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Asymmetric effects of fiscal policy on output of the Greek economy: Does the business cycle matter?

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Ασύμμετρες επιδράσεις της δημοσιονομικής πολιτικής στο παραγόμενο προϊόν της ελληνικής οικονομίας: Ο ρόλος των επιχειρηματικών κύκλων

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Περίληψη

Η παρούσα εργασία διερευνά εάν η επίδραση των δημόσιων δαπανών στο παραγόμενο προϊόν μπορεί να επηρεαστεί από την κατάσταση του επιχειρηματικού κύκλου της οικονομίας. Τα αρχικά οικονομετρικά αποτελέσματα που προκύπτουν από τη χρήση της τεχνικής παλινδρόμησης Markov Switching υποδηλώνουν ότι οι επιπτώσεις των δημόσιων δαπανών στην παραγωγή είναι ασύμμετρες σε σχέση με τον επιχειρηματικό κύκλο. Η μεγαλύτερη επίδραση παρατηρείται κατά τη διάρκεια της ύφεσης. Αντιθέτως, σε περιόδους οικονομικής ανάπτυξης, ο αντίκτυπος των δημοσίων δαπανών είναι αρνητικός. Δεδομένου ότι οι μεταβλητές του παραγόμενου προϊόντος και των δημόσιων δαπανών είναι ενδογενείς, λαμβάνουμε επιπλέον εκτιμήσεις με χρήση της instrumental variable regression οικονομετρικής τεχνικής. Ακόμη και στην περίπτωση αυτή, επαληθεύουμε ότι η υψηλότερη επίδραση των δημόσιων δαπανών λαμβάνει χώρα κατά τη διάρκεια της ύφεσης. Ωστόσο, σε περιόδους ανάπτυξης, ο αντίκτυπός τους είναι συγκριτικά λιγότερο αρνητικός σε σχέση με την επίδραση που προέκυψε από τις αρχικές εκτιμήσεις.

Asymmetric effects of fiscal policy on output of the Greek economy: Does the business cycle matter?

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Abstract

We analyze if the influence of public expenditure on output can be affected by the state of the economy. Markov Switching regression results are reported on quarterly data for Greece and suggest that the effects of public spending on output are quite asymmetric over the business cycle. The highest influence is observed during recessions. On the contrary, in periods of growth, this impact is negative. Given that endogeneity is a real concern when considering the effects of fiscal policy, we obtain instrumental variable estimates that are as free as possible of endogeneity. Even, in this case we verify that the highest influence of public spending is observed during contractions. Nevertheless, in periods of growth, its impact is less negative as compared to the influence obtained by our initial estimates.

Keywords: Public spending, Output, Regime Switch Models, Endogeneity

JEL classification: E32, E62, O40.

1. Introduction

The impact of fiscal policy on aggregate output remains one of the most controversial topics in modern macroeconomics. Empirical evidence provided so far has been quite indeterminate with theoretical views offering quite diverging predictions. On the one hand, Keynesian economic theory supports that fiscal policy can influence output by supporting aggregate demand. By contrast, neoclassical predictions contend that expansionary fiscal policy can hamper growth by crowding out the private sector. The debate on the effects of fiscal policy moved to a new direction after the advent of the crisis and the subsequent fiscal consolidation followed by a number of European countries. The effectiveness of this kind of fiscal policy has been questioned recently due to the disappointing growth performance of several European countries which may in part be due to fiscal tightening measures.

The latest literature demonstrates that the state of the economy indeed matters in determining the impact of fiscal policy on output. Blanchard and Leigh (2013) show that stronger fiscal consolidation in the EU countries has been associated with lower than expected growth especially in the early period of the crisis. In the same spirit, Auerbach and Gorodnichenko (2012) illustrate that the output effects of fiscal policy are higher in recessions than in expansions.[1] A number of recent studies also demonstrate that the stance of monetary policy matters in determining the influence of public spending. Christiano *et al*. (2011), Woodford (2011), Davig and Leeper (2011), Eggertsson (2010) and Conenen *et al*. (2012) show that the government spending

[1] The existing empirical evidence on the effects of fiscal policy is not uniform. Blanchard and Perotti (2002) show that shocks in government spending were associated with higher output of the US economy during the post war period, with the size of the multiplier being close to one. The results of Monacelli *et al*. (2010) are also in favor of a multiplier which is larger than one in the U.S. economy. However, influences of fiscal policy on output seem to have weakened, with the impact being particularly stronger in the period before the 80s (Perotti, 2005; 2007). Alesina and Ardagna (2010) have shown that fiscal stimulus based on tax cuts is more likely to increase growth as compared to fiscal expansion based on spending increases. They also show that adjustments based on spending cuts rather than tax increases are less likely to create recessions.

multiplier can be very large when monetary policy does not respond to changes in prices, mostly in cases when the nominal interest is very close to zero. In contrast, when the central bank follows a Taylor rule, then the value of the government spending multiplier is less than one.

