Spring 5-22-2015

The curious case of Greece: The impact of fiscal policy shocks on key macroeconomic variables. A VAR based approach.

Manny Kaliontzakis
University of San Francisco, manny.kalio@gmail.com

The curious case of Greece: The impact of fiscal policy shocks on key macroeconomic variables.

A VAR based approach.

University of San Francisco
Masters of Science in International and
Development Economics
Department of Economics
2130 Fulton Street,
San Francisco, CA 94117

Master's Thesis by

Manny Kaliontzakis
MSc International and Development Economics
Candidate 2015

Contents

Abstract

For years, the Vector Autoregressive approach has been the main tool for monetary economics and macroeconomic researchers around the world. Leading central banking figures, academics, and modern economic think tanks have used the approach to determine the effects of interest rate shocks on basic macroeconomic variables such as GDP, industrial production and unemployment rate. Shocking policy variables, such as interest rates or long term bond rates have given economists the ability to run reliable forecasts. The last 20 years have seen a turn in the use of the VAR approach on fiscal policy as well. Even though, in general, previous work has shown the ineffectiveness of fiscal policy towards controlling or affecting main macro variables, the following paper will analyze how fiscal policy shocks can indeed change essential macroeconomic variables using the VAR method. The country in focus is Greece, whose economy has been hampered and tormented by a deep debt crisis and subsequent strict austerity measures. The absence of independent, sovereign monetary policy after the replacement of the drachma with the Euro on January 1st 2002 has left the Greek government powerless with fiscal policy as its only weapon to get out of its long recession. The following sections of this paper will show how a shock in the country's government spending has the desired Neo-Keynesian effects, but only in the very short term. Interestingly, an unexpected increase in tax revenue has the most profound long term effect in decreasing the country's unemployment rate while giving a long term, permanent push on exports. Increasing efficiency in tax collection and not necessarily tax rates, can be a major catalyst for Greece, a country with chronic tax evasion and tax avoidance issues. [1]

[1] I am grateful to University of San Francisco professor Sunny Wong for being an excellent advisor and dynamic collaborator. I am also thankful to assistant professor Michael Jonas for his insightful advice and instruction in the field of time series econometrics and Vector Auto-Regression forecasting. Many thanks to all the staff and faculty of the University of San Francisco that have been instrumental to the development of this research project. A special mention to all the anonymous referees that helped me bring this paper to fruition.

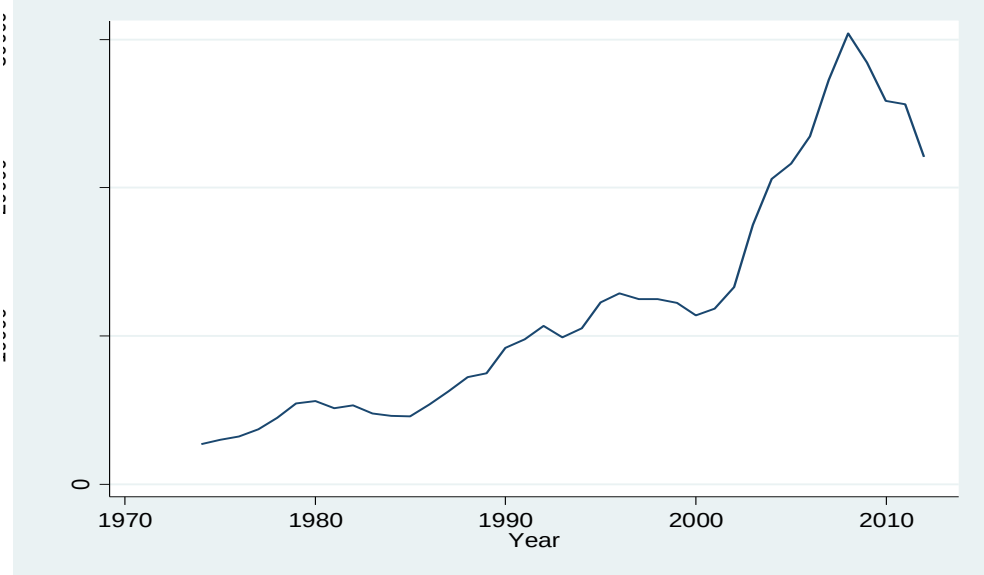
2. Non-technical summary and brief historical outline

Greece has never been a country that impressed economists and other financial experts. As a country not a protagonist in industrial production amongst European counterparts, Greece has become a spending sovereign entity which after the single currency was introduced, witnessed its public debt skyrocket to non-serviceable levels. But why did it really come to this? Who is responsible for this acute sovereign debt and how can the country exit this fiscal slump and regain its confidence and potentially start growing again?

