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Article

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The fiscal policy impact to the Greek economy: Asymmetric evidence from a switching regime approach

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Abstract. This paper empirically investigates the magnitude of general government expenditures and tax income revenues to the Greek output within a regime-switching framework during the period 2000:1 – 2016:3. This nonlinear methodology captures the fiscal effects across periods of high and low growth. In more deep analysis, we examine the relationship of expenditures and GDP over time, by adopting the GARCH(1,1)-DCC methodology. Our results show that the magnitude of general government expenditures is larger during periods of low growth or economic recession, as well as the magnitude of tax income revenues. Furthermore, during the "bailout" period (2010-2016) when the fiscal adjustment was strict, GDP seem to be even stronger negatively affected by the reduction of government expenditures.
Keywords. Fiscal policy impact, regime switching, GARCH-DCC, Greek economy.
JEL. E61, E62, H21.

1. Introduction

The impact of fiscal policy on the economic activity is an issue that has concerned academics, economists and policy makers for almost a century. Especially, after the outbreak of the global financial crisis of 2008 and the European debt crisis of 2010 this issue was raised again but still as debatable issue. The impact of fiscal policy on the GDP was attempted to be measured already from 1930s.[1] Nevertheless, there is no wide agreement whether indeed the increase in public spending and/or the tax relaxation positively affect the GDP and vice versa (fiscal consolidation reduces growth or, even worse, results to recession).

Economic theory has three mainstream but contradictory explanations for the relation between fiscal policy and economic activity. Firstly, the Keynesian view supports that as long as the economy is not at the state of full employment, the fiscal expansion with the increase of government expenditures and/or the tax relaxation (reduction of tax ratios, shrinkage of tax base etc.) has real positive effects on economic activity.[2] Contrary to the Keynesian view, the neoclassical view supports that the increase of government spending cause an interest rates increase and therefore discourage private investments (crowding out effect). Thus, the impact of fiscal stimuli on the GDP is negative due to the reduction of private investments (Spencer & Yohe, 1970; Beenstock, 1980). Last, but not least, the Ricardian view, elaborated by Barro (1974; 1989; 1996), considers fiscal stimulus, either through government spending or tax relaxation as neutral to the economic activity, since current government deficits create future tax obligations. Hence, the

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taxpayers prudently avoid current consumption in order to save money for the payment of future tax obligations. The result is that the aggregate demand stays unaffected.

Empirically there is a vast amount of literature trying to identify the impact of fiscal expansion or consolidation to the economic activity, with mixed results. However recently there is a strand of literature, which underlines that the size of the magnitude of the fiscal policy depends on the state of the economy. In other words there are strong asymmetries and therefore the magnitude is larger during economic recessions and milder or even negligible during economic expansions (see for example: Auerbach & Gorodnichenko, 2011, 2012; Baum *et al.,* 2012; Arin *et. al.,* 2015; Perroti, 2002; Ramey, 2011 and Suárez *et al.,* 2016).

In this study, we use a multiple regime framework first suggested by Hamilton (1989) to explore the effects of fiscal policy on the Greek GDP. Greece is a striking example of developed economy that faced a sharp decrease of GDP and increase of unemployment during a program of fiscal adjustment.[3] Hence, it is rather intriguing to explore if this deterioration is attributed to the fiscal consolidation and if the recession path that the Greek economy followed further increase the magnitude of the effects of the fiscal policy, driving to a downward spiral. More specific, we estimate a model containing the general government expenditures and the tax income revenues within a nonlinear Markov-switching framework. This procedure allows us to estimate the magnitude of fiscal policy impact during periods of economic expansion and economic recession. In more deep analysis, we empirically investigate the time-varying relationship between GDP and general government expenditures by adopting a GARCH(1,1)-DCC model. Furthermore, the empirical findings provide important implications for fiscal policy when a country is in a bailout program.