Erceg and Linde (2013) using a two country DSGE model examined the effects of tax based and expenditure based fiscal consolidation in a currency union. Given the limited scope for monetary accommodation, they showed that tax based consolidation tends to have smaller adverse effects on output than expenditure based consolidation in the short run, though its influence is more costly in the longer run. They also evidence that expenditure based consolidation is counterproductive in the near term when the zero lower bound is binding. Blanchard et al. (2016) show that a fiscal expansion by the core economies of the euro area would have a large and positive impact on periphery GDP assuming that policy rates would remain low for a prolonged period. Under their model specification, an expansion of core government spending equal to one percent of euro area GDP would boost periphery GDP around 1 percent in a liquidity trap that would last for three years.

Although the latest literature has come to the conclusion that fiscal policy transmissions to the real economy are quite different during recessions than in normal times, most of this research ignores that fiscal variables that enter in the regression are in fact endogenous. It is likely that both variables of public spending and public revenues are affected by the phase of the business cycle and the size of economic activity. This study aims to contribute in this direction by treating the fiscal variables that are used in the empirical analysis as endogenously determined.

We use Markov Switching regression in a model where the output gap is used to determine the state of the economy. We use data on the Greek economy, as it

constitutes a representative example of a country which has suffered recently from a deep and prolonged recession and has adopted a number of fiscal tightening measures in response to poor economic activity and high debt.[2] The econometric results are reported on quarterly data and show us that the effects of public spending on growth are asymmetric over the business cycle. The highest influence on output is observed during recessions. On the contrary, in periods of growth, the impact of public spending is negative. Next we perform auxiliary regressions to obtain instruments of the output gap and fiscal variables that are as free as possible of endogenous association with output growth. When using instruments instead of endogenous variables in the regression, we confirm that the highest influence of fiscal policy is observed in periods of recession. By contrast, in periods of growth, the negative effect of public spending is less strong as compared to the influence obtained by initial estimates.

The paper proceeds as follows: section 2 presents the theoretical framework of our study. Section 3 presents the data and discuses the methodology that is used to obtain the output gap variable. Section 4 introduces the econometric methodology and examines the link between public spending and output from the perspective of a Markov Switching model. Section 5 reports estimates after correcting for endogeneity of fiscal variables. Finally, section 6 concludes.

[2] As regards the influence of fiscal policy on growth of the Greek economy, Angelopoulos and Philippopoulos (2007) showed that a smaller government share in GDP, a reallocation of funds away from the wage bill and towards public investment, and an improvement in government efficiency could lead to long term growth for the Greek economy. Recently, Tagkalakis (2014b) showed that changes in government spending and in net taxes exert Keynesian effects with the increase in government consumption exerting the most pronounced effect on output growth. Also, it has been documented that fiscal shocks have more positive effects on the output of the Greek economy when credit is constrained (Tagkalakis, 2014a).

2. Theoretical framework

Predictions of the existing theoretical literature are ambiguous as regards the impact of fiscal policy on output. General equilibrium new Keynesian models show that the government spending multiplier can be close or above one (Gali et al. 2007; Monacelli and Perotti 2008). In new Keynesian models, consumers do not face infinitely lived horizons and do not behave in a Ricardian fashion. Therefore, their consumption is a function of current disposable income and, thus, an increase in government spending financed by deficit and not tax increases leads to higher consumption and output.

On the other hand, standard real business cycle models are in sharp contrast to new Keynesian models in their predictions of the effects of government spending on output and consumption. Specifically, the size of the multiplier is less than one (Baxter and King 1993; Burnside et al. 2004; Ramey 2011), while consumption is expected to decline. The main reason for such a significant difference with new Keynesian models, is the implicit assumption of consumer behavior in real business cycle models featuring infinitely lived Ricardian households, whose consumption depends on an intertermporal budget constraint. In this way, an increase in government spending lowers the present value of income after taxes, which in turn generates negative wealth effects and decrease in consumption.[3]

[3] Several studies have tried to reconcile predictions of neoclassical models with observed empirical evidence showing that a raise in consumption occurs after an increase in government spending. In particular, Gali *et al*. (2007) allow for the co-existence of Ricardian households and 'rule of thumb' consumers and show that a combination of rule of thumb consumers with sticky prices and deficit financing of government spending can account for higher consumption when spending increases. Hall (2009) developed a model in which a decline in markups of prices over costs is allowed when output raises and an elastic response of employment is featured when demand increases. Under these assumptions, the model delivers quite high multipliers and increase in consumption. Finally, Cogan *et al*. (2010) showed that government spending multipliers are smaller in new Keynesian models than old Keynesian ones, with the estimated stimulus in GDP being one sixth of what is predicted in old Keynesian ones.

