Estimating a Fiscal Reaction Function for Greece

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Abstract. This study performs a simple evaluation of fiscal policy conduct in Greece after the euro adoption, in an attempt to shed light on the reasons which determined the difficult economic situation the country is currently facing. More specifically, we estimate a fiscal reaction function, focusing on the influence of public debt and GDP fluctuations on the primary balance. A desirable situation pointing to sustainability would be that in which fiscal policy is counter-cyclical and responds to a positive dynamic of public debt with an increase of the primary surplus. The main result is that the business cycle and public debt affect fiscal policy variables in a statistically insignificant manner. This indicates that fiscal policy conduct is among the causes of the difficult macroeconomic situation that Greece is now facing.

Keywords: fiscal sustainability, fiscal reaction function, pro-cyclical / counter-cyclical fiscal policy

1. Introduction

Fiscal policy issues have always benefited from much attention in the context of the European Monetary Union. Moreover, given the current international situation, the focus is on this topic for at least two reasons. On the one hand, interest rates are at very low levels, limiting the possibility of central banks to dampen the effects of the economic downturn, and thus fiscal measures are generally perceived as the only way of restoring the countries back on the track of sustainable growth. Furthermore, in the aftermath of the financial crisis, a sovereign debt crisis has emerged, affecting countries in the euro area (henceforth EA), including Greece. While the general slowdown in economic activity determined a decrease in public revenues, expenses surged in connection with stimulus packages, rising unemployment and/or bailout costs, determining in many countries important increases of public deficits and debts.

As figures 1 and 2 show, in Greece, public deficit and debt have constantly been above European Union (henceforth EU) and EA averages, not to mention the limits enforced by the Stability and Growth Pact (henceforth SGP). Because of the recent developments, the two variables gained momentum, calling to question the sustainability of public finances in this country. Van Riet *et al.* (2010) obtain projections for the evolution of public debt for the euro area members based on three scenarios of fiscal adjustment. Under the optimistic (and most difficult to implement) scenario, consisting of a 1 percentage point of GDP improvement of the primary deficit per year, until a balanced budget is obtained, public debt in Greece would reach 134.4% of GDP in 2020 and 93.1% of GDP in 2030, still below SGP limits. The pessimistic scenario of no fiscal consolidation places debt at 189.3% of GDP in 2020 and 272.5% of GDP in 2030 (all the scenarios assume output growth is at potential, a negative output gap would further deteriorate the debt forecast).

Against this background, the paper approaches the topic of fiscal sustainability, with an empirical study on the Greek economy, in an attempt to gain understanding on the factors which determined the difficult fiscal situation the country is facing.

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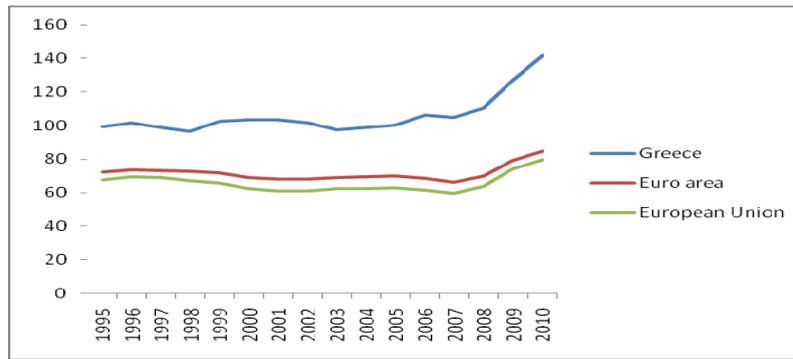 *E-mail address*: alexandruleonte@yahoo.com

Fig. 1: Government consolidated gross debt (% of GDP), source: IMF World Economic Outlook Database.
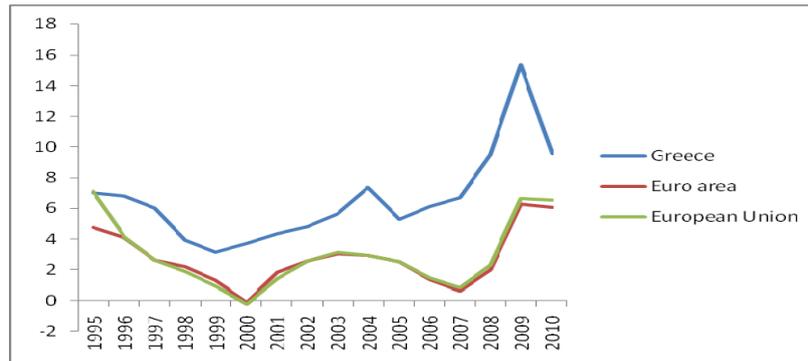

Fig. 2: Government deficit (% of GDP), source: IMF World Economic Outlook Database.