Our results show that the magnitude of general government expenditures is larger during periods of low growth, as well as the magnitude of tax income revenues. Furthermore, during "bailout" periods the government expenditures reduction, which accompanies the fiscal adjustment, seems to cause a harsh deterioration of economic activity by decreasing the GDP and increase the unemployment. Additionally, these results provide a significant impact on the national policy mix, focusing on spending and taxation. The rest of the paper is structured as follows. In section two, the econometric methodology is stated, while in section three, we describe the data. The empirical results are discussed in section four, while some concluding comments are provided in the last section.

2. Methodology framework

We propose an alternative way to detect the dynamics between lagged fiscal policy and economic growth. The model applied in this study proposed by Hamilton (1989) is designed to allow for shifts in the mean, for periods of high economic growth and low economic growth, and is specified as follows:

$$y_t = \mu(s_t) + \beta_1(s_t)x_{t-1} + \beta_2(s_t)z_{t-1} + \beta_3(s_t)spread_{t-1} + \sigma(s_t)\varepsilon_t \qquad (1)$$

$$\mu(s_t) = \sum_{i=1}^{2} \mu^{(i)} 1\{s_t = i\}, \quad \sigma(s_t) = \sum_{i=1}^{2} \sigma^{(i)} 1\{s_t = i\}, \ (t \in \mathrm{T})$$

Where y_t = growth rate of real GDP, seasonally adjusted, x_t = growth rate of real total general government (GG) expenditures, seasonally adjusted, z_t = growth rate of tax income revenues, seasonally adjusted and the squared spread between the long (10 years government bond yield) and short term (3 months treasury bill rate) interest rates (seasonally unadjusted).[4] In addition, ε_t are i.i.d. errors and s_t are independent variables that indicate the unobserved state of the system at time *t.* Furthermore, ε_t and s_t are considered independent and that independence implies that regime changes takes place independently of the past history of y_t. Since s_t is unobserved, estimation of Eq. (1) requires restrictions on the probability process governing s_t. Given that s_t follows a first-order, homogenous, two-state Markov chain, any persistence in the state is completely considered by the value of the state of the previous period. Thus, the regime indicators $\{s_t\}$ are assumed to form a Markov chain on $\otimes=\{1,2\}$ with transition probability matrix $P'=[p_{ij}]_{2x2}$, where

$$p_{ij}=\Pr(s_t=j|\,s_{t-1}=i),\ \ i,j\in\otimes, \tag{2}$$

and $p_{i1}=1-p_{i2}\quad(i\in\otimes)$, which indicate that each column sums to unity and all elements are non-negative. Since these regime changes are governed by the probability law, are flexible enough to allow for a wide variety of different shifts (i.e., depending on the values of the transition probabilities).[5]

The main scope of this study is to investigate the extent to which fiscal policy instruments associated with low-high phase growth rates. Therefore, the terms $\beta_1=(\beta_1^{Low},\beta_1^{high})$ and $\beta_2=(\beta_2^{Low},\beta_2^{high})$ measure the impact of change in real government output, in real general government expenditures and in real tax income revenues, respectively.

Furthermore, we extend our research by investigate the impact of fiscal policy during Greek bailout programs. To do so, we create a "bailout" dummy, which is equal to unity for the Greek bailout period and zero otherwise, to the following OLS equation:

$$y_t=c_0+c_1x_{t-1}D_{bailout}+c_2z_{t-1}D_{bailout}+\varepsilon_t \tag{3}$$

Where c_0 is the constant term and $D_{bailout}$ the "bailout" dummy. The "bailout" dummy is specified by historical events that officially endorsed the bailout condition of Greek economy. More analytically, at May the 2nd of 2010 the IMF, together with the 15 eurozone countries agreed with the Greek government for a bailout package for 110 billion euros over 3 years. Since that day, two more bailout packages are agreed with the third package to be still in progress. Thus, the dummy variable spans from 2010Q3 until the end of our sample (i.e. 2016Q3).

