}_t^i - \bar{\tau}_t^i + R\bar{b}_{t-1}^i \quad \text{, i=c,s} \qquad (6)$$

with b_0 given. We assume that b_0 is too high, in the sense that the party in power cannot achieve its expenditure and revenue targets simultaneously. (6) imposes an intertemporal constraint on the targets of political parties for primary expenditure and taxes.

To simplify the notation in the subsequent analysis, we shall define primary government expenditure, taxes and government debt as deviations from targets. We thus define,

$$\hat{g}_t^i = \left(g_t - \bar{g}_t^i \right), \quad \hat{\tau}_t^i = \left(\tau_t - \bar{\tau}_t^i \right), \quad \hat{b}_t^i = \left(b_t - \bar{b}_t^i \right) \tag{7}$$

We shall assume that the party in government tries to minimize the present value of discounted future losses from deviations from its primary expenditure and revenue targets, and that initial debt is too high to allow it to achieve its targets perfectly.

Thus, the problem of the incumbent government is to minimize

$$L(i) = \sum_{t=1}^{\infty} \delta^{i,t-1} L_t^i I_t \tag{8}$$

subject to the debt accumulation equation (2). δ^i is the discount factor and is assumed to be less than unity. We assume that $\delta^c \geqq \delta^s$, i.e that socialist governments, being more focused on current government consumption and the distribution of income, may discount the future more heavily than conservative governments. The index variable I takes the value of 1 when party i is in government and 0 when the party is delegated to the opposition.

We solve for Markov-perfect equilibria in which the optimal policies are functions of the current state variable. Since the model is linear quadratic, we focus on linear Markov strategies.[3]

[3] It is worth noting that Lockwood et al (1996, 2001) assumed the same discount factor for both political parties.

The solution of the problem is characterized by the following pair of Bellman equations.

$$\beta_n^i\left(\hat{b}_{t-1}\right)^2 = \min\left(\theta^i(\hat{g}_t)^2 + (\hat{\tau}_t)^2 + \delta^i\beta_e^i\left(\hat{b}_t\right)^2\right) \quad \text{in an non-election year (n)} \tag{9}$$

$$\beta_e^i\left(\hat{b}_{t-1}\right)^2 = \min\left(\theta^i(\hat{g}_t)^2 + (\hat{\tau}_t)^2 + \delta^i q\beta_n^i\left(\hat{b}_t\right)^2\right) \quad \text{in an election year (e)}$$

where, $\beta_n^i\hat{b}_{t-1}^2, \beta_e^i\hat{b}_{t-1}^2$ are the present value of losses to party i in the respective e and n years and *q* is the reelection probability of the incumbent.

From the minimization of the Bellman equations subject to the debt accumulation equation (3), we get the following Markov strategies.

$$\hat{g}_t = -\lambda_j^i R\hat{b}_{t-1} \tag{10a}$$

$$\hat{\tau}_t = \theta^i\lambda_j^i R\hat{b}_{t-1} \tag{10b}$$

where $j = n,e$, $i = c,l$ and,

$$0 \le \lambda_n^i \equiv \frac{\delta^i\beta_e^i}{\theta^i + \delta^i\beta_e^i(1+\theta^i)} < 1 \quad \text{and} \quad 0 \le \lambda_e^i \equiv \frac{\delta^i q\beta_n^i}{\theta^i + \delta^i\beta_n^i(1+\theta^i)} < 1 \tag{11}$$

Substituting the Markov strategies (10) in the debt accumulation equation (3) in deviation form, we get

$$\hat{b}_t = \left(1 - \lambda_j^i(1+\theta^i)\right)R\hat{b}_{t-1} \tag{12}$$

The Markov strategies (10) define the equilibrium reaction functions of primary government expenditure and total government revenue to

inherited debt. The characteristics of the equilibrium have been analyzed by Lockwood et al (1996) and can be summarized as follows:

First, the two policy instruments, primary expenditures and tax revenue are used to stabilize the government debt to GDP ratio. The primary expenditure to GDP ratio is a negative function of inherited debt, while the government revenue to GDP ratio is a positive function of inherited debt. We shall term this characteristic of the political equilibrium, the debt stabilization effect. However, this feedback debt stabilization policy depends on political factors.

Second, for both parties the primary expenditure to GDP ratio is higher in election years than in non-election years. The proof is in Appendix A of Lockwood et al (1996), who show that $\lambda_e<\lambda_n$ for both parties. As a result, debt stabilization is weaker in election years. In election years the incumbent optimally resorts to excess spending and lower tax revenue relative to non-election years. The reason is that, with a positive probability, she will be in opposition after the election and will not have to face the consequences of higher deficits until she is reelected. We shall term this the electoral effect. If the probability of reelection of the incumbent is zero, then the debt stabilization effect disappears in election years. In our model, we shall allow for an additional Rogoff Sibert electoral effect, through the government targets for primary expenditure and revenue, which may differ between election and non-election years.

Third, there are partisan effects. Per unit of accumulated debt, both primary expenditure and taxes will be higher under a socialist

administration, both in election and non-election years. From (7) and (10a,b), it follows that,

$$g_t = \bar{g}_t^{\,i}(j) - \lambda_j^i R\left(b_{t-1} - \bar{b}_t^{\,i}\right) \tag{12a}$$

$$\tau_t = \bar{\tau}_t^{\,i}(j) + \theta^i \lambda_j^i R\left(b_{t-1} - \bar{b}_t^{\,i}\right) \tag{12b}$$

Lockwood et al (1996) show that $\lambda^s < \lambda^l$ and that $\theta^s\lambda^s > \theta^l\lambda^l$, both in election and non-election years. This follows from the assumption that θ, the cost of deviating from the expenditure target relative to deviating from the revenue target, is assumed to be higher for socialist administrations. However, they also argue that the two partisan effects, on expenditure and taxes cancel each other out, and that there is no partisan effect on the reaction of the primary deficit, or debt itself, to accumulated debt.

By the assumption (5) that socialist administrations have higher expenditure and revenue targets than conservative ones, and that both types of administration have higher primary expenditure targets and lower revenue targets in election years, one would also expect possible additional partisan and electoral effects through the expenditure and revenue targets.

Finally, in our model there is a third potential partisan effect through the discount factor δ. If socialists discount the future more heavily than conservatives, then it follows that $\lambda^s < \lambda^l$ even in the case where θ is the same for both parties. In this case, one expects a higher feedback coefficient in conservative administrations.