We argue that during recessions the effect of fiscal policy on growth is stronger. In periods of economic slack, an increasing number of households becomes credit constrained, as the uncertainly about their future economic prospects makes borrowing less easy.[4] When models allow for the presence of credit constraints and feature non Ricardian households, the marginal propensity to consume rises and therefore fiscal policy becomes a more powerful tool for the stabilization of economic activity.[5]

Also, during recession, the influence of fiscal policy can be affected by monetary policy conditions. The impact of public spending can become stronger when monetary policy does not respond to changes in fiscal policy, mainly when the nominal interest rate is close to the zero lower bound. In this case, an initial increase in government spending leads to a rise in output. With nominal interest rates held constant, the expected rise in inflation lowers the real interest rate and therefore private spending increases leading to a further increase of output. However, when monetary policy responds by increasing the nominal interest rate the impact of public spending on growth weakens.

3. Data and stylized facts

For the purpose of our study, a quarterly dataset has been compiled from the National Accounts' database of the Hellenic Statistical Authority (2016) which covers the variables of output and public spending (defined as the sum of public consumption and public investment). These variables enter in real terms and are seasonally

[4] Ratto *et al*. (2009) in their model for the euro area estimated that half of the non liquidity constrained households to be credit-constrained.
[5] Credit constrained households differ from Ricardian households in that they face collateral constraints on their borrowing and therefore they raise their consumption after an increase in public spending.

adjusted. The length of the time span for which these variables are available covers the period from the first quarter of 1999 to the first quarter of 2016.

Average quarterly changes of output and public spending are shown in Figures 1 and 2. It is very clear that growth rates of output present a highly asymmetric behaviour between 1999-2007 and 2008-2015, with average GDP growth rates remaining negative for the whole period of 2008-2016. Similarly, public spending growth patterns are quite different between 1999-2007 and 2008-2015. While in the first period government expenditure was constantly rising, in the subsequent period the growth rates of public spending became highly negative as a consequence of tight fiscal policy measures.

As regards the variable of the output gap, we follow the estimation of a Kalman econometric filter to obtain a measure of potential output of the Greek economy. Then the output gap variable is measured as the difference between actual and potential GDP. In contrast to most of the existing studies having so far used either a univariate approach or simple detrending methods, we employ a multivariate filter approach to decompose actual GDP into its potential and cyclical component (Blagrave *et al*., 2015). Equations 1-3 describe a simple multi-equation model in which actual GDP (expressed in natural logarithm) consists of its potential and cyclical component (Equation 1). Potential output follows a random walk and is affected by current inflation (INF) and one period ahead inflation expectations (Equation 2) while cyclical GDP follows a random walk (Equation 3).

$$ln(actual\ gdp_t) = ln(potential\ gdp_t) + ln(cyclical\ gdp_t) + u_t \quad (1)$$

$$ln(potential\ gdp_t) = ln(potential\ gdp_{t-1}) + \alpha * INF_t + \beta * INF_{t+1} + e_t \quad (2)$$

$$ln(cyclical\ gdp_t) = \gamma * ln(cyclical\ gdp_{t-1}) + \varepsilon_t \quad (3)$$

As a way to obtain more accurate econometric estimates, prior values were assigned to the variances of the error terms (u_t, e_t , ε_t) of equations (1-3) following our previous knowledge for the variances of actual, potential and cyclical GDP. Figure 3 demonstrates that the evolution of the output gap variable shifted form positive to negative from the last quarters of 2007 onwards.

4. Econometric results

We examine the relationship between public spending and growth. Given that both variables display an asymmetric behavior over time (Figures 1&2), a Markov Switching model is appropriate to explore whether the impact of public spending on output is uneven in the Greek economy. We consider the following Markov Switching model with two regimes:

$$growth_t = a + \sum_{i=-m}^{0} \beta_i(s_t)\Delta PUB_{t+i} + u_t \qquad (4)$$

where *growth* is the quarterly growth rate of output and *ΔPUB* is the quarterly public spending growth rate. Public spending is defined as the sum of government consumption and government investment, while both variables of output and public spending enter real terms and are seasonally adjusted.