The final part of our study focus on the GDP growth and GG expenditures growth relationship, by using the multivariate dynamic conditional correlation (DCC, thereafter) model proposed by Engle (2002). The DCC model is specified as follows:

$$H_t=D_tCorr_tD_t \tag{4}$$

Where $D_t=diag(h_{11t}^{1/2}....h_{NNt}^{1/2})$, The estimates of time varying standard deviations are obtained from univariate GARCH(1,1) models with $\sqrt{h_{ii,t}}$ on the I th diagonal. The $Corr_t$ is an $n\times n$ time-varying correlation matrix. In our case, the elements of D_t are generated by the following simple univariate GARCH(1,1) process:

$$h_{i,t}=\omega_i+a_iu_{i,t-1}^2+\beta_ih_{i,t-1} \tag{5}$$

where ω_i is the constant term, a_i captures the ARCH effect and β_i measures the persistence of volatility[6]. The evolution of correlation in the DCC specification is given by the following equation:

$$Q_t = (1-\alpha-\beta)\overline{Q} + \alpha u_{t-1}u_{t-1}^{'} + \beta Q_{t-1} \quad (6)$$

Where $Q_t=(q_{ij,t})$ is the $n \times n$ time-varying covariance matrix of residuals, $\overline{Q} = E[u_t u_t^{'}]$ is the $n \times n$ time-invariant variance matrix of u_t, while a and β are nonnegative scalar parameters satisfying $a+\beta<1$. Because Q_t does not have unit elements on the diagonal, the correlation matrix $Corr_t$ is obtained by scaling it as follows:

$$Corr_t = (diag(Q_t))^{-1/2} Q_t (diag(Q_t))^{-1/2} \quad (7)$$

A typical element of $Corr_t$ has the form:

$$\rho_{ij,t} = q_{ij,t}\sqrt{q_{ii,t}q_{jj,t}}\ ,\ i, j = 1,2,\ldots,n, \text{ and } i \neq j \quad (8)$$

Therefore, the correlation coefficient at time t is defined as follows:

$$\rho_{ij,t} = \frac{(1-\alpha-\beta)\overline{q_{ij}} + au_{i,t-1}u_{j,t-1} + \beta q_{ij,t-1}}{\sqrt{(1-\alpha-\beta)\overline{q_{ij}} + au_{i,t-1}^2 + \beta q_{i,t-1}}\sqrt{(1-\alpha-\beta)\overline{q_{jj}} + au_{j,t-1}^2 + \beta q_{j,t-1}}} \quad (9)$$

The correlation coefficients are a key importance in this study, since they provide important information on the behavior of the GDP and GG expenditures series over time.

3. Data and preliminary analysis

The dataset used in the present study consisted by four variables concerning the Greek economy: The GDP, the General Government Expenditures, the Tax Income Revenues and the spread between the interest rates of the 10 years Greek Government bond and the 3 months treasury bill rate, as a control variable. The GDP, GG expenditures and tax income revenues series are in quarterly basis, unadjusted and in million Euro, while the spread is in percentage (of the difference between long and short term interest rates). All series are sourced from Eurostat database during the period from 1999Q1 until 2016Q3, leading to a sample of 71 observations. The aforementioned variables (except from interest rate) are converted in real term by dividing with the GDP deflator index (also sourced from Eurostat, non-seasonally adjusted) and then transformed into seasonally adjusted series by applying the U.S. Census X13 methodology.[7] The GDP, GG expenditures and tax income revenues are expressed quarterly compounded growth rates, which essentially combine the logarithmic and differencing transformations, as follows: $p_t = \ln\left(\frac{p_t}{p_{t-4}}\right)$, where p_t is the value of the under examination variable at time t.

Summary statistics for the growth rates and squared spreads are displayed in Table 1. All series, except from spread, are skewed to the right, while the expenditures and spreads exhibit excess kurtosis, supporting strong asymmetrical effects, thus a model such as the Markov Switching Regimes seems appropriate (Hamilton, 1989). Furthermore, the Jarque-Bera statistic rejects normality at 1% level for all time series, except for tax income revenues.