By subtracting (12b) from (12a), the reaction function for the primary deficit will take the form,

$$d_t = g_t - \tau_t = \left(\bar{g}_t^{\,i}(j) - \bar{\tau}_t^{\,i}(j) \right) - \lambda_j^i \left(1+\theta^i\right) R \left(b_{t-1} - \bar{b}_t^{\,i} \right) \qquad (12c)$$

By estimating (12c), the reaction function for the primary deficit, we can identify most of the effects that we have highlighted. A negative coefficient on the lagged debt to GDP ratio identifies the stabilization effect. A smaller absolute value of the coefficient in election years identifies the electoral effect. And finally, a different coefficient for the type of administration identifies the potential net partisan effect. The additional political effects through the target variables can also be estimated through appropriate specification of the government targets.

5. Econometric Evidence: Greece 1975-2009

We now turn to econometric estimates of the model. As a first step we investigate the statistical properties of the data.

5.1 Data

We use annual data for Greece, from the Spring 2010 Statistical Annex of the European Economy of the Commission of the European Union. The exact series are reproduced in the Data Appendix.[4]

[4] In the Autumn of 2010 Eurostat and the Greek government redefined the scope of the general government to include public enterprises. Data since then include the additional deficits and debt of public enterprises as well. However, the redefined government finance data have only been extended backwards to 2006. The data we use in this investigation do not incorporate this redefinition, in order to concentrate on a consistently defined version of the general government for the whole 1975-2009 period.

Our main data set consists of five series: general government gross debt (b_t), primary (i.e. net of interest payments) expenditure of the general government (g_t), total revenue of the general government (τ_t), the primary (i.e. net of interest payments) deficit of the general government ($d_t=g_t-\tau_t$), and the debt multiplier R_t, which depends on the difference between the real interest rate of government debt and the GDP growth rate (as in (3)). All series apart from R are shares of GDP at current market prices. We also use the rate of growth of GDP in the euro area, as an exogenous measure of the state of the economy. Greece is a small open economy and its economic cycle is strongly synchronized with the rest of the euro area.[5] The state of the economy is expected to affect primary expenditure and revenue relative to GDP, either through the operation of automatic stabilizers, or through discretionary government actions to stabilize the economy.

In Table 2 we present unit root tests for our six main series. At the conventional 5% level, the hypothesis of a unit root cannot be rejected for any of the main series apart from R. We also present cointegration tests, which suggest that the series are cointegrated at conventional significance levels. In fact, if one calculates the tests conditional on dummy variables for elections, the party in power and the post 1992 convergence period associated with the euro, there are not only one, but up to three cointegrating equations.

[5] See Figure 4, which depicts the rate of growth of GDP in Greece and the euro area.

Thus, estimating the model assuming a deterministic trend would be appropriate, and the set of estimates reported here assumes a deterministic trend.[6]

5.2 Econometric Specification

It is worth noting that the main predictions of the model can be tested from estimates of the adjustment equation for the primary deficit (12c). However, in order to estimate all the parameters we need to estimate the primary expenditure and revenue equations (12a), (12b) jointly. This will allow us to draw full conclusions about the fiscal adjustment process in Greece.

A problem that remains to be addressed is the specification of the target variables for primary expenditure and total revenue of the two political parties. Given the properties of the data, we shall assume that the targets have a deterministic trend, and also depend on political factors, such as the identity of the party in power and the incidence of elections. In addition we shall allow for effects from the Maastricht treaty, which Greece signed in 1992, and the Stability and Growth Pact of the euro area, in order to test for their effectiveness as political commitment mechanisms. With its emphasis on the 3% target for government deficits and the 60% target for the government debt to GDP ratio, the

[6] We have also estimated the model assuming stochastic trends. This amounts to estimating the model using the variables in first differences, as in Lockwood, Philippopoulos and Tzavalis (2001). The econometric estimates are available upon request. Our main conclusions are not affected, though there are some subtle differences in the estimates. Given that cointegration cannot be rejected and the standard error of estimate of our deterministic trend equations is much smaller, we have more confidence in the results reported here, especially as level effects are thrown out once one uses the variables in first differences.

Maastricht treaty and the Stability and Growth Pact imposed additional constraints on government targets. Thus we assume,

$$\bar{g}_t^i(j) = g_0 + \phi_1 g_{t-1} + \zeta_{11} P_t + \zeta_{12} E_t - \zeta_{13} M_t + \zeta_{14} t \quad (13a)$$

$$\bar{\tau}_t^i(j) = \tau_0 + \phi_2 \tau_{t-1} + \zeta_{21} P_t - \zeta_{22} E_t + \zeta_{23} M_t + \zeta_{24} t \quad (13b)$$

$$\bar{b}_t^i = b_0 + \phi_3 b_{t-1} - \zeta_{33} M_t \quad (13c)$$

g_0 , τ_0 and b_0 are constant parameters. P_t, E_t and M_t are zero-one (0,1) dummy variables. P_t (for Party) takes the value of 1 for a socialist government and 0 for a conservative government. E_t (for Election) takes the value of 1 in election years and 0 in non-election years. M_t (for Maastricht) takes the value of 1 in the post-1992 Maastricht treaty and euro area period and zero before that. ϕ_1, ϕ_2 and ϕ_3 are parameters that measure "hysteresis", i.e state dependence in the government targets. It is assumed that ϕ_1, ϕ_2 and $\phi_3 < 1$. The ζ parameters are presumed to be positive and embody our three political assumptions: first, that socialist administrations have higher targets for government expenditure and taxes, second, that all governments have higher primary expenditure targets and lower revenue targets in election years (the Rogoff-Sibert effect), and, third, that the Maastricht treaty and the Stability and Growth Pact were effective commitment mechanisms for Greek governments inducing them to lower their primary expenditure and debt targets, and raise their revenue targets (the commitment mechanism effect). t is an exogenous time trend on primary expenditure and revenue. In (13c) we have assumed that there are neither partisan, nor electoral effects on debt targets, and that neither party had a growing target for the debt to GDP ratio.