The variable of *growth* is assumed to have been generated by a Markov Switch model with two regimes and *m* lags in the regressor of public spending growth. The value of the intercept α does not differ between the two regimes while the β coefficients depend on the current regime represented by s_t. We allow for regime dependent heteroskedasticity and, therefore, the error term u_t is represented by $u_t|s_t \sim N\left(0, \sigma^2(s_t)\right)$. This class of models was initially developed by Goldfeld and Quandt (1973) as a response to the asymmetric evolution of key economic variables during the business cycle. The state of the regime, represented by the variable s_t, is

determined by the quarterly output gap. We assume two different regimes, the recessionary one, which is defined by low output gaps and the expansionary one, which is determined by high output gaps. We specify s_t as a first order Markov chain, where the transition probability between the two regimes depend on the past value of the most recent regime: $P(s_t = j|s_{t-1} = i) = p_{ij}$.

The selection criteria that were followed for the choice of the number of *m* lags of public spending was that convergence in the estimation should be achieved and no serial correlation should be present in the estimated residuals. As the number of observations is not very high, the highest number of lags *m* of the public spending growth variable was set equal to four, provided that the two basic criteria (convergence and no serial correlation in the residuals) were first met.

Table 1 shows regression results with the output gap being the regime variable. We note that the number of lags for the variable of public spending ranges from zero to four, a common constant term is assumed in both regimes, while, also econometric estimates have encompassed the impact of the lagged dependent variable. In order to test the robustness of the obtained results a number of different regressions is performed, with Table 1 displaying estimates after: a) having included a variable for tax revenues, b) having distinguished on the effects of public investment and public consumption.

The majority of regression estimates shown in columns 1-4 illustrate that the impact of public spending on output is positive and statistically significant in the recessionary regime. They also indicate that when the economy is booming (high output gap regime) the influence of government expenditure is positive but not always statistically significant. When regression results encompass the highest number of lags (column 5), we note that the coefficient estimates of public spending are higher if

the output gap variable remains at the low regime. We verify this result when the variable of taxes enters in the regression (column 6). When distinguishing on the effects of public investments and public consumption, we obtain results that are in favor of a statistically significant and positive effect of public investment only in the recessionary regime. By contrast, when considering the variable of government consumption, our regression results do not vary substantially between the two regimes. Figure 4 illustrates graphically each of the two regimes' probabilities over time.

In light of the obtained estimates, we assess the effect of fiscal policy under the two different regimes. Relying on regression results which encompass the influence of taxes (column 6), we conduct a series of simulations to trace the impact of a hypothetical fiscal shock in contraction and expansion which lasts for five quarters (current quarter and 4 lagged quarters). The influence that we estimate is defined as follows:

$$Cumulative\ one\ year\ influence = \sum_{t=0}^{4} f_t * G \qquad (5)$$

where f_t is the public spending variable coefficient estimate in period t. G represents the fiscal shock that is set equal to the one standard deviation of the variable of public spending. The one year percentage impact of public spending is illustrated numerically in the upper part of Table 2. We conclude that the percentage response of output after an increase government spending differs substantially between expansions and contractions with a positive influence observed only in recessions. By contrast, in expansion periods, output is affected in a negative way after an increase in public expenditure.

5. Endogeneity

The regression results of Table 1 provide us with evidence that the influence of fiscal policy is superior during recessions than in periods of growth. However, both fiscal variables (public spending and taxes) that enter in the regression as well as the variable of the output gap that determines the regime are probably endogenous and therefore are correlated with the dependent variable of output growth. As a way to get estimates that are less subject to endogeneity bias, we consider a two stage instrumental variable approach (two stage predictor substitution method), a technique which has been widely used in the empirical research (Terza *et al*., 2008).

In the first step, auxiliary regressions are performed with the obtained residuals used to generate instrumental values for endogenous variables. Then, these instruments are used to substitute the initial endogenous regressors. In our attempt to find appropriate explanatory variables for the auxiliary regressions of the first step, we have in mind that the resulting instruments should satisfy the following two conditions: a) they should be correlated with the endogenous variables and b) they should not have a high association with the error term of the regression. Given that the instruments should have the lowest possible correlation with the error term of the regression and therefore with output growth, we considered essential to include as regressors in the first stage the lagged growth rates of output. In this way, we expect that the resulting instruments should be orthogonal to the dependent variable. A rule of thumb for the choice of lags of the explanatory variables was that their coefficient estimates should be at least significant at 10% level.[6] The same methodology was followed for both fiscal variables of public spending and net taxes as well as for the regime determinant of the output gap, as they are all subject to endogeneity and

[6] Regression results are available upon request.