Table 1. *Descriptive Statistics and KPSS Tests.*

	GDP (*y*)	Expend. (*x*)	Tax Inc. Rev. (*z*)	Spreadqr. (*spread*)
Mean	0.0008	0.0070	0.0027	0.0066
Median	0.0071	0.0320	0.0043	0.0005
Maximum	0.0673	0.0952	0.2374	0.0610
Minimum	-0.0111	-0.2046	-0.3050	2.29E-08
Std. Dev.	0.0489	0.0703	0.1206	0.0128
Skewness	-0.7281	-1.1360	-0.3429	2.9671
Kurtosis	2.5071	3.5067	2.8685	11.744
Jarque-Bera	6.5978**	15.1294***	1.3619	311.803***
Probability	0.0369	0.0005	0.5061	0.000
KPSS test statistic	2.0589***	0.5889***	0.1958**	0.3697***

Notes: The GDP, expenditures and tax income revenues are expressed in q-o-q compounded growth rates, while the interest rate is expressed as percentage. For the KPSS test, lag length is specified via Schwarz information criterion, using the GLS (detrended AR) spectral estimation methodology. The critical values at 1%, 5% and 10% significant levels are 0.216, 0.146 and 0.119. The test has conducted with both intercept and trend as exogenous variables.
, * denote significance at 5% and 10% level, respectively.

Finally, KPSS tests for the presence of unit roots can convincingly be rejected for all variables, indicating their suitability for methodologies such as Markov switching regime regressions (MSR, thereafter). Overall, these results support that MSR is an appropriate specification to capture asymmetries and transition probabilities (the probability of staying in each of the two regimes, low economic activity and high economic activity).

Figure 1illustrates the evolution of GDP growth, expenditures growth, tax income revenues growth rates and the squared spread between the 3-month T-Bill rate and 10-year government bond during the period from 1999Q1until 2016Q3. The figure shows significantly higher volatility after 2010, supporting the different behavior of the series during turmoil periods. This characteristic supports the use of MSR model to analyze the different behavior of the series during "good" times and "bad" times.

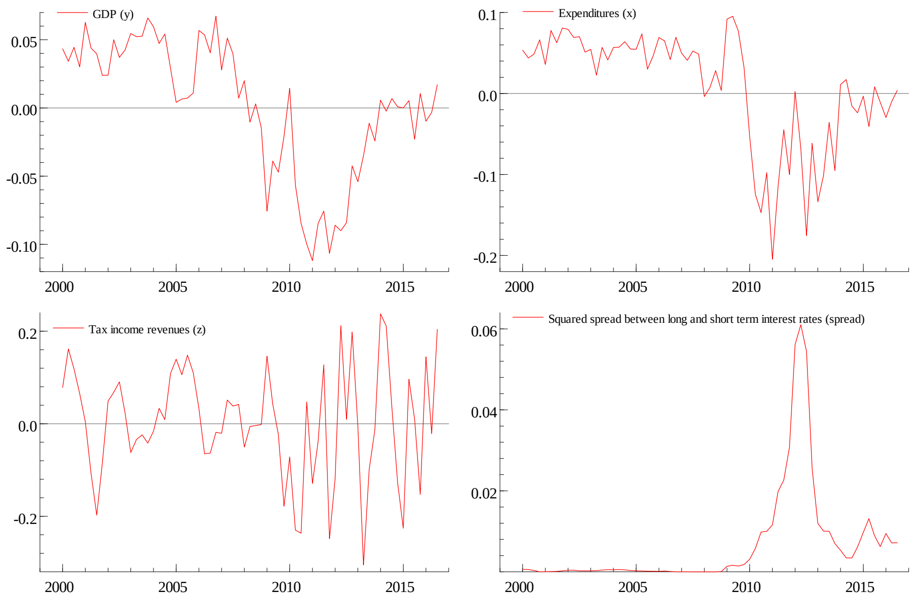

Figure 1. *The Growth Rate Path of GDP (y), Expenditures (x), Tax Income Revenues (z) and Squared Spread Between Long and Short Interest Rates over Time (spread).*