Substituting (13a,b,c) in (12a,b,c), we end up with,

$$g_t = g_0 + \lambda_j^i Rb_0 - \lambda_j^i(1-\phi_3)Rb_{t-1} + \phi_1 g_{t-1} + \zeta_{11}P_t + \zeta_{12}E_t - \left(\zeta_{13} + \zeta_{33}\lambda_j^i R\right)M_t + \zeta_{14}t \quad (14a)$$

$$\tau_t = \tau_0 - \theta^i\lambda_j^i Rb_0 + \theta^i\lambda_j^i(1-\phi_3)Rb_{t-1} + \phi_2\tau_{t-1} + \zeta_{21}P_t - \zeta_{22}E_t + \left(\zeta_{23} + \zeta_{33}\theta^i\lambda_j^i R\right)M_t + \zeta_{24}t \quad (14b)$$

$$d_t = d_0 + (1+\theta^i)\lambda_j^i Rb_0 - (1+\theta^i)\lambda_j^i(1-\phi_3)Rb_{t-1} + \phi_1 d_{t-1} + \zeta_1 P_t + \zeta_2 E_t - \zeta_3 M_t + \zeta_4 t \quad (14c)$$

where, $d_0 = g_0 - \tau_0$, $\zeta_1 = \zeta_{11} - \zeta_{21}$, $\zeta_2 = \zeta_{12} + \zeta_{22} > 0$, $\zeta_3 = \zeta_{13} + \zeta_{23} + \zeta_{33}(1+\theta^i)\lambda_j^i R > 0$.

In (14c) we have imposed the testable assumption that the hysteresis coefficient is the same for both primary expenditure and revenue targets, i.e. that $\phi_1=\phi_2$.

In our econometric estimates we shall consider generalized versions of (14a,b,c) in which the state of the business cycle is also allowed to affect the evolution of the primary expenditure, revenue and primary deficit to GDP ratios. This could be either through the operation of automatic stabilizers, or through additional motives to use discretionary fiscal policy. Since Greece is a small open economy and its economic cycle is strongly synchronized with that of the euro area economies, we shall use the rate of growth of GDP in the euro area as an exogenous measure of the state of the business cycle.

Thus, our final econometric specifications take the form,

$$g_t = g_0 + \lambda_j^i Rb_0 - \lambda_j^i(1-\phi_3)Rb_{t-1} + \phi_1 g_{t-1} + \zeta_{11}P_t + \zeta_{12}E_t - \left(\zeta_{13} + \zeta_{33}\lambda_j^i R\right)M_t + \zeta_{14}t - \sigma_g y_t^* + v_{1t} \quad (15a)$$

$$\tau_t = \tau_0 - \theta^i\lambda_j^i Rb_0 + \theta^i\lambda_j^i(1-\phi_3)Rb_{t-1} + \phi_2\tau_{t-1} + \zeta_{21}P_t - \zeta_{22}E_t + \left(\zeta_{23} + \zeta_{33}\theta^i\lambda_j^i R\right)M_t + \zeta_{24}t + \sigma_\tau y_t^* + v_{2t} \quad (15b)$$

$$d_t = d_0 + (1+\theta^i)\lambda_j^i Rb_0 - (1+\theta^i)\lambda_j^i(1-\phi_3)Rb_{t-1} + \phi_1 d_{t-1} + \zeta_1 P_t + \zeta_2 E_t - \zeta_3 M_t + \zeta_4 t - (\sigma_g + \sigma_\tau)y_t^* + v_{1t} - v_{2t} \quad (15c)$$

where $\sigma_{g,}$ σ_{τ} >0 measure the impact of the state of the European economy on the primary expenditure to GDP ratio and the government revenue to GDP ratio respectively. y* is the rate of growth of GDP in the euro area. Thus, σ_g measures by how much the primary expenditure to GDP ratio falls, following a one percent increase in the rate of growth of euro area GDP (and vice versa), and σ_{τ} measures the extent to which the total revenue to GDP ratio rises following a one percent increase in the euro area growth rate (and vice versa). $v_{1,}$ and v_2 are i.i.d disturbances.

5.3 Econometric Estimates and Tests

In what follows we shall first present estimates of the reaction function (15c) for the primary deficit, as it is the primary deficit that drives the process of government debt accumulation. An additional advantage of estimating (15c) is that we can rely on single equation methods.

We shall subsequently also present joint estimates of the reaction functions for primary expenditure and total government revenue (15a) and (15b), in order to identify whether the adjustment of the primary deficit takes place mainly through primary expenditure or taxes and in order to identify those parameters that cannot be identified from the primary deficit reaction function.

Estimates for the reaction function (15c) for the primary deficit is presented in Table 3. The estimates have been obtained by Ordinary Least Squares (OLS) and t-statistics based on heteroscedasticity consistent standard errors are reported in parentheses below the

estimated parameters. A number of diagnostics are also reported, which do not suggest misspecification problems in the estimated regressions.[7]

In order to estimate the parameters λ which are assumed to differ between socialist and conservative governments, and between election and non-election years, we have interacted lagged debt to GDP with the partisan and electoral (0,1) dummy variables. We have thus created the following variables:

$b^{c}_{n,t-1} = (1-P_t)(1-E_t)b_{t-1}$ for a non-election year with a conservative government

$b^{s}_{n,t-1} = P_t(1-E_t)b_{t-1}$ for a non-election year with a socialist government

$b^{c}_{e,t-1} = (1-P_t)E_t b_{t-1}$ for an election year with a conservative incumbent

$b^{s}_{e,t-1} = P_t E_t b_{t-1}$ for an election year with a socialist incumbent

We have also created lagged debt to GDP variables to test for potential purely electoral and purely partisan effects.

$b_{n,t-1} = (1-E_t)b_{t-1}$ for a non-election year

$b_{e,t-1} = E_t b_{t-1}$ for an election year

$b^{c}_{t-1} = (1-P_t)b_{t-1}$ for a conservative government

$b^{s}_{t-1} = P_t b_{t-1}$ for a socialist government

[7] R^2 is the centered coefficient of determination, T-N is the number of degrees of freedom, where T is the number of observations and N the number of estimated parameteres. SSR is the sum of squared residuals, s the standard error of estimate and DW the Durbin Watson statistic for first order residual autocorrelation. AUT is the Breusch-Godfrey LM test for residual autocorrelation up to second order, HET is the Breusch-Pagan-Godfrey LM test for residual heteroskedasticity and ARCH is the Engle test for autoregressive conditional heteroskedasticity. The F-form of these diagnostics is reported. NORM is the χ^2 Jarque-Bera normality (skewness kurtosis) test on the residuals.

One can use the purely electoral variables to impose the restriction that there are no partisan effects, and the purely partisan variables to impose the restriction that there are no electoral effects.

The main conclusions from the estimates in Table 3 can be summarized as follows:

First, there does seem to exist a statistically significant trend in the ratio of the primary deficit to GDP. Other things equal, the primary deficit rises by between 0.3 and 0.4 of a percentage point of GDP every year. This is indicated by the estimated trend coefficient.