therefore correlated with past growth rates of output. We consider the following there auxiliary econometric equations:

$$Public\ spending\ growth_t = c + \sum_{j=1}^{n} \beta_t * y_{t-j} + u_t \quad (6)$$

$$Net\ taxes\ growth_t = a + \sum_{j=1}^{n} \delta_t * y_{t-j} + e_t \quad (7)$$

$$Output\ gap_t = \gamma + \sum_{j=1}^{n} \theta_t * y_{t-j} + \varepsilon_t \quad (8)$$

where y_t stands for the output growth variable in period *t*,

The next step in our analysis is to get final estimates that are as free as possible of endogeneity. The residuals obtained by equations 6-8 are included in the regressions as instruments to substitute the endogenous variables. Table 3 shows Markov switching estimates under the additional assumption of regime dependent intercept coefficient estimates. Results of column 1 illustrate that the influence of public spending remains highly positive in the recessionary regime. By contrast, in the expansionary regime, the results are in favor of a negative association between public spending and output. Next we include the influence of taxation (Column 2), while Columns 3 and 4 distinguish between the effects of public investment and public consumption. We confirm that public spending affects output in a positive way during recessions and that it exerts an adverse impact on economic activity in boom periods. This finding holds for both public investment and public consumption whose influence remains substantially higher during recessions. Results of Column 5 present results after replacing the endogenous variable of output gap with its instrument. Again, we verify the differential impact of public spending between recessions and expansions. The bottom part of Table 3 includes diagnostic tests which verify that the instruments used in the regression are uncorrelated with the error term. These F tests

arise after having performed regressions of the instrumental variables on the lagged predicted error terms.

Again we numerically quantify the contribution of fiscal policy on output under the two regimes. We use Equation (5) and we rely on regression results of the fifth column of Table 3. The numerical impact of public spending as derived from estimates corrected for endogeneity is shown in the bottom part of Table 2. We verify that that the response of output is higher in the low output gap regime. The influence of public spending during recession is comparable to that obtained from our initial estimates. By contrast, in expansionary periods, the negative effect of public spending is less strong as compared to the influence derived from our initial estimates.

6. Concluding remarks

The obtained results confirm that the effects of public spending on growth are cyclically dependent with higher effects observed during downturns. It is also obvious that its growth influence is positive during recessions. On the contrary, its impact remains negative during economic booms. In order to correct our estimates for endogeneity bias, we obtained instruments for the variables of public spending, net taxes and output gap. When the endogenous variables were replaced by their instruments in the regression, we confirmed that the highest influence of fiscal policy is observed in periods of recession. However, it was shown that the negative effect of public spending during expansion is remarkably lower in magnitude when we control for endogeneity in our estimates.

We agree with a number of recent studies having demonstrated that the influence of government spending is higher during recessions (Cugnasca and Rother, 2015; Hernandez de Cos and Moral-Benito, 2016). We attribute this evidence on the

high percentage of credit constrained households and firms in the Greek economy during the last years.[7] An economy with credit constraints responds more strongly to fiscal policy measures as the marginal propensity to consume and invest increases. On the contrary, in normal times this relationship weakens as households and businesses have more opportunities to finance their consumption and investment through borrowing by the private financial sector. In this case there are no benefits to expansionary fiscal policy as it would primarily raise interest rates and crowd out the private sector, as analytically described in neoclassical models.

[7] Ratto *et al*. (2009) in their model for the euro area estimated that half of the non liquidity constrained households is credit-constrained.