4. Empirical results

4.1. Fiscal policy impact during recession times and expansion times

We proceed with the estimation results of the MSR. Estimation results are presented on Table 2. The results are based to Eq. (1) mentioned in the methodology subsection. Two main hypotheses are empirically investigated: the effect of policy instruments in periods of *i*) low growth ($\beta_1^{low}=0$, $\beta_2^{low}=0$) and *ii*) high growth ($\beta_1^{high}=0$, $\beta_2^{high}=0$). As documented in Table 2, the coefficient (β_1) estimated as 0.3204 for periods of low growth and 0.2994 for periods of high growth. Respectively on the tax income revenues side (β2) the estimated coefficients are smaller for periods of low growth compared to the periods of high growth, since during "bad" times the coefficient is -0.1325 while at "good" times is-0.039. These results indicate that both general government spending and tax income revenues significantly affect the Greek GDP; The positive sign of the general government spending coefficient and the negative sign of the tax income revenues coefficient implies positive and negative relation to the Greek GDP respectively. As far as the state of the economy (the regime) is concerned, the impact is stronger during episodes of low growth than for episodes of high growth.

The above results is in line with the literature that finds large asymmetries in the impact of fiscal policy in recessions and expansions (Auerbach & Gorodnichenko, 2011, 2012; Baum *et al.,* 2012; Arin *et al.,* 2015; Suárez *et al.,* 2016). As far as the fiscal policy mix is concerned, our results indicate that the effect of government expenditures on GDP is stronger than the effect of revenues (i.e. mainly tax income revenues). It is obvious that the selection of the "right tool" at the "right time" for counter the fiscal shocks is crucial. According to our results an important policy implication is that during fiscal consolidation when a fiscal adjustment is necessary may be preferable for the Greek Government to give emphasis more to the increase of tax income revenues than of the decrease of government expenditures. The reduction of government expenditures may harm the economic activity more severely than the increase of taxation and counterbalance any positive effect on the public debt to GDP ratio.

Table 2. *Estimation Results of Markov Switching Regression.*

Low growth rate			*High growth rate*		
	Parameters	z-stat.		Parameters	z-stat.
μ^{low}	-0.049***	-6.527	μ^{high}	0.018***	4.295
β_1^{low}	0.320***	4.440	β_1^{high}	0.2994***	3.819
β_2^{low}	-0.132**	-2.517	β_2^{high}	-0.039***	-1.382
β_3^{low}	-0.985**	-2.553	β_3^{high}	-0.938**	-2.395
$Log(\sigma)^{common}$	-3.961***	-40.88			
$p_{11}-\mu^{low}$	-2.461**	-2.442	$p_{21}-\mu^{high}$	4.073***	3.593
		Diagnostic test statistics			
Q (1)		[0.020]	*Log Lik*	*159.775*	
Q^2 *(1)*		[0.402]			
Jarque-Bera		[0.304]			
		Constant Markov transition probabilities			
Low gr. - P_{11}	0.983				
High gr. - P_{22}	0.921				
		Constant expected durations			
Low growth	59.777				
High growth	12.716				

Notes: The likelihood optimized by the BFGS algorithm, using Marquardt steps. The initial probabilities obtained from ergodic solutions and standard errors (not reported here) and covariance computed using Hessian information matrix. The convergence achieved after ten iterations; Q(1) and $Q^2(1)$ are respectively the Ljung-Box test of significance of autocorrelations of one lag in the standardized and standardized square residuals; **, *** denote significance at 5% and 10% level, respectively. Numbers in brackets are p-values.

Furthermore, Table 2 presents also the estimation results of transition probability matrix. There is considerable state dependence in the transition probabilities with a relatively higher probability of remaining in the origin regime (i.e., 0.921 for the high output state, 0.983 for the low output state). In addition, the corresponding expected durations in the regime are approximately 59.777 and 12.716 quarters, respectively. As far as the stability of the model is considered, diagnostics test for autocorrelation and normality indicate only some signs of autocorrelation to standardized residuals (for 5% significance level), supporting the overall stability of the model.