Second, there does seem to be a statistically significant negative reaction of the primary deficit to the government debt to GDP ratio (see Table 3, columns 1 to 4). A higher government debt to GDP ratio does cause a reduction of the primary deficit relative to GDP in the following year. Thus, one of the main predictions of our model, the debt stabilization motive appears to be supported. The estimated debt stabilization reaction is estimated at between 7-8% of a change in the debt to GDP ratio, and is rather weak (see columns 2 and 4). Furthermore, the debt stabilization motive appears to be independent of the identity of the party in power, or elections. In columns 1 and 3 we have estimated the model under the assumption that the debt stabilization motive can differ according to the identity of the party in power and between election and non-election years. The parameter estimates suggest similar reactions for both parties and similar reactions for election and non-election years. In columns 2 and 4 we have imposed the restriction that the debt stabilization motive is the same for both

parties and for election and non-election years. The restriction cannot be rejected at conventional significance levels.

Third, there seems to be a relatively strong and statistically significant negative impact from the state of the euro area economy on the primary government deficit of Greece relative to its GDP. In periods when euro area growth is strong, Greece's primary deficit is lower than in periods of weak euro area growth. A one percent increase in the rate of growth of euro area GDP causes Greece's primary deficit to fall by around 0.6 of a percentage point of GDP. This may simply reflect the operation of strong "automatic stabilizers" as, for a small open economy such as Greece's, high external growth causes high domestic growth, which in turn results in higher tax revenues and lower primary expenditures for unemployment benefits and other categories of social expenditure. Alternatively, this effect could be interpreted in terms of a countercyclical discretionary use of fiscal policy by Greek governments. It is worth noting however that this alternative explanation is not the most plausible one, as purely domestic macroeconomic developments do not appear to have affected the evolution of the primary deficit to GDP ratio. When lagged domestic GDP growth, inflation, unemployment and the current account were added to the regression, they did not turn out to be statistically significant, suggesting that the authorities in Greece have not been using discretionary fiscal policy to counteract macroeconomic fluctuations.

Fourth, there appear to be no partisan effects on the primary deficit. The estimates in column 1 and 3 suggest that there are no discernible partisan effects on government targets for the primary deficit, as the

coefficient on the socialist party dummy variable is not statistically significant.

Fifth, there are significant electoral effects. On the basis of the estimates in Table 3 one would not be able to reject the hypothesis of significantly higher primary deficits in election years. The feedback coefficients to government debt do not depend on elections, but the government targets for the primary deficit do appear to depend on elections. Other things equal, the primary deficit is higher by between 1.5 and 3 percentage points of GDP in an election year. The models of Rogoff and Sibert (1988) and Rogoff (1990) provide an explanation for such an effect, based on the attempts of governments to improve their reelection probability by increasing primary expenditure and reducing taxes. Given that elections in Greece have taken place once every three years (12 elections in 35 years of data), elections have resulted in an average primary deficit to GDP ratio which is higher by between half and a full percentage point of GDP.

Finally, the restrictions implied for the fiscal policy of Greece by the Maastricht treaty and subsequent participation in the euro area appear to have had a significant negative effect on the primary deficit. The estimated coefficient on the Maastricht dummy variable suggests that in the post-1992 period the average primary deficit of Greece has been lower by between 4 and 5 percentage points of GDP, compared to what it would have been otherwise.

To conclude, on the basis of the estimates in Table 3, there has been a statistically significant but relatively weak debt stabilization behavior by Greek governments of both political parties. This was concentrated in

non-election years, as in election years the primary deficit increased by between 1.5 and 3 percentage points of GDP. Budgetary policy in Greece was adversely influenced by the incidence of elections. The post-Maastricht treaty period, when Greece adopted convergence and stability and growth programs, resulted in significantly lower primary deficit to GDP ratios, compared to what would have happened otherwise.

We next turn to the joint estimates of the reaction functions for primary expenditure and government revenue in Table 4. The estimates have been obtained by the Generalized Method of Moments (GMM) with heteroscedasticity consistent standard errors.

Our main findings from the estimates of the reaction function for the primary deficit are confirmed from these estimates. A number of interesting additional conclusions emerge from these separate estimates.

The first additional conclusion is that the trend increase in the primary deficit to GDP ratio is due to rises in primary expenditure. Primary expenditure rises by about 0.4 of a percentage point of GDP per annum, while the total revenue to GDP ratio displays almost no trend. Increases in primary expenditure have thus been the driving force of higher primary deficits.

The second additional conclusion is that the negative feedback of the primary deficit to inherited debt is mostly due to government revenue. Of the roughly 7% reaction of the primary deficit to inherited debt, about 6% is due to the reaction of government revenue, and only about

1% is due to the reaction of primary expenditure. Primary expenditure has scarcely been used for debt stabilization purposes. The implicit estimate of θ, the relative cost of deviations from expenditure targets relative to deviations from the revenue target in our model, is about 6, which suggests that Greek governments have found it 6 times more difficult to reduce primary expenditure for fiscal adjustment purposes than to increase revenue.

The third additional conclusion is that the state of the euro area economy has roughly equal effects on the primary expenditure to GDP ratio and to total revenue relative to GDP. The effect of a one percent increase in the growth rate of euro area GDP is about 0.3 of a percentage point of GDP for both the primary expenditure to GDP ratio and for the total revenue to GDP ratio. Thus, other things equal, a fall in the growth rate of euro area GDP by one percent, results in an increase in Greece's primary deficit to GDP ratio by 0.6% of GDP, about half of it coming from higher primary expenditure relative to GDP and another half of it coming from lower government revenue.

The fourth additional conclusion is that there are significant partisan effects on the primary expenditure targets. Socialist administrations appear to be associated with primary expenditure which is higher by about 1% of GDP compared with conservative administrations. They are also associated with higher government revenue of less than one percent of GDP, but this latter effect is not statistically significant at conventional significance levels. In any case, this effect is not statistically different from the 1% effect of primary expenditure either. Thus, one would not be able to reject the hypothesis that although socialist

administrations have been associated with higher primary expenditure, they have not been necessarily associated with higher primary deficits, because they have been prepared to target higher tax revenue.

Our fifth conclusion concerns the electoral effects. It appears that the positive electoral effects on the primary deficit that we have identified are almost entirely due to primary expenditure. In electoral years, primary expenditure rises by about 1.4% of GDP on average, while government revenue is scarcely reduced. The coefficient of the electoral dummy variable is statistically significant in the primary expenditure reaction function, but not in the revenue reaction function.

