

Stella Spilioti (Greece)

The relationship between the government debt and GDP growth: evidence of the Euro area countries

Abstract

This paper investigates the average impact of government debt on GDP growth in the Euro area countries using data from the period 1981-2014. The empirical results suggest that the impact of debt on economic growth is positive and statistically highly significant. In our estimation of the growth equation the author also includes some other control variables such as: 1) the variables capturing the impact of inflation, 2) the indicators of the openness of the economy and the external competitiveness, and 3) other control variables related to the demographic characteristics of the economy as well as indicators that expected to influence the future investments.

Keywords: government debt, economic growth, time series.

JEL Classification: G1.

Introduction

The economic literature examines the impact of public debt on GDP growth and concludes that in the long-run public debt has a negative impact on economic growth. This idea is supported by the results of many empirical studies that have proven the above relationship in advanced and emerging economies (see for example, Diamond, 1965; Saint-Paul, 1992; Schclarek, 2004; Adam and Bevan, 2005; Aizenman et al., 2007).

In the context of economic and financial crisis of 2007-2011 in the Euro area, the gross government debt and deficit ratios have been increased rapidly causing a negative effect in the long-term fiscal sustainability. Within this economic and financial background, an important question that arises is whether the negative relationship between high levels of public debt and economic growth, is observed only above a certain level of government debt. More specifically, a lot of empirical studies concur that there is a negative correlation between external debt and economic growth and support that this correlation becomes particularly strong when debt reaches a certain threshold (see, for example, Pattilo et al., 2002; Reinhart and Rogoff, 2010; Kuman and Woo, 2010; Cordella et al., 2010; Cechetti et al., 2011, Checherita and Rother, 2012).

Despite of the importance of the topic there is limited empirical literature for the Euro area that examines the relationship between public debt and economic growth during the economic and financial crisis. This is precisely the motivation of this paper: we aim to investigate the average impact of government debt on GDP growth using data from a sample of 14 countries of the Euro area for the period 1981-2014, such as Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden. In

our estimation of the growth equation we also include some other control variables such as: 1) the variables capturing the impact of inflation, 2) the indicators of the openness of the economy and the external competitiveness, and 3) other control variables related to the demographic characteristics of the economy as well as indicators that expected to influence the future investments.

1. Literature review

A lot of empirical studies support that there is a negative relationship between public debt and economic growth in advanced and emerging economies. According to their empirical results this correlation is particularly strong when public debt reaches 100 percent of GDP (see for example, Reinhart and Rogoff, 2010; Kuman and Woo, 2010; Checherita and Rother, 2010; Cechetti et al., 2011).

The empirical literature examines the relationship between external debt and debt restructuring on economic growth mostly in developing countries. For developed countries the empirical evidence, particularly for economies belonging to the Euro area, is very limited, and most of them examine the impact of fiscal variables (such as government debt, taxes) on long term interest rates and spreads only as an indirect approach affecting economic growth (see for example, Hiebert et al., 2002).

Among the studies that examine the impact of debt on GDP growth, is that of Diamond (1965) which makes an evaluation of the effect of taxes on capital stock, and reaches to the conclusion that the public external and internal debt reduces the available lifetime consumption of tax payers as well as their savings, and thus the capital stock. Adam and Bevan (2005) examine the impact of fiscal deficit on economic growth for a panel of 45 developing countries. They support that there is a threshold effect at a level of the deficit around 1.5% of GDP. The same conclusions derive from the studies of Saint-Paul (1992), Aizenman et al. (2007) who also

find a negative relation between public debt and economic growth rate. Schclarek (2004) also finds that the above relationship is particularly strong for a number of developing countries for the period 1970-2002 and not as strong for industrial countries. In the same line, Aschauer (2000) examines the relationship between public capital and economic growth using data from 48 contiguous U.S. states over the period 1970-1990. The empirical results show whenever the government debt is used to finance productive public capital, an increase in debt has a positive effect up to a certain threshold and negative effect beyond it.