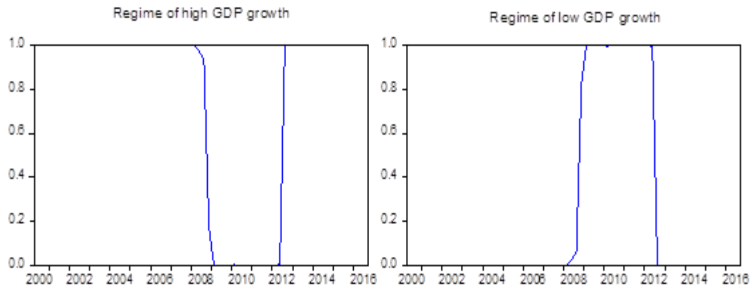

Figure 2. *Markov Switching Smoothed Probability of Being in Low GDP Growth*

Lastly, we display the smoothed probability of the two identified regimes (see Figure 2) according to our Markov switching regime approach. The regime of low growth, which ranges from the beginning of 2008 until the second semester of 2012 and the regime of high growth, which ranges from 2000 to 2008 and from 2012 to 2016. Thus, model captures the ever economic downturn of the Greek economy that started after the breakout of the global financial crisis of 2008 and peaked at 2012 where the Greek economy was almost one step before default.

4.2. Fiscal multipliers' behavior during "bailout" times

We next provide further results on the behavior of fiscal multipliers during the Greek bailout period. Table 3 presents the results of Eq. (3). The estimates of coefficients are statistically significant general government expenditures but not statistically significant for the tax income revenues term (c_2). However, the impact of general government expenditures to the Greek output is different, in relation to MSR model. Throughout the whole period of our sample the coefficient of GG expenditures (c_1) is 0.6601, which is almost double than the MSR finding for the "bad" times period (i.e., 0.3489).This finding further supports the aforementioned implications for the fiscal policy mix supports that during "bailout" times the role of government expenditures as a stabilization tool is essential for the Greek economy. Thus, fiscal decisions about cutting public expenditures must be cautious, since the GDP may be strongly negatively affected. Moreover, during "bailout" times the tax income revenues coefficient is not statistically significant indicating its secondary part for a reliable rebound of the Greek economy.

Table 3. *Results OLS estimation During Greek Bailout Period.*

	Parameters	t-stat.
c_0	0.0160*	1.889
c_1	0.6601**	5.953
c_2	-0.0255	-0.732
Diagnostic tests for statistics		
Heteroskedasticity test: Breusch-Pagan-Godfrey		
F-stat.	0.199	
Prob. F(2,63)	[0.819]	
Autocorrelation test: Ljung-Box		
Q(1) statistic	19.721***	
Prob.	[0.000]	
$Q^2(1)$ statistic	1.940	
Prob.	[0.163]	
Normality test:Jarque-Bera		
Jarque-Bera	6.6627**	
Prob.	[0.035]	

Notes: The results are based on Eq. (3) in the text. Diagnostic tests are reported that show the stability and robustness of the model. The OLS model passes the autocorrelation test for standardized squared residuals, Breusch–Pagan–Godfrey heteroskedasticity test and Jarque-Bera normality test. For the OLS estimation the diagnostic test statistics indicate no many evidence of heteroscedasticity, autocorrelation and non-normality.

Finally, diagnostic tests (see Table 3), as well as the recursive estimations using CUSUM test on standardized residuals (see Figure 3) show that the parameters remain stable over time.