The final conclusion concerns the Maastricht treaty and euro participation effects. Roughly 60% of the reduction in the average primary deficit in the post-Maastricht period was due to increases in government revenue and only 40% to reductions in primary expenditure. This is consistent with our previous finding that Greek governments have mainly used revenue and not expenditure for debt stabilization purposes.

Our findings can thus be summarized as follows:

First, primary government expenditure in Greece has been rising faster that government revenue, and this is the main proximate cause of the rise in Greece's government debt. The trend increase in primary government expenditure was at about 0.4 of a percentage point of GDP per annum, while the trend increase in total revenue was only 0.05 percentage point of GDP per annum. This trend increase was independent of which party was in government.

Second, Greek governments have displayed debt stabilizing behavior during non-election years. In election years, there appears to have been an average increase of primary deficits by about 1.5 percentage points of GDP. The increase in primary deficits in election years was mainly due to increases in primary expenditure and not to reductions in taxes and government revenue.

Fourth, the preferred instrument of debt stabilization in Greece has been increases in government revenue rather than reductions in primary expenditure. However, due to tax smoothing considerations, this debt stabilization reaction has been rather weak.

Fifth, the Maastricht treaty and participation in the euro area resulted in a significant reduction in Greece's primary deficit to GDP ratio. This reduction was achieved mostly through increases in government revenue, the preferred fiscal adjustment instrument of Greek governments, but primary expenditure reductions also played a significant part.

Finally, as expected, fluctuations in euro area GDP growth have had a significant impact on Greek primary deficits. A one percent rise in euro area GDP results in a fall in the Greek primary deficit by about 0.6 of a percentage point of GDP. The impact is roughly equally divided between reductions in primary expenditure and increases in revenue.

The model thus identifies the main economic and political determinants that have contributed to the accumulation of Greek debt as the trend increase in primary government expenditure, the weak debt stabilizing reactions of tax revenue, due to tax smoothing, and elections. The rules

of the Maastricht treaty and the Stability and Growth Pact contributed to lower primary deficits after 1992, but their impact was just sufficient to stabilize Greece's government debt at around 100% of GDP.

Our findings can also help explain the destabilization of Greece's public finances in 2009. 2009 was a year in which Greece's primary deficit increased by 5.6 percentage points of GDP, from 3.2% of GDP in 2008 to 8.8% of GDP in 2009. About half of this increase (2.8 percentage points of GDP) can be explained by the recession in the euro area. Euro area GDP growth was -4.4% in 2009, versus 0.3% in 2008. 1.5 percentage points can be explained by the electoral increase in primary expenditure, and the remainder through hysteresis effects, as the primary deficit had also increased in 2008 for related economic (the slowdown in euro area GDP growth) and political reasons (the election of 2007). Thus, the economic and political factors highlighted in our econometric model can help explain the largest part of the recent destabilization of Greece's public finances.

6. Conclusions

This paper contains an econometric investigation of the macroeconomic and political factors that contributed to Greece's excessive debt accumulation and its failure to adequately address its fiscal imbalances, from the restoration of democracy in 1974 till the crisis of 2009. Given Greece's turbulent fiscal experience, Greece provides an ideal test case for political economy theories of debt accumulation.

The econometric investigation is based on a model in which two political parties alternate in power, and in which governments choose primary

expenditure and taxes to minimize deviations from politically determined expenditure and tax targets, subject to a debt accumulation equation. The model predicts a political equilibrium in which primary expenditure and taxes follow feedback rules which go in the direction of stabilizing the debt to GDP ratio. However, this stabilization incentive is weaker in election years. The model also predicts potential partisan differences in the evolution of primary expenditure and taxes, due to the different preferences of political parties.

Estimates of government reaction functions to public debt for the period 1975-2009 suggest a statistically significant, but weak, stabilizing reaction of primary deficits to public debt.

This stabilizing reaction almost disappears in election years, which are characterized by strong fiscal expansions. These electoral fiscal expansions have taken place through increases in primary expenditure, while the subsequent stabilization efforts were attempted mainly through increases in government revenue.

The stabilization attempts were inadequate, as government revenue generally failed to keep up with the trend growth in primary expenditure and the electoral expenditure increases. This resulted in a significant increase in Greece's debt to GDP ratio, especially during the 1980s.

The constraints imposed on Greece from the 1992 Maastricht treaty and the euro area rules appear to have resulted in a significant reduction of Greece's primary deficit, which helped stabilize Greece's debt to GDP ratio until 2008.

Our findings also suggest that fluctuations in euro area GDP growth have a significant impact on Greek primary deficits, through automatic stabilizers. A one percent fall in euro area GDP appears to result in a rise in the Greek primary deficit by about 0.6 of a percentage point of GDP, roughly equally divided between reductions in revenue and increases in primary expenditure.

Appendix

TABLE 1: Elections and Governing Parties in Greece, 1974-2009

Election Date	Incoming Government and Prime Minister
1974, November	ND (Constantine Karamanlis)
1977, November	ND (Constantine Karamanlis)
1981, October	PASOK (Andreas Papandreou)
1985, June	PASOK (Andreas Papandreou)
1989, June	ND in Coalition with United Left (Tzannis Tzannetakis)
1989, November	National Unity (Xenophon Zolotas)
1990, April	ND (Constantine Mitsotakis)
1993, October	PASOK (Andreas Papandreou)
1996, September	PASOK (Constantine Simitis)
2000, March	PASOK (Constantine Simitis)
2004, March	ND (Costas Karamanlis)
2007, September	ND (Costas Karamanlis)
2009, October	PASOK (George Papandreou)

TABLE 2: Unit Root and Cointegration Tests

1. Unit Root Tests

Variable	ADF Statistic*	Probability**
b_t	-1.434	0.832
d_t	-0.936	0.940
g_t	-2.828	0.198
τ_t	-0.085	0.993
R_t	-4.0588	0.016
y^*_t	-3.354	0.074

Note: The unit root tests are based on regressions that contain a constant and a deterministic trend. * 5% critical value -3.544 under the null of a unit root. ** Based on MacKinnon one sided p-values.

2. Johansen Cointegration Tests

2.1 Unconditional Cointegration Test for bt , gt , τt , Rt , y*t				
Hypothesized number of CEs	Eigenvalue	Trace Statistic	Probability*	5% Critical Value
None**	0.776	105.365	0.002	88.804
At most 1	0.477	50.001	0.414	63.876
At most 2	0.316	26.048	0.735	42.915
At most 3	0.221	11.980	0.813	25.872
At most 4	0.071	2.729	0.907	12.518

Note: A linear deterministic trend has been included. *MacKinnon Haug Michelis p-values. **Trace test indicates 1 cointegrating equation at the 5% level.