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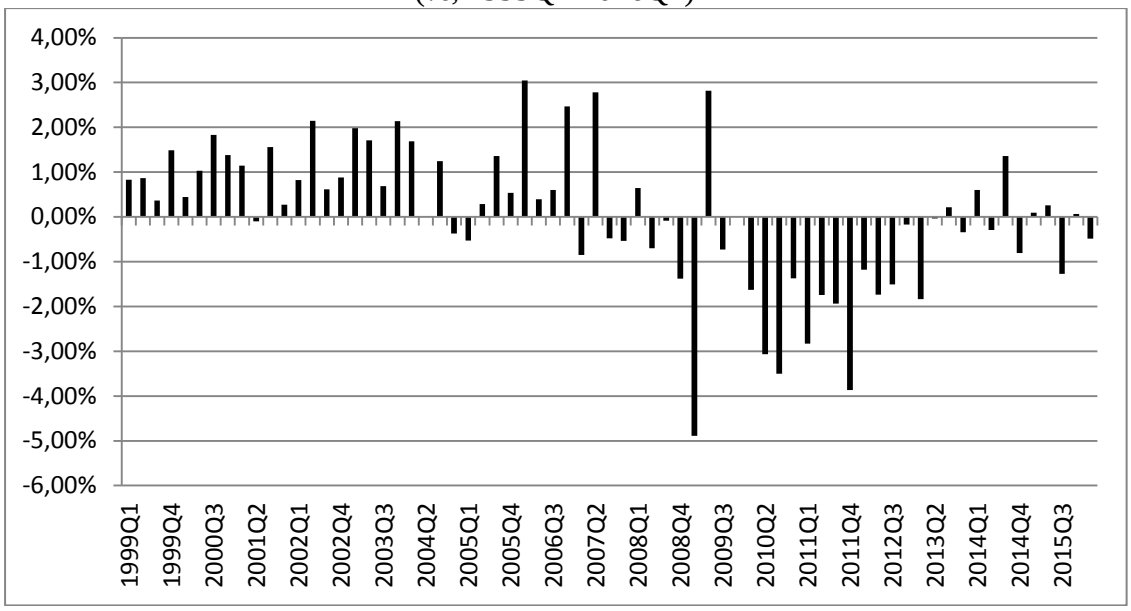
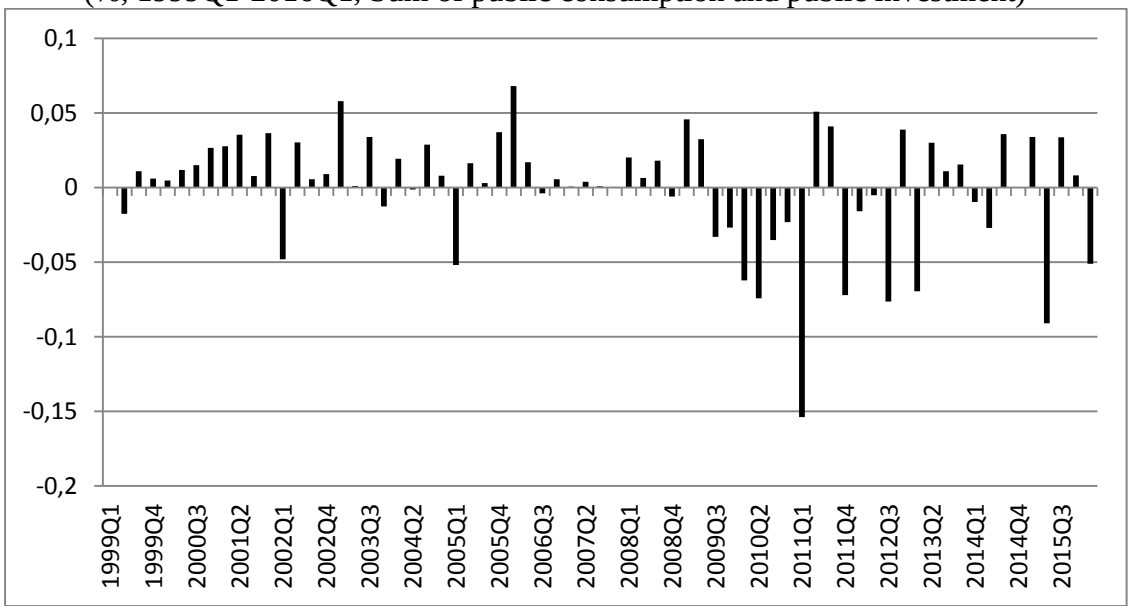
Tables and figures

Figure 1 Quarterly GDP growth
(%, 1999Q1-2016Q1)



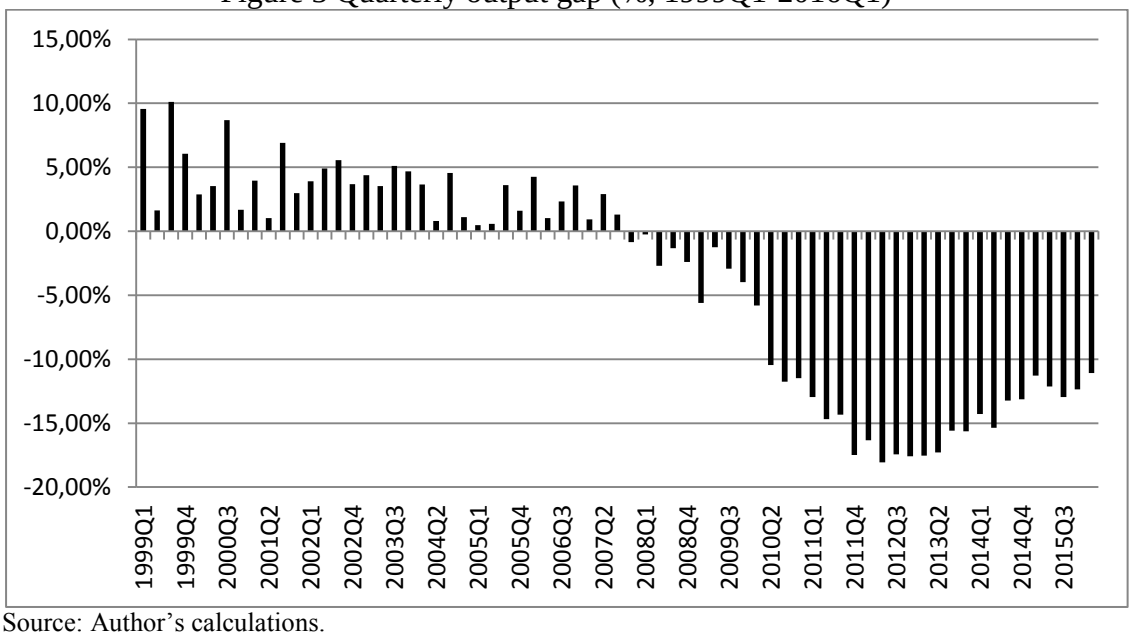
Source: ELSTAT (Hellenic Statistical Authority), National Accounts.