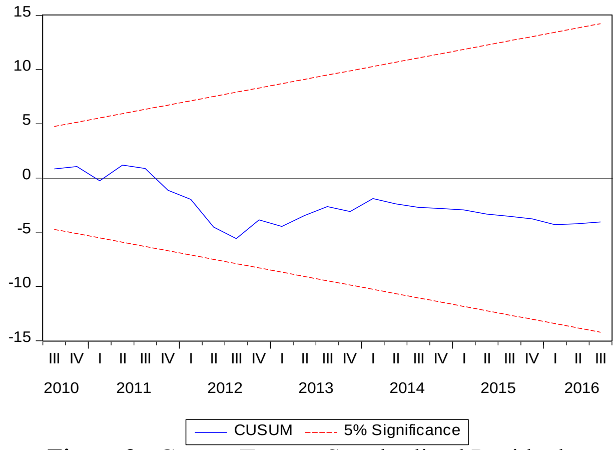

Figure 3. *Cusum Test on Standardized Residuals.*

4.3. The dynamic relationship between GDP and expenditures

Since the tax income revenues during the "bailout" times are not significant according to the previous subsection, we focus mainly on the relationship of GDP (y) and expenditures (x) over time.

The estimation results of the bi-variate GARCH(1,1)-DCC model are stated in Table 4. According to Panel A of Table 4, the ARCH and GARCH parameters are statistically significant, non-negative and their sum is below unity, justifying the stability and robustness of the GARCH(1,1) specification. The fact that the sums of the estimated ARCH and GARCH coefficients ($\alpha+\beta$) are close to unity, implies that the volatility exhibits a high degree of persistence.

During the DCCs estimations, presented in Panel B of Table 4, alpha and beta parameters are statistically significant, supporting the appropriateness of the GARCH(1,1)-DCC model. The evolution of the estimated conditional correlation dynamics are plotted in Figure 3. The DCCs display fluctuations over the entire sample period, suggesting that the assumptions of constant correlations are not appropriate.

Table 4. *Bivariate GARCH(1,1)-DCC Estimation Results.*

Panel A: GARCH(1,1)	GDP(y)	Expenditures (x)
Constant (mean)	0.0326***	0.0487***
z-stat.	3.571	7.589
ω (variance)	0.0001	0.0001
z-stat.	1.173	1.334
ARCH (α)	0.5543***	0.5597***
z-stat.	3.409	2.561
GARCH (β)	0.4069***	0.4453**
z-stat.	2.996	2.036
Panel B: DCC estimates		
constant	0.4985***	
z-stat.	3.130	
Alpha	0.2372***	
z-stat.	2.872	
Beta	0.7386***	
z-stat.	7.872	
Loglik.	243.779	

Notes: To accommodate the presence of "fat tails", we use the quasi-maximum likelihood method of Bollerslev & Wooldridge (1992) to generate consistent standard errors that are robust to non-normality. Standard errors (not reported) are calculated using the quasi-ML method of Bollerslev & Wooldridge (1992), which is robust to the distribution of the underlying residuals.

In order to model the level shift of DCCs during the memoranda period of Greece, we include the "bailout" dummy variable (i.e., $D_{bailout}$) in the following OLS equation:

$$DCC_t = c_0 + c_1 D_{bailout} + \varepsilon_t \quad (10)$$

As the model implies, the statistical significance of the estimated dummy coefficient (c_1) indicates that structural changes occurred in DCCs (Dynamic Conditional Correlations) due to memoranda. A positive and statistically significant dummy coefficient indicates that the correlation has increased compared to that of the control period, supporting the rising magnitude of expenditures' effect on GDP and vice versa. On the other hand, a statistical non-significant dummy coefficient indicates that the relationship among GDP and expenditures stays unaffected.

Specifically, Table 5 reports the estimating results using the "bailout" dummy variable. The c_1 term is highly positive and statistically significant, indicating that the correlation is statistically different from the previous period (i.e., stable). This finding supporting a structural change due to memoranda (i.e., the Greek bailout period). Thus, the impact of the Greek "bailout" leads to higher correlations among GPD and GG expenditures.

Table 5. *Test of Changes In Dynamic Correlations Using OLS.*

	Parameters	t-stat.
c_0	0.1691***	5.337
c_1	0.7840***	11.742

Notes: Estimates are based on Eq. (9) in the text. The c_1 term indicates the correlation path after the Greek memoranda.