2.2 Conditional Cointegration Test for bt , gt , τt , Rt , y*t				
Hypothesized number of CEs	Eigenvalue	Trace Statistic	Probability*	5% Critical Value
None**	0.797	138.337	0.000	88.804
At most 1**	0.536	79.286	0.002	63.876
At most 2**	0.509	50.858	0.007	42.915
At most 3	0.353	24.519	0.073	25.872
At most 4	0.203	8.396	0.221	12.518

Note: A linear deterministic trend, plus political party, election and euro dummy variables have been included. *MacKinnon Haug Michelis p-values. **Trace test indicates 3 cointegrating equations at the 5% level.

TABLE 3: Estimates for the Primary Deficit Reaction Function

Greece 1975-2009

Dependent Variable	**d_t** (1)	**d_t** (2)	**d_t** (3)	**d_t** (4)
Constant	0.020 (3.586)	0.023 (4.141)	0.020 (3.895)	0.024 (4.055)
d_{t-1}	0.406 (2.860)	0.322 (2.960)	0.404 (3.514)	0.312 (2.952)
$R_{t-1}b^{c}_{n,t-1}$	-0.097 (-2.723)	-0.079 (-2.651)	-0.097 (-3.024)	-0.070 (-2.506)
$R_{t-1}b^{s}_{n,t-1}$	-0.083 (-3.080)	-0.079 (-2.651)	-0.083 (-3.045)	-0.070 (-2.506)
$R_{t-1}b^{c}_{e,t-1}$	-0.110 (-2.991)	-0.079 (-2.651)	-0.110 (-3.319)	-0.070 (-2.506)
$R_{t-1}b^{s}_{e,t-1}$	-0.110 (-3.442)	-0.079 (-2.651)	-0.110 (-3.421)	-0.070 (-2.506)
y^*_t	-0.574 (-4.723)	-0.631 (-5.693)	-0.575 (-4.710)	-0.626 (-5.702)
P_t	-0.0003 (-0.028)	0.004 (0.908)		
E_t	0.029 (3.135)	0.015 (3.402)	0.029 (3.127)	0.015 (3.365)
M_t	-0.037 (-2.014)	-0.044 (-2.484)	-0.037 (-2.039)	-0.047 (-2.762)
t	0.004 (4.459)	0.004 (5.460)	0.004 (5.855)	0.003 (5.365)
R^2	0.892	0.878	0.892	0.875
T-N	35-11=24	35-8=27	35-10=25	35-7=28

Dependent Variable	d_t (1)	d_t (2)	d_t (3)	d_t (4)
SSR	0.003957	0.004483	0.003957	0.004580
s	0.01284	0.01286	0.01258	0.01279
DW	2.435	2.598	2.434	2.554
AUT(2,T-N-2)	3.877	3.876	2.873	3.726
HET(N-1,T-N)	0.502	0.829	0.430	1.172
ARCH(1,T-3)	1.163	3.067	1.162	1.946
NORM(2)	1.639	0.423	1.634	0.286

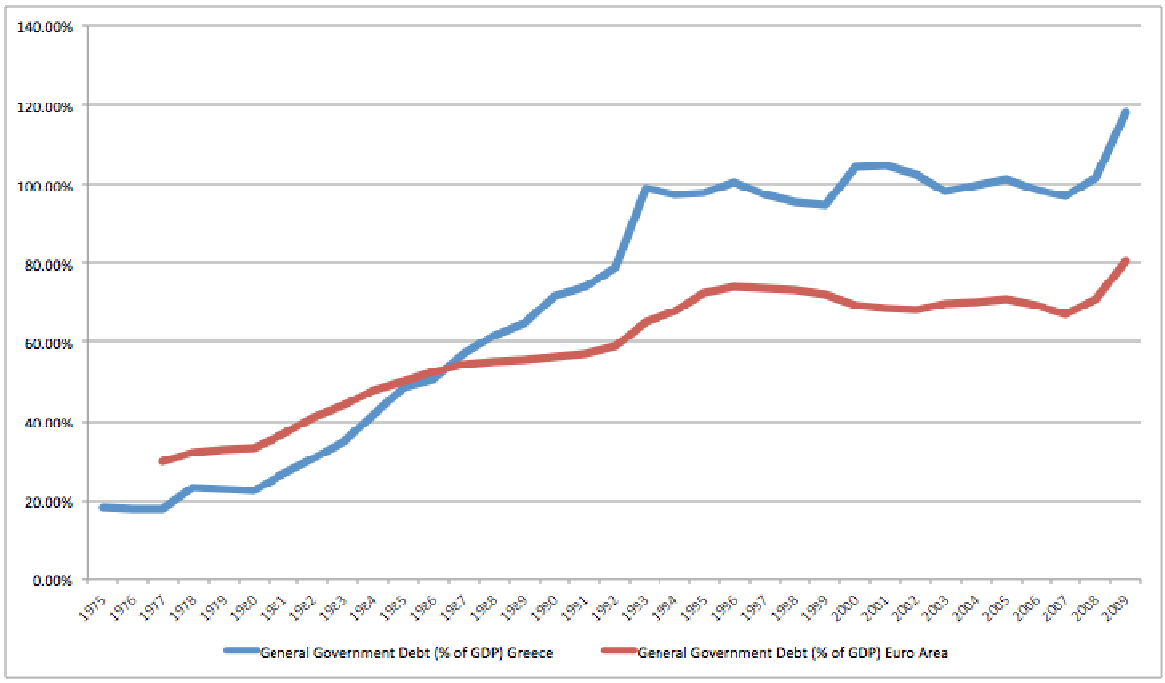
Note: OLS estimates. Asymptotic t-ratios based on heteroscedasticity consistent (Eicker-White) standard errors are in parentheses below the estimated coefficients.