There is another set of empirical studies that examine in more detail the impact of different levels of public debt on economic growth and find that this negative relationship exists only after a certain debt-to-GDP ratio. Smyth and Hsing (1995) indicate that the optimal debt ratio is 38.4% when debt held by the public sector and 48.9% for total debt. Pattillo et al. (2002) using a large panel data set of 93 developing countries for the period 1969-1998, support that the negative impact of external debt on per-capital GDP growth exists only when the net present value of debt levels are above 35%-40% of GDP. In the same line, Clements et al. (2003) based on a panel of 55 low-income countries data over the period 1970-1999, find that the turning point in the net present value of external debt is at 20%-25% of GDP. Reinhart and Roggof (2010) also study the economic growth and inflation at different levels of government and external debt, based on new data on forty-four countries for the period 1970-2009. Their findings show that the relationship between government debt and real GDP growth is weak for debt/GDP ratios below a threshold of 90% of GDP. Kumar and Woo (2010) examine the impact of high public debt on long-run economic growth, based on a panel of advanced and emerging economies' data for a period of almost four decades. The empirical results suggest that on average, a 10% point increase in the initial debt – to GDP ratio is associated with a slowdown in annual real per capital GDP growth of around 0.2% points per year.

2. Methodology definition of variables and hypotheses

2.1. Methodology. In this paper we use a combination of time-series and cross-section data (panel data analysis) which has a number of advantages. For example, a panel data approach not only provides efficient and unbiased estimators but also a larger number of degrees of freedom allowing researchers to overcome small sample problems associated with the estimation of the linear regression model, especially due to the time-dimension of the data (see e.g. Baltagi and Raj, 1992; and Maddala,

1987). Additionally, the panel data models allow researcher to analyze a number of important economic questions that cannot be addressed using cross-sectional or time-series data sets alone. Our econometric model can be represented as follows:

$$Y_{it} = \alpha + \mu_i + \lambda_t + \sum_{K=1}^K \beta_K X_{Kit} + \varepsilon_{it}, \quad (1)$$

$$i = 1, \dots, N,$$

$$t = 1, \dots, T,$$

where Y_{it} is the price per share for the cross section i at time t , X_{Kit} is the value of the K^{th} explanatory variable for the cross section i at time t , μ_i is an unobserved cross-section, individual effect, λ_t is an unobserved time effect and ε_{it} is the unobserved overall remainder. Equation (1) is estimated under the assumption that μ_i and λ_t are fixed so that $\sum_{i=1}^N \mu_i = 0$ and $\sum_{t=1}^T \lambda_t = 0$, describing the well known least square dummy variable model or the covariance model (see, among others, Kmenta, 1971; Griffiths et al., 1993; Hsiao, 1986; Greene, 2000).

2.2. Definition of variables. 2.2.1. The dependent variable.

The growth rate of gross domestic product (GRGDP). GRGDP is the growth rate of gross domestic product.

2.2.2. The independent variables.

The gross debt (DEBT). DEBT is the general government consolidated gross debt. This variable expresses the impact of debt on GDP growth.

The gross domestic product (GDP). GDP is the initial level of gross domestic product. This variable shows the impact of the wealth of the economy on GDP growth.

The gross savings (SAVINGS). SAVINGS is the gross national savings. This variable expresses the highest amount that the economy disposes in order to invest without having to borrow.

The exports (Exports). Exports is the sum of exports of goods and services.

The imports (Imports). Imports is the sum of imports of goods and services.

The growth rate of trade (GRTRADE). GRTRADE the growth rate of trade of goods and services.

We mention that Imports, Exports, Grtrade are considered as control variables because they represent important indicators of the openness of the economy and its external competitiveness, and as such they are used in the relative literature.

The long term interest rates (LONG). LONG is the nominal long term interest rates that is used as a control variable because it captures the impact of inflation.

The unemployment (UNEMPLOYMENT). UNEMPLOYMENT is the total unemployment rate. This variable is used as a control variable because it expresses the cost of salaries in the economy which is expected to influence the future investments.

The population (POPULATION). POPULATION is the total population.

The growth rate of population (GRPOPULATION). GRPOPULATION is the growth rate of total population. The population and the growth rate of population are considered as control variables because they are related to the demographic characteristics of the economy.

2.3. Hypotheses. The main hypothesis we aim to test is whether the variability of the growth rate of the gross domestic product is explained by the variability of the different levels of the government debt. A secondary hypothesis that we have to examine is whether the variability of the growth rate of the gross domestic product is explained by the

variability of other control variables such as the sum of imports and exports, the growth rate of trade, the long term interest rates, the unemployment, the population and the growth rate of population. If any of these hypotheses is true, the implication would be that the growth rate of gross domestic product is affected by some of the above independent variables. If the alternative hypotheses are true we would infer that the changes of the growth rate of the gross domestic product is not explained by the changes of the above explanatory variables.