The above finding is consistent with the DCC paths shown in Figure 4. The two variables exhibit increasing co-movement from the beginning of 2010 until the end of our sample, indicating that their dependence is larger in turmoil than stable periods. This outcome has some similarities with Paren et al. (2015), who found that the magnitude of government spending on the GDP is larger during periods of low economic activity.

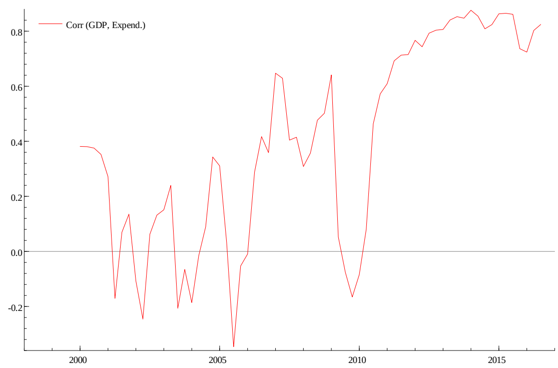

Figure 4. *Dynamic Conditional Correlation Behavior over Time.*

5. Concluding remarks

This paper examined the impact of fiscal policy and particular the impact of general government expenditures and tax income revenues to the Greek output, during "good", "bad" and "bailout" times. The empirical results show that changes of both general government expenditures and tax income revenues are affecting the GDP; the expenditures positive and the revenues negative. Moreover the magnitude of both the GG expenditures and tax income revenues is larger during times of low growth ("bad" times) and smaller during periods of high growth ("good" times), providing strong evidence of asymmetry. However, the magnitude of GG expenditures, measured by its coefficient, is higher than that of the tax income revenues. The aforementioned result may have implications for the Greek fiscal policy mix during a fiscal adjustment. If a fiscal adjustment is necessary or/and is imposed it may be preferable for the Greek government to give emphasis on the revenue side, thus the negative effects on the output may be milder than that of a large cut of public expenditures.

Additionally during the "bailout" times, our empirical findings further supports the crucial role of expenditures as stabilization tool, since its magnitude almost doubled, in relation to "bad" times. Specifically, based on an advanced GARCH(1,1)-DCC model, the estimated dynamic conditional correlation showed an statistically significant increase of correlation between GG expenditures and output from the beginning of 2010, until 2016. This result suggests that during "bailout" times the co-movement of expenditures and GDP is very high. Therefore, it is wiser for policy makers to avoid severe expenditure cuts during fiscal adjustment since this may hurt strongly the economic activity and deteriorates, among others, the public debt to GDP ratio.

Notes

[1] The first who attempted to quantify the effect of fiscal policy to the economic activity was J.M.Keyne's student, Richard Kahn (Kahn, 1931).

[2] See among many others Arestis & Sawyer (2013).

[3] The accumulative loss of real GDP from 2010 to 2016 was about 41.5 billion euros (approximately 25% of the GDP) and the unemployment skyrocket from 12.7% to 27.5% during the aforementioned period.

[4] We added the spread (squared) between long term and short-term interest rates as an indicator of economic conditions (i.e., economic cycle). Thus, a narrow or even a negative difference between long term and short-term interest rates implies a high possibility for a pending economic recession. On the other hand a wide gap of these two rates may indicate a serious possibility of a default thus the investors avoid long term commitments (10 year government bonds) and prefer short term financial instruments (3 month T-Bill rate). The rationale for including the square of the spread variable is that the output may be affected only when a certain spread level is exceeded (Pappas & Seremetis 2013). We also explore the sensitivity of the results to the inclusion of variables aiming to control for underlying financial and fiscal conditions to check for robustness. Thus we add various other indicators according to previous literature (i.e., Barro & Redlick; 2011), such as squared government bond yields, short-term interest rate and debt-to-GDP ratio. However, these results (not reported) indicate that changes to our results due to different economic and monetary indicator are rather small and not significant.

[5] For example, when a value of p_{ii} is very close to unity imply that structural parameters are not subject to frequent changes and vice versa.

[6] The mean equation contains only the constant and error terms.

[7] See U.S. Department of Commerce, Bureau of Census.

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