TABLE 4: System Estimates of the Parameters of the Model
Greece 1975-2009

Dependent Variable	g_t (1)	τ_t (1)	g_t (2)	τ_t (2)
Constant	0.140 (5.335)	0.083 (3.008)	0.120 (6.393)	0.100 (5.342)
g_{t-1}	0.414 (3.541)		0.507 (6.208)	
τ_{t-1}		0.592 (4.589)		0.507 (6.208)
$R_{t-1}b_{t-1}$	-0.006 (-0.264)	0.052 (2.734)	-0.010 (-0.461)	0.060 (3.094)
y^*_t	-0.320 (-3.909)	0.291 (3.749)	-0.315 (-4.209)	0.297 (3.562)
P_t	0.009 (4.081)	0.003 (0.454)	0.009 (4.313)	0.004 (0.753)
E_t	0.014 (3.550)	-0.002 (-0.701)	0.014 (4.259)	-0.002 (-0.759)
M_t	-0.018 (-1.581)	0.015 (1.952)	-0.013 (-1.337)	0.018 (2.247)
t	0.004 (4.034)	0.0003 (0.408)	0.003 (4.491)	0.0005 (0.744)
R^2	0.972	0.984	0.972	0.984
s	0.0111	0.0097	0.0113	0.0098
DET	6.66×10^{-9}		7.03×10^{-9}	
J-statistic	0.120930		0.122058	

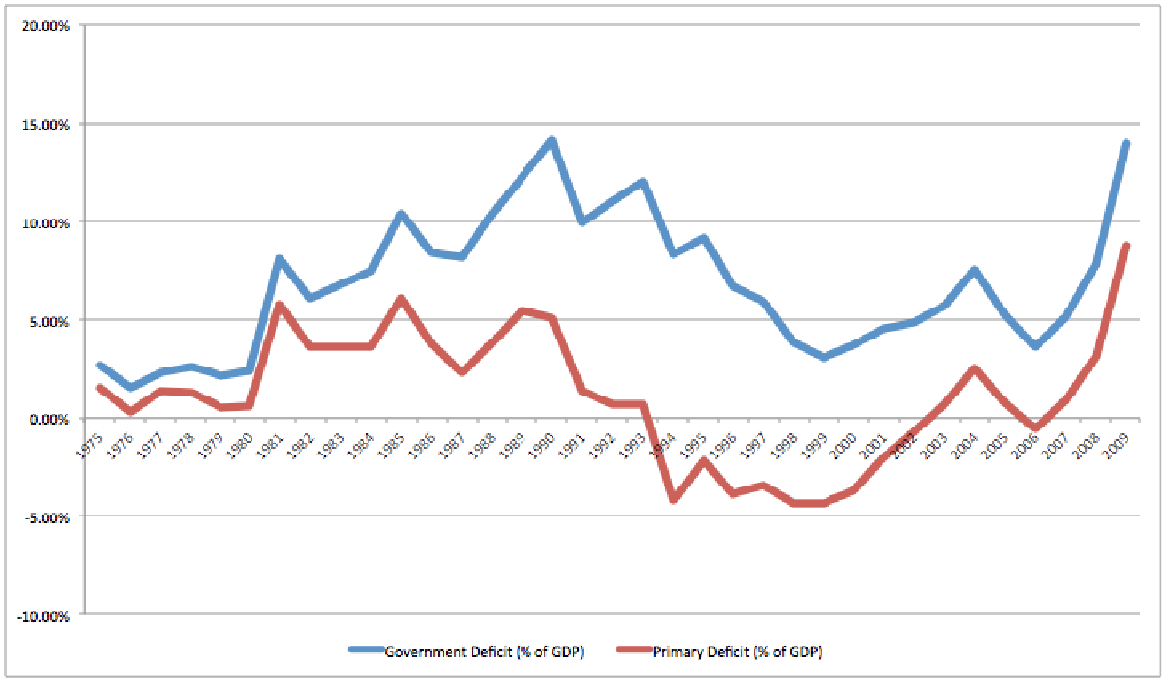
Note: Generalized Method of Moments (GMM) estimates, based on (15a) and (15b). Asymptotic t-ratios based on HAC standard errors are in parentheses below the estimated coefficients. DET is the determinant of the residual covariance matrix, and the J statistic is a χ^2 test of the over-identifying restrictions.

FIGURE 1: The Accumulation of Government Debt



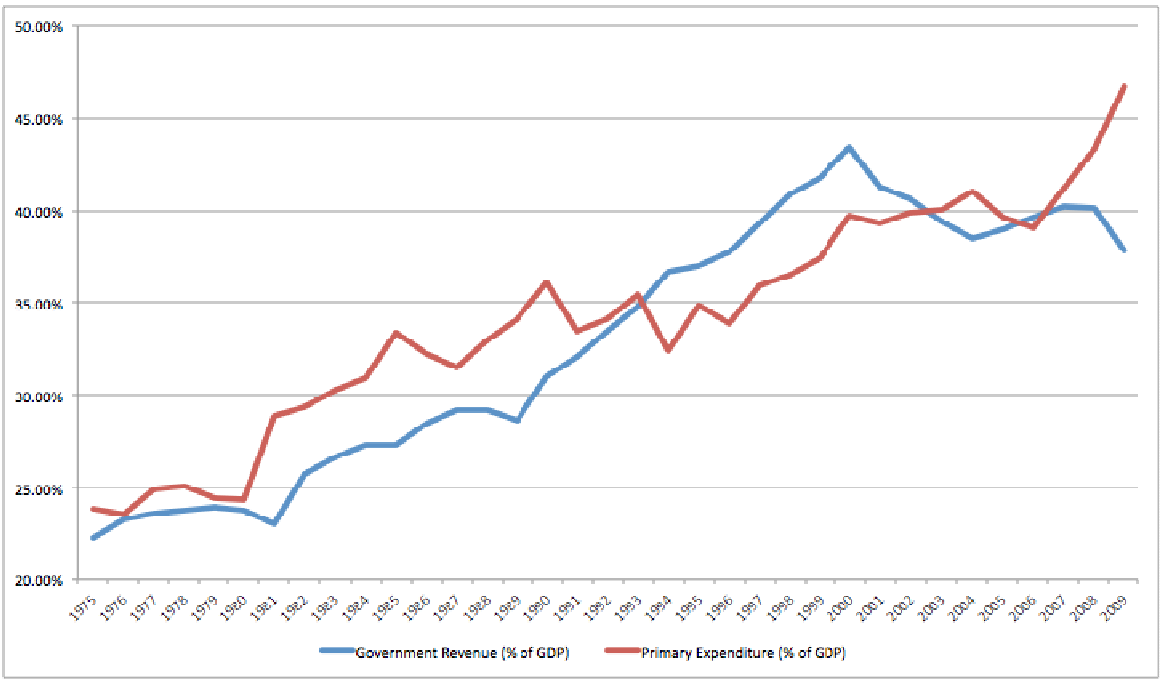
Data Source: European Commission, Statistical Annex of the European Economy, (Spring 2010)