The years following military rule after 1974 have been years of growth for the country. Investor confidence was on a high as democracy returned to the country that founded it. Traditional sectors of the economy, such as shipping and tourism, created jobs and wealth. Foreign direct investment, which was a relatively new concept for the country, became a reality as American and European multinationals entered the country in anticipation for brand recognition in a very promising environment. Landmark deals such as the country's membership with the European Economic Community (predecessor to the EU) during the summer of 1975 meant that trade deals became less bureaucratic. Greece saw steady progress in terms of growth and was able to maintain a strong position with a viable and "hard" currency in the drachma.

The graph below shows the steady increase of Greece's GDP up to the turn of the new century. The Maastricht treaty of 1992[2] opened a new perspective for European countries since the foundations of a common European currency were instituted and the dream of one single currency would start to shape. In Maastricht, the Community received the baptism of fire in order to become the Union that we know of today. Countries members of the European Economic Community agreed on the terms of entry into the European Monetary Union which constituted three stages, the last of which would of course be official use of the new common currency. The three basic convergence criteria that Maastricht dictated to the countries submitting candidacy for the single currency were outlined on article 121 of the treaty; Low inflation rates that do not exceed 1.5 percentage points over the average of the best three performing nations in the Union, annual government deficits that do not exceed 3% of the country's GDP and serviceable, sustainable national debt which is not to exceed 60% of the candidate country's GDP.

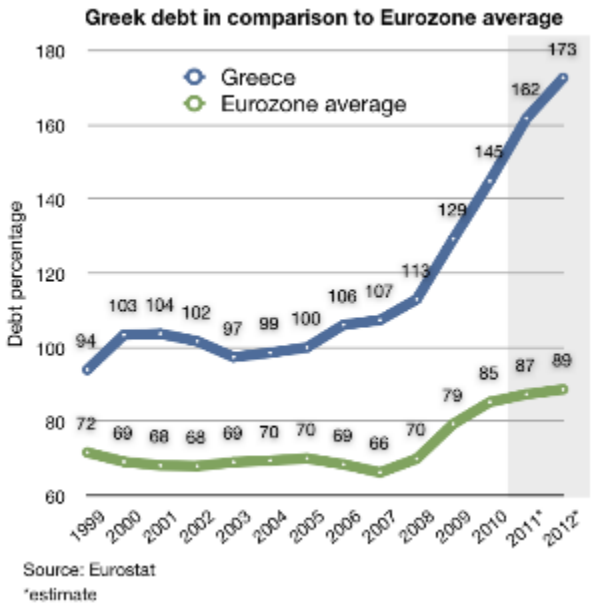
[2] A full version of the Maastricht treaty is available and can be found at *www.euro**treaties**.com/**maastricht**ec.pdf*



Graph1: Greece's GDP has experienced unprecedented growth since the mid 70's.The ongoing recession is the worst in its modern history. Data: World Bank, Analytics: Stata.

The idea of a single currency was to promote openness and solidify trade and economic relationships amongst members of the union. Jacques Delors, the emblematic French politician who served as a president of the European Commission between 1985 and 1994, saw a vision of Europe that would in many ways emulate the United States of America. In his vision, Europe was to become, in the long term, a sustainable and strong federation that would have a common fiscal policy, along with the common currency with a super central bank that would in many ways resemble the Federal Reserve. Monetary union was only a small piece of the puzzle he was trying to build. Delors and other prominent European visionaries were open about their federalist ideas, even though they knew that huge cultural differences in addition to resistance from many governments to surrender a big part of their national sovereignty would create enormous obstacles in their quest for a unified economy and society.

Fear of extreme political cost and revolt from the local governments were the main reasons behind abandoning their ambitious federalist plans. The institution of a monetary Union, without a central government that would be able to control individual member state budgets, was bound to reveal serious problems in the long term. The lack of a central fiscal mechanism and the independent decision making of individual national parliaments, led to unbalanced budgets, excess spending and ballooning of national debt. Countries like Greece, Italy, Portugal, and even France are all in the triple digit debt to GDP ratio with both Italy and Greece at 132.6% of GDP (2013) and 175.1% of GDP (2013) respectively. The graph below indicates the severity of the situation for Greece; as a nation with low industrial production, these levels of debt are non serviceable and unsustainable.



Graph 2: Borrowing beyond its means: Comparing Greece's Debt to a European average

The country was declared in a state of financial emergency during the first months of 2010. Fiscal irregularities and extreme borrowing have put the country under tight supervision by a task force put together by the IMF, the European Commission, and the ECB. This trifecta of organizations has been given the hard task of cleaning house in Greece by implementing strict guidelines regarding fiscal consolidation, rapid privatizations and massive curtailing of government spending mainly through layoffs or long terms suspensions. Greeks have labeled the team of financial technocrats as the Troika. The level of austerity that has been imposed over the last 4 years has lead to a long, unsustainable recession during which unemployment has risen to an all time high level of 25.8% in 2014. The astonishing number involves the country's hopeless youth. A stunning 50.6% of the eligible to work population under 25 years of age is unemployed*[1].