3. Empirical findings

Table 1 presents the descriptive statistics of the variables used in our study. As we can see from this table, the average GRGDP is 0.00 with a standard deviation of 0.03. The average GDP is 208.50, a value that is higher than the average of DEBT (60.70) and the average of SAVINGS (21.60). The average EXPORTS, IMPORTS and GRTRADE have a value of 33.40, 34.40 and 0.00 respectively. In addition, the average of LONG is 7.85, while the average of UNEMPLOYMENT has a similar value (8.16). On the other hand, the average POPULATION is 10191.50 while the average GRPOPULATION has a very low value (0.00).

Table 1. Descriptive statistics of variables

PANEL 1				
	GRGDP	DEBT	GDP	SAVINGS
Mean	0.05	65.41	472.23	21.08
Median	0.05	60.70	208.50	21.60
Maximum	0.23	170.60	2593.00	29.00
Minimum	-0.17	11.60	18.40	4.20
Std. dev.	0.05	27.33	570.69	4.22
PANEL 2				
	EXPORTS	IMPORTS	GRTRADE	LONG
Mean	40.08	39.00	0.00	7.80
Median	33.40	34.40	0.00	6.50
Maximum	104.90	84.10	0.19	24.10
Minimum	16.10	16.70	-0.11	2.60
Std. dev.	19.09	15.75	0.03	4.15
PANEL 3				
	UNEMPLOYMENT	POPULATION	GRPOPUL	
Mean	8.16	23859.62	0.00	
Median	7.85	10191.50	0.00	
Maximum	21.70	82520.00	0.26	
Minimum	1.50	3444.00	-0.01	
Std. dev.	3.74	24345.12	0.01	

Notes: GRGDP: GRGDP is the growth rate of the gross domestic product; DEBT: DEBT is the general government consolidated gross debt; GDP: GDP is the gross domestic product; SAVINGS: SAVINGS is the gross national savings; EXPORTS: EXPORTS is the exports of goods and services; IMPORTS: IMPORTS is the imports of goods and services; GRTRADE: GRTRADE is the growth rate of trade; LONG: LONG is the nominal long term interest rates; UNEMPLOYMENT: UNEMPLOYMENT is the total unemployment rate; POPULATION: POPULATION is the total population; GRPOPULATION: GRPOPULATION is the growth rate of population.

The results of the estimation of equation (1) above are presented in Table 2. The explainability of the model is significant bearing in mind that the

independent variables explain a moderate portion of the variability of the dependent variable (51%). The results show that key independent variables such as

the government debt, the gross domestic product and the gross national savings represent important determinants of the growth rate of the gross domestic product. The main question of our analysis of whether the growth rate of the gross domestic product is affected by the different levels of the government debt is upheld by the data. The results also show that other independent variables such as the sum of imports and exports, the growth rate of trade representing indicators of the openness of the economy and the external competitiveness have an important impact on the determination of the dependent variable. In addition the empirical findings reveal that the long term interest rates capturing the impact of inflation explain a large portion of the variability of the dependent variable. Moreover the other control variables such as the unemployment, the population, the growth rate of population have also a significant impact on the GDP growth. So the second question of our analysis of whether the growth rate of the gross domestic product is affected by the inclusion in the estimation of the growth equation of some other control variables is also upheld by the data. The Durbin-Watson statistic and the Residual Sum of Squares have a price of 1.62 and 0.48 respectively. The results also show that all explanatory variables are statistically significant and have the expected sign.

Table 2. Estimation of the model

Independent variables	Model
CONSTANT	-0.10 (-2.15)**
DEBT	0.00 (3.13)***
GDP	-3.93E-05 (-1.92)**
SAVINGS	0.00 (5.58)**
EXPORTS	-0.00 (-2.22)**
IMPORTS	0.00 (-2.14)**
GRTRADE	0.74 (7.48)**
LONG	-0.00 (-3.53)**
UNEMPLOYMENT	-0.00 (-3.40)**
POPULATION	2.64E-06 (1.88)*
GRPOPUL	0.42 (2.74)**
\bar{R}^2	0.51

References

1. Adam, C. and Bevan, D. (2005). Fiscal Deficit and Growing in Developing Countries, *Journal of Public Economics*, 89, pp. 571-597.
2. Aizenman, J., Kletzer, K. and Pinto, B. (2007). Economic Growth with Constrains on Tax Revenues and Public Debt: Implications for Fiscal Policy and Cross-Country Differences, NBER, Working Paper.