Figure 2 Quarterly public spending growth
(%, 1999Q1-2016Q1, Sum of public consumption and public investment)



Source: ELSTAT (Hellenic Statistical Authority), National Accounts.

Figure 3 Quarterly output gap (%, 1999Q1-2016Q1)



Source: Author's calculations.

Table 1 Regression results of Markov Switch model (regime variable: output gap)

Dependent variable: Output growth, Regime variable: Output gap								
	1	2	3	4	5	6	7	9
	No lag	1 lag	2 lags	3 lags	4 lags	Taxes	Public investment[1]	Public consumption[1]
Constant tem	-0.001 (-0.28)†	-0.0006 (-0.23)	0.0001 (0.04)	-0.0005 (-0.68)	-0.001* (-1.82)	-0.003*** (-4.57)	-0.034*** (-42.23)	-0.011 (-1.34)
Regime: Low output gap								
Public spending	0.025 (0.41)	0.045 (1.09)	0.155*** (4.43)	0.100* (1.87)	0.125*** (5.57)	0.137*** (27.48)	0.009*** (6.21)	-0.002 (-0.41)
Public spending (t-1)		0.018 (0.67)	0.186*** (5.40)	0.083 (1.17)	0.136*** (6.28)	0.184*** (42.33)	0.024*** (11.01)	0.112*** (11.44)
Public spending (t-2)			0.108*** (2.92)	0.178*** (4.23)	0.099*** (3.67)	0.139*** (18.57)	0.011*** (6.84)	0.040* (1.63)
Public spending (t-3)				0.178*** (3.54)	0.029 (1.01)	0.046*** (5.84)	0.023*** (15.17)	0.111*** (4.36)
Public spending (t-4)					-0.047* (-1.78)	-0.093*** (-10.96)	0.016*** (7.64)	-0.248*** (-38.85)
Regime: High output gap								
Public spending	0.080 (0.43)	0.067 (0.96)	0.265 (1.38)	0.169*** (10.06)	0.019 (0.10)	-0.307*** (-3.92)	-0.048*** (-15.71)	0.134*** (2.84)
Public spending (t-1)		0.048 (0.65)	-0.120 (-0.48)	0.175*** (10.65)	0.176 (1.40)	-0.421*** (-10.34)	0.025*** (10.13)	0.026 (0.50)
Public spending (t-2)			0.131 (1.00)	0.090*** (4.08)	0.034 (0.34)	-0.173*** (-3.87)	-0.046*** (-19.62)	0.308*** (8.85)
Public spending (t-3)				-0.031 (-1.14)	0.229* (1.74)	-0.220*** (-4.96)	0.064*** (24.66)	-0.075*** (-2.71)
Public spending (t-4)					0.151** (2.09)	0.018 (0.35)	-0.103*** (-35.19)	0.164*** (4.63)
Test-equal variances (p-value)						-3.149 (0.00)		
Test-equal coefficients (p-value)						10.195 (0.00)		

*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. †z-statistics are reported in parentheses. [1] The econometric specification includes the variable of net taxes.