There is genuine belief that Greece has historically been suffering through a lack of foreign investment and foreign capital. Certain industries in the country have been thriving, such as tourism and shipping, but the reality is that the reasons are not explained through economics of growth and fiscal prudence but through geographical location. Greece is enjoying a lofty position on the Southeastern corner of the European continent. It has access to a huge number of coastal kilometers which has provided the country a huge advantage in the maritime industry. Shipping is one of Greece's biggest industries. It accounts for

almost 4.5% of GDP while the Hellenic Merchant Marine has under its control almost 16.2% of the world's merchant fleet. An outstanding number for a country of roughly 11 million people.

There is a similar dominance in tourism and hospitality. Greece attracted over 22 million tourists in 2014 which was a staggering 18% of the country's GDP. Despite this niche and dominance in these two very important sectors, the country's central government is struggling to raise cash in order to comply with its fiscal responsibilities and service its outrageous amounts of foreign debt (See graph 2). The lack of significant heavy industry has created a service based economy that is ranked one of the last in exporting activity among the initial members of the Euro-zone. This lack of industry and private sector initiative, along with Greece's traditional ties to labor unions and socialist economic values have over the years expanded the public sector to unsustainable levels. To give a perspective of this situation, the state payroll was at 913,000 workers at the end of 2009 or 12% of the population. These huge numbers are injecting massive amounts of bureaucracy and red tape in the economy. It has become increasingly difficult for foreign entities to break the monopoly of State Owned Enterprises (SOE) while foreign businesses were deterred from investing in the country.

The "Troika" imposed austerity measures have created an environment of economic depression, unemployment, and severe wage cuts. In a recent report on November 30th, 2013, the ministry of administrative reform announced that state employees were at 681,392, reduced by almost 230,000 from four years prior.

2.1 Data

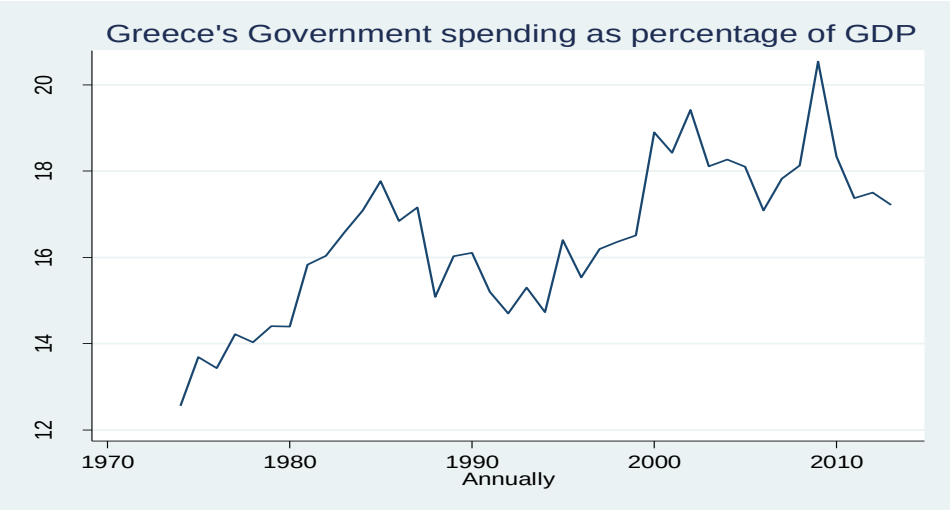
The purpose of this paper is to examine the effects of severe changes in tax collection and government spending on macroeconomic variables that are traditional highlighters of the overall health of an economy. The paper focuses on Greece's foreign sources of revenue with the spotlight being on Exports of goods and services converted in logarithmic form. We use a baseline structural VAR approach by defining our fiscal variables as government spending as a percentage of GDP and total tax revenue. This paper also examines the effect of the above fiscal variable shocks on more "generic" macroeconomic variables such as the annual unemployment rate, GDP per capita, and private final consumption per capita. GDP figures are net and deflated by the GDP deflator.

Graph3: Greece's Tax Revenue as percentage of GDP since the mid 70's.The country is experiencing a stagnation in tax revenue at the turn of the century. Data: World Bank, Analytics: Stata.

The data analyzed range from 1974 to 2014. The frequency of the data is annual and it is drawn from the European Commission's annual macroeconomic database (AMECO). Unemployment data is drawn from the IMF database as well as from the world development indicators of the World Bank. Total tax revenue data is drawn from the OECD (Organization of Economic Cooperation and Development) database. All figures demonstrated in the data are in Euros and in current market prices.