RSS	0.48
D-W	1.63
F-statistic	8.79
Prob(F-statistic)	0.00

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels, respectively; DEBT: DEBT is the general government consolidated gross debt; GDP: GDP is the gross domestic product; SAVINGS: SAVINGS is the gross national savings; EXPORTS: EXPORTS is the exports of goods and services; IMPORTS: IMPORTS is the imports of goods and services; GRTRADE: GRTRADE is the growth rate of trade; LONG: LONG is the nominal long term interest rates; UNEMPLOYMENT: UNEMPLOYMENT is the total unemployment rate; POPULATION: POPULATION is the total population; GRPOPULATION: GRPOPULATION is the growth rate of population; t-statistics appear in parentheses; RSS denotes the Residuals Sum of Squares.

Conclusions

The objective of this paper is to investigate the average impact of government debt on GDP growth in the Euro area, by using data of about 30 years starting in 1981. In our estimation of the growth equation we also include some other control variables such as: 1) the variables capturing the impact of inflation, 2) the indicators of the openness of the economy and the external competitiveness, and 3) other control variables related to the demographic characteristics of the economy as well as indicators that expected to influence the future investments.

The empirical results show that the explainability of the model is significant bearing in mind that the independent variables explain a moderate portion of the variability of the dependent variable (51%). The results suggest that key independent variables such as the government debt, the gross domestic product and the gross national savings represent important determinants of the growth rate of the gross domestic product. The results also suggest that the inclusion of some other control variables in the estimation of growth equation has an important impact on the GDP growth rate.

These empirical findings are consistent with the results of the previous empirical literature which examines the impact of public debt on GDP growth suggesting that debt develops the economic activity. The results support the existence of a positive and statistically significant relationship between government debt and GDP growth. For similar, but not identical, results, see for example, Pattilo et al. (2002), Clements et al. (2003), Smyth and Hsing (1995), Cohen (1997), Reinhart and Roggof (2010).

3. Aschauer, A. (2000). Do states optimize? Public Capital and Economic Growth, *The Annals of Regional Science*, 34 (3), pp. 343-363.
4. Baltagi, B.H., and B. Raj (1992). A survey of recent theoretical developments in the econometrics of panel data, *Empirical Economics*, 17, pp. 85-109.
5. Cecchetti, S., Mohanty, M. and Zampolli, F. (2011). *The Real Effects of Debt*, Working Paper, European Central Bank.
6. Checherita, C. and Rother, R. (2012). The Impact of high and growing Government Debt on Economic Growth: An Empirical Investigation for the Euro Area, *European Economic Review*, 56, pp. 1392-1405.
7. Clements, B., Bhattacharya, R. and Nguyen, T. (2003). External Debt, Public Investment, and Growth in Low-Income Countries, IMF Working Paper.
8. Cordella, T., Ricci, L. and Ruiz-Arranz (2010). Debt Overhang or Debt Irrelevance? IMF, Staff Papers.
9. Diamond, P. (1965). National Debt in a Neoclassical Growth Model, *The American Economic Review*, 55, pp. 1126-1150.
10. Greene, W. (2000). *Econometric Analysis*, Prentice Hall, Upper Saddle River, NJ.
11. Griffiths, W.E., C. Hill and G.G. Judge (1993). *Learning and Practicing Econometrics*, John Wiley and Sons, INC.
12. Hsiao, C. (1986). *Analysis of Panel Data*, Econometrics Society Monographs, No. 11.
13. Hiebert, P., Lamo, D. and Vidal, J. (2002). Fiscal Policies and Economic Growth in Europe : An Empirical Analysis, Banca d' Italia, Public Finance Workshop on the Impact of Fiscal Policy.
14. Kmenta, J. (1971). *Elements of Econometrics*, Macmillan, New York.
15. Kumar, M. and Woo, J. (2010). Public Debt and Growth, Working paper, IMF Publications.
16. Maddala, G.S. (1987). Recent developments in the econometrics of panel data analysis, *Transportation Research*, 21, pp. 303-326.
17. Pattillo, C., Poirson, H. and Ricci, L. (2002). External Debt and Growth, IMF Working Paper.
18. Reinhart, C. and Rogoff, K. (2010). Growth in a Time of Debt, *American Economic Review*, American Economic Association, 100 (2), pp. 573-578.
19. Saint-Paul, G. (1992). Fiscal Policy in an Endogenous Growth Model, *Quarterly Journal of Economics*, 107, pp. 1243-1257.
20. Schclarek, A. (2004). Debt and Economic Growth in Developing Industrial Countries, Working Paper, Lund University, Department of Economics.
21. Smyth, D. and Hsing, Y. (1995). In Search of an Optimal Debt Ratio for Economic Growth, *Contemporary Economic Policy*, 13, pp. 51-59.