Figure 4 Regime probabilities (High-low output gap)

Fig. 5.1: Low output gap

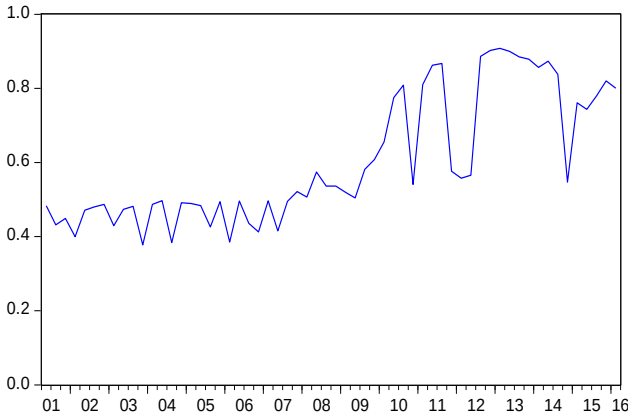


Fig. 5.2: High output gap

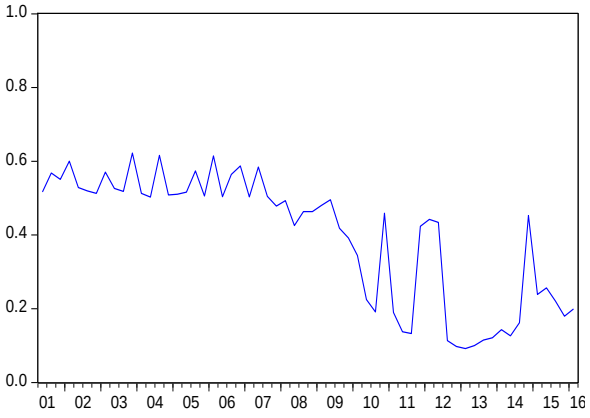


Table 2 Predicted accumulated change in output growth (%)
after a shock in government spending

	HIGH OUTPUT GAP	LOW OUTPUT GAP
IMPACT ON OUTPUT (INITIAL ESTIMATES)	-4.321%	1.618%
IMPACT ON OUTPUT (ESTIMATES CORRECTED FOR ENDOGENEITY)	-0.614%	1.528%

Table 3 Estimates corrected for endogeneity

Dependent variable: Output growth, Regime variable: Output gap					
	1	2	3	4	5
	Endogenous public spending	Endogenous public spending & endogenous taxes	Endogenous public investment	Endogenous public consumption	Endogenous public spending & endogenous output gap
Regime: Low output gap					
Constant term	-0.0006 (-0.17)†	0.013*** (3.93)	-0.002 (-0.64)	-0.003*** (-3.51)	-0.005*** (-3.80)
Public spending	0.134*** (8.47)	0.156*** (32.53)	0.014*** (4.68)	0.160*** (46.33)	0.081*** (16.77)
Public spending (t-1)	0.162*** (9.40)	0.125*** (23.21)	0.028*** (7.15)	0.184*** (49.21)	0.098*** (21.48)
Public spending (t-2)	0.097*** (5.19)	0.038*** (5.72)	0.022*** (5.44)	0.247*** (75.31)	0.155*** (35.40)
Public spending (t-3)	0.071*** (3.69)	0.146*** (17.28)	0.021*** (5.57)	-0.063*** (-18.53)	0.099*** (14.24)
Public spending (t-4)	-0.014 (-0.70)	-0.037*** (-6.33)	0.020*** (5.50)	0.029*** (12.53)	-0.010* (-1.97)
Public spending (t-5)				0.033*** (11.48)	
Regime: High output gap					
Constant term	-0.001 (-0.78)	0.015*** (4.07)	0.009* (1.85)	-0.007*** (-5.73)	-0.007*** (-3.84)
Public spending	-0.282*** (-3.58)	-0.498*** (-16.84)	0.016 (1.38)	-0.106*** (-10.39)	-0.073*** (-4.95)
Public spending (t-1)	-0.173** (-2.40)	0.013 (1.07)	0.016 (1.09)	-0.118*** (-9.66)	0.054*** (2.59)
Public spending (t-2)	-0.153*** (-2.72)	-0.087*** (-5.34)	-0.026 (-1.64)	-0.168*** (-21.36)	-0.230*** (-16.92)
Public spending (t-3)	-0.024 (-0.43)	-0.219*** (-12.67)	0.078*** (4.04)	0.123*** (13.08)	0.010 (0.75)
Public spending (t-4)	0.148*** (2.86)	-0.023 (-0.80)	-0.143*** (-6.29)	0.085*** (18.82)	0.068*** (4.25)
Public spending (t-5)				0.090*** (9.27)	
Correlation of the instrument of output gap with the error term (F-stat, p-value)[1]			2.542 (0.11)		
Correlation of the instrument of public spending with the error term(F-stat, p-value)[1]			0.715 (0.40)		
Correlation of the instrument of net taxes with the error term (F-stat, p-value)[1]			0.027 (0.86)		

*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. †z-statistics are reported in parentheses.

1. Correlation tests are based on the OLS regression of the instrumental variable on once and twice lagged predicted residuals. Null hypothesis: absence of correlation

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