FIGURE 2: Deficits of the General Government



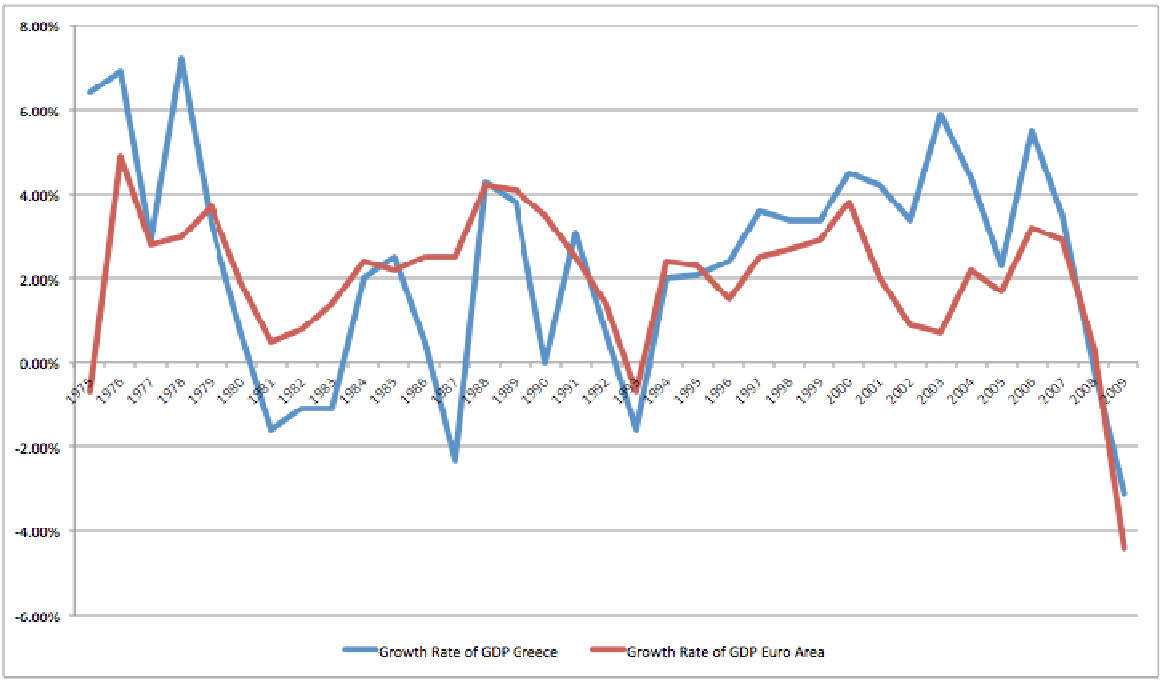
Data Source: European Commission, Statistical Annex of the European Economy, (Spring 2010)

FIGURE 3: Government Revenue and Primary Expenditure



Data Source: European Commission, Statistical Annex of the European Economy, (Spring 2010)

FIGURE 4: Growth Rate of GDP



Data Source: European Commission, Statistical Annex of the European Economy, (Spring 2010)

Data Appendix

Year	b	g	τ	R	y*	E	P	M
1970	0.181	0.209	0.227		0.055	0.000	0.000	0.000
1971	0.188	0.212	0.221	0.939	0.037	0.000	0.000	0.000
1972	0.191	0.212	0.219	0.886	0.046	0.000	0.000	0.000
1973	0.157	0.200	0.205	0.729	0.057	0.000	0.000	0.000
1974	0.212	0.226	0.221	0.920	0.026	1.000	0.000	0.000
1975	0.184	0.238	0.223	0.864	-0.007	0.000	0.000	0.000
1976	0.179	0.236	0.232	0.843	0.049	0.000	0.000	0.000
1977	0.180	0.249	0.236	0.901	0.028	1.000	0.000	0.000
1978	0.235	0.251	0.237	0.872	0.030	0.000	0.000	0.000
1979	0.228	0.244	0.239	0.847	0.037	0.000	0.000	0.000
1980	0.227	0.243	0.237	0.895	0.019	0.000	0.000	0.000
1981	0.270	0.288	0.230	0.928	0.005	1.000	0.000	0.000
1982	0.305	0.294	0.258	0.861	0.008	0.000	1.000	0.000
1983	0.350	0.303	0.267	0.935	0.014	0.000	1.000	0.000
1984	0.417	0.310	0.273	0.899	0.024	0.000	1.000	0.000
1985	0.488	0.334	0.273	0.911	0.022	1.000	1.000	0.000
1986	0.507	0.322	0.285	0.923	0.025	0.000	1.000	0.000
1987	0.570	0.315	0.292	1.004	0.025	0.000	1.000	0.000
1988	0.618	0.330	0.292	0.927	0.042	0.000	1.000	0.000
1989	0.648	0.341	0.286	0.942	0.041	1.000	1.000	0.000
1990	0.716	0.361	0.310	0.962	0.035	1.000	0.000	0.000
1991	0.740	0.335	0.321	0.916	0.025	0.000	0.000	0.000
1992	0.790	0.341	0.335	1.006	0.014	0.000	0.000	1.000
1993	0.991	0.355	0.348	1.036	-0.007	1.000	0.000	1.000
1994	0.973	0.324	0.366	1.009	0.024	0.000	1.000	1.000
1995	0.979	0.349	0.370	1.010	0.023	0.000	1.000	1.000
1996	1.003	0.339	0.378	1.021	0.015	1.000	1.000	1.000
1997	0.975	0.359	0.393	0.997	0.025	0.000	1.000	1.000
1998	0.954	0.365	0.409	1.004	0.027	0.000	1.000	1.000
1999	0.949	0.374	0.417	1.018	0.029	0.000	1.000	1.000
2000	1.044	0.397	0.434	1.004	0.038	1.000	1.000	1.000
2001	1.047	0.393	0.413	0.993	0.020	0.000	1.000	1.000
2002	1.026	0.399	0.406	0.987	0.009	0.000	1.000	1.000
2003	0.983	0.401	0.394	0.952	0.007	0.000	1.000	1.000
2004	0.998	0.410	0.385	0.980	0.022	1.000	0.000	1.000
2005	1.012	0.397	0.390	0.996	0.017	0.000	0.000	1.000
2006	0.986	0.391	0.396	0.964	0.032	0.000	0.000	1.000
2007	0.971	0.412	0.402	0.977	0.029	1.000	0.000	1.000
2008	1.018	0.433	0.401	1.005	0.003	0.000	0.000	1.000
2009	1.183	0.467	0.379	1.057	-0.044	1.000	0.000	1.000

Note: d is defined as g-τ.

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