Numerous approaches have been developed in order to study fiscal sustainability, the interested reader can consult Chalk and Hemming (2000) or Giammarioli *et al.* (2007) for discussions and reviews. A popular method to assess the strength of public finances is to check if the government is in compliance with the Present Value Borrowing Constraint (henceforth PVBC, which is also known as the Intertemporal Fiscal Constraint). According to the PVBC, the current value of government debt is less than or equals the sum of discounted future government surpluses, implying that the government is not financing its activities through a Ponzi scheme. Earlier papers like Hamilton and Flavin (1986), Hakkio and Rush (1991), Quintos (1995), which study the US economy, along with more recent papers which study other economies (for a review see Afonso (2005)) employ the PVBC methodology, empirically testing the constraint by determining the order of integration of the public debt series, or by checking to see if there is a cointegration relationship between government revenues and expenditures. However, other papers adopt a critical point of view regarding this methodology. Bohn (2007) argues in favour of an approach that relies more on economic intuition, and gives several examples of studies which follow a fiscal reaction function approach.

We follow the recommendation in the aforementioned paper, specifically, we build and estimate a fiscal reaction function for the Greek economy. A significant number of studies employ this methodology. Building on the work of Barro (1979, 1986), Bohn (1998) uses a multiple regression to assess the systematic relationship between the primary surplus (the dependent variable) and public debt (one of the explanatory variables, along with temporary government spending and a measure of the business cycle) in the US economy. He finds that authorities have responded to a positive dynamic of debt with an increase of the primary deficit, which points to a sustainable fiscal position. A similar approach is put forward in papers which focus on EA and EU members. Gali and Perotti (2003) emphasize that in order to capture the influence of discretionary policy measures, cyclically adjusted fiscal variables must be included in the reaction function. Their baseline specification includes the primary deficit (cyclically adjusted) as dependent variable and the current output gap, last period's debt and the dependent variable with one lag as explanatory variables, and they further develop the model by including dummy variables associated with the Maastricht Treaty and the SGP in order to observe the influence of these events on the relationship between fiscal policy and the business cycle. The sample includes observations that cover the period 1980-2002, for the EA12 countries except Luxembourg, and two control groups. In all the analyzed countries except the Netherlands,

the debt coefficient is negative (pointing to sustainability), however in most cases statistically insignificant, including the case of Greece. Ballabriga and Martinez-Mongay (2005) argue it would be more appropriate to use the previous period's output gap as an explanatory variable, due to the lags in implementing fiscal policy decisions. According to their results, in Greece, an increase in public debt is followed by an increase of the primary surplus the following period, the debt coefficient being positive and statistically significant across specifications. Models with a larger number of explanatory variables require more degrees of freedom to obtain significant results, and are generally estimated using panel data. Examples of papers following this approach are Afonso and Hauptmeier (2009) who study the influence of government spending decentralization on fiscal policy, or Tagkalakis (2010), who focuses on the connection between fiscal variables and asset prices.

2. The model

In this paper we estimate a fiscal reaction function for the Greek economy. With regard to the dependent variable of the multiple regression, we followed Tagkalakis (2010) and opted for the unadjusted primary deficit. Our choice is motivated by the numerous shortfalls in the methodology of determining cyclically adjusted variables, see Girouard and André (2005), box 1, for a discussion. Moreover, we shall attempt to distinguish between the influence of automatic stabilizers and discretionary policy measures by estimating a reaction function in which the dependent variable will be public spending. As Fedelino *et al.* (2009) notice, public spending is not correlated with the business cycle, with the exception of unemployment-related expenses, which generally hold a small weight in total public expenses, therefore, the dynamic of public expenses generally reflects discretionary decisions.

Our baseline model is represented by the following multiple regression:

$$pr\_bal_t = \alpha_1 + \beta_1 \cdot pr\_bal_{t-1} + \gamma_1 \cdot y\_gap_{t-1} + \delta_1 \cdot debt_{t-1} + \varepsilon_t \quad (1)$$

where *pr_bal* is the primary balance (surplus), expressed as percentage deviation of actual GDP from potential GDP, *y_gap* is the output gap, expressed as ratio to potential GDP, and *debt* is government debt, expressed as percentage deviation from the value in the previous period.

Since our goal is to shed light on the fiscal policy variables in the post-euro adoption period, and gain understanding on the causes which determined the difficult fiscal situation the country is facing, we estimate equation (1) using quarterly data covering the period 2001Q1-2008Q2, because 2008Q3 was the first quarter of recession in Greece. Nominal debt is expressed in real terms using the Consumer Price Index. The output gap was determined as the percentage difference between actual GDP and potential GDP, the latter being proxied as the trend obtained with the Hodrick-Prescott filter. All data come from the Eurostat.

Before estimating the model given by (1), we test the stationarity of the variables included in regression (1) using the Augumented Dickey Fuller (ADF) test. Results, which are reported in table 1, point to stationary series, we can therefore continue with the estimation procedure. Results are shown in table 2

Table 1: ADF test results for the variables in equation (1)

Series	Test statistic	Conclusion
Primary balance	-2.7477*	Series is stationary
Debt	-5.6019***	Series is stationary
Output gap	-5.2124***	Series is stationary

Note: * and *** stand for statistical significance at the 90% and 99% levels, respectively.

Source: Author's calculations in Eviews..

Table 2: Estimation results for equation (1)

Coefficient	β_1 (balance (t-1))	γ_1 (output gap(t-1))	δ_1 (debt % variation (t-1))
Estimation	0.5717***	-0.3732	0.1631

Source: Author's calculations in Eviews.

We can see that the most significant influence on the primary balance is given by the value of the same variable in the previous period, therefore we can state that there is a significant degree of inertia in fiscal policy. The coefficient of the output gap is negative, pointing to a pro-cyclical policy, however the estimation is statistically insignificant. Our main focus is on the coefficient of lagged debt, and we find that is positive, thus indicating sustainability, but insignificant.

Using the cyclically unadjusted primary balance is equation (1) renders us unable to separate the influence of automatic stabilizers from that of discretionary measures in the reaction of the fiscal policy variable to business cycle and public debt developments. Given that primary government spending is largely unaffected by the business cycle, we can use this variable to replace the primary deficit in equation (1), and interpret the parameters as discretionary reactions. Therefore, we estimate the following model:

$$pr\_ex_t = \alpha_2 + \beta_2 \cdot pr\_ex_{t-1} + \gamma_2 \cdot y\_gap_{t-1} + \delta_2 \cdot debt_{t-1} + e_t \quad (2)$$

where *pr_ex* represents government primary expenditures, expressed as ratio to GDP. Estimation results are reported in table 3.

Table 3: Estimation results for equation (2)

Coefficient	β_2 (expenses (t-1))	γ_2 (output gap(t-1))	δ_2 (debt % variation (t-1))
Estimation	0.4370**	0.7375	-0.1671

Note: * * stands for statistical significance at the 95% level.

Source: Author's calculations in Eviews.

Results are in line with those of equation (1). Inertia seems to be the main characteristic of fiscal policy conduct in Greece. An increase in public expenses will trigger on average an increase of the variable in the following period also, which indicates an unsustainable path of public expenses. With regard to the output gap, the authorities' reaction is pro-cyclical, however statistically insignificant. An increase in debt will determine on average a decrease in primary expenses, pointing to fiscal sustainability, still the estimation is insignificant, and so we cannot draw a firm conclusion.

3. Conclusions

In this paper we estimated a fiscal reaction function for the Greek economy, focusing on the period which started with the euro adoption and ended when the economic recession began. Our objective was to gain understanding on whether fiscal policy conduct is one of the causes which determined the difficult economic situation that Greece is now facing. We found that fiscal policy is mainly driven by inertia, while the business cycle and public debt affect fiscal variables in a statistically insignificant manner. This indicates that fiscal policy conduct is indeed among the causes of the Greek economic turmoil.

4. Acknowledgements

5. References

[1]   A. Afonso. Fiscal sustainability: the unpleasant European Case. *FinanzArchiv*. 2005, **61**(1): 19-44

[2]   A. Afonso and   S. Hauptmeier. Fiscal behaviour in the European Union: rules, fiscal decentralization and government indebtness. *European Central Bank Working Paper no. 1054*. 2009

[3]   F. Ballabriga and C. Martinez-Mongay. Sustainability of EU public finances. *European Comission Economic Papers no. 225*

[4]   R. Barro. On the Determination of the Public Debt. *Journal of Political Economy*. 1979, **87**(5): 940-971

[5]   R. Barro. U. S. Deficits Since World War I. *The Scandinavian Journal of Economics*. **88**(1): 195-222.

[6]   H. Bohn. The Behaviour of U. S. Public Debt and Deficits. *The Quarterly Journal of Economics*. 1998, **113**(3):

949-963

[7] H. Bohn. Are stationarity and cointegration restrictions really necessary for the intertemporal budget constraint?. *Journal of Monetary Economics*. 2007, **54**: 1837-1847

[8] N. Chalk and R. Hemming. Assessing fiscal sustainability in theory and practice. *IMF Working Paper no. 81*, 2000.

[9] A. Fedelino, A. Ivanova and M. Horton. Computing Cyclically Adjusted Balances and Automatic Stabilizers. *IMF Technical Notes and Manuals*. 2009.

[10] J. Galí and R. Perotti. Fiscal Policy and Monetary Integration in Europe. *NBER Working Paper no. 9773*. 2003

[11] N. Giammarioli, C. Nickel, P. Rother and J. P. Vidal. Assessing fiscal soundness. Theory and practice. *European Central Bank Occasional Paper no. 56*. 2007

[12] N. Girouard and C. André. Measuring Cyclically-adjusted budget balances for OECD countries. *OECD Economics Department Working Paper no. 434*. 2005

[13] C. Hakkio and M. Rush. Is the Budget Deficit 'Too Large'?. *Economic Inquiry*. 1991, **29**(3): 429-446.

[14] J. Hamilton and M. Flavin. On the limitations of government borrowing: a framework for empirical testing. *American Economic Review*. 1986, **76**: 808-819

[15] C. Quintos. Sustainability of the Deficit Process With Structural Shifts. *Journal of Business & Economic Statistics*. 1995, **13**(4): 409-417

[16] A. Tagkalakis. Fiscal policy and financial market movements. *Bank of Greece Working Paper no. 116*. 2010

[17] A. van Riet (editor). Euro area fiscal policies and the crisis. *European Central Bank Occasional Paper no. 109*. 2010