There is the traditional objection to using a VAR to examine the effects of fiscal or monetary policy shocks via annual data. VAR is much more effective as an empirical method if the observations are more frequent and large in number. It would be ideal if the data used in this paper were expressed on a quarterly basis. Unfortunately, one can easily notice the lack of reliability in the data when it comes sto Greece's fiscal figures, as well as the existence of frequently revised data. That is exactly why empirical studies involving Greece are scarce, which indicates the degree of difficulty in constructing appropriate arguments in this paper. There is a strong belief that the lack of quarterly data might not prove to be as critical as initially feared. The main reason for this is that Greece is a country that is very inelastic in terms of tax reforms and government expenditures. It has the strongest collective bargaining agreements in Europe where government employees are life serving and their status is protected by the constitution[3] . Also, private sector labor unions, in addition to red tape and government bureaucracy, do not allow organic growth of businesses and startups, which has created a negative business landscape. Major business change happens primarily after there is a shift of power in government during national elections.

[3] Article 103, Paragraph 4 of the Constitution of the Hellenic Republic



Graph 4: Greece's Government Spending as percentage of GDP since the mid 70's. Data: World Bank, Analytics: Stata.

My analysis aims to identify discretionary fiscal policy as one of the few, if not the last mean of sovereign policy for Greece. The Maastricht Treaty and the participation of the country in the Stability and Growth Pact as a major prerequisite for European Monetary Union integration, meant that the country was bound to lose part of its fiscal policy freedom along with the given absence of independent monetary policy. The pact was a restricting mechanism for overspending and a tool for proper maintenance of balanced budgets. Deviations and exclusions from the pact were very common especially after the introduction of the common currency. Many countries including Greece were forced to use government spending and taxation as the means to execute an indirect form of monetary policy with all known consequences. The inclusion of variables, such as unemployment, and GDP per capita is part of the desire to illustrate the case of a lost generation in Greece. Also the exporting activity variable is part of an analysis that wishes to highlight the importance of fiscal policy incentives-shocks towards igniting Greece's exporting and producing activities. This paper hopes to identify a way out of the austerity slump through a form of fiscal liberalization that will lead to growth in a more organic, and less painful way. The austerity suggestions from the Troika or "coalition of institutions", seems to have hampered Greece's growth prospects.

3. Literature review

The empirical goal of this paper is to capture and analyze the dynamic, medium run effects of government spending and taxation shocks in Greece after the military government era. As mentioned earlier, the structural VAR approach is very much correlated to a monetary policy research framework. As a matter of fact, the structural VAR approach used in this paper is used in a number of papers and studies about monetary policy, notably in the paper from Bernanke and Blinder (1992). This approach is a good fit for fiscal policy research because, unlike monetary policy, fiscal policy is rarely used to stabilize

macroeconomic variables such as GDP and output. Bernanke and Blinder show how a shock to the Fed Funds rate, and other long and short term debt vehicle rates, can have a significant long term effect with regard to output, bank deposits and other macroeconomic factors. Contrary to that taxation and government spending are not vehicles that can endogenously effect GDP. Both are exogenous variables by nature which makes the effects of unexpected shocks more genuine and dynamic.

Blanchard and Perotti (2002), investigate the dynamic effects of government spending and taxation shocks in the United States on GDP and private consumption from the late 1940's to the late 90's. They highlight the differences between high frequency-quarterly data and lower frequency annual, or decade by decade data. Their argument for the effect on the US is that fiscal policy can be adjusted a year or so later in response to potential changes in GDP. Therefore quarterly data is more accurate in capturing shocks. since there is not enough time for the economy to adjust. This is the case in a very elastic and flexible business environment such as in the US. Overall, Blanchard *et al,* find that when government spending increases, output will increase, and when taxes increase, output is bound to decrease. They find that private consumption will respond in a positive manner when government spending goes up, and private investment seems to be phased out. This paper uses private consumption, as well as GDP, as two of the macroeconomic variables examined when fiscal variables are shocked. Another interesting part of the paper by Blanchard et al is the section on defense spending. While the authors control for defense spending during particular periods in US history, the case of Greece is fundamentally different, as the country's budget has been chronically suffering from that component, mainly due to the national security issues that its neighboring nations impose.

In a paper by Dario Caldara and Cristophe Kamps (2008) the two ECB economists also use a VAR model for the US to predict responses of real GDP, real private consumption, and real wage to fiscal policy shocks. In particular, all above variables appear to increase when spending and taxation are shocked. In the following sections of this paper, one can easily notice the intense focus on real private consumption which is a variable examined in this analysis. Caldara and Kamps find that empirical results in their analysis support all theoretical models, which assume an increase in private consumption when fiscal policy shocks are delivered (the same will be shown for Greece). The authors also find very strong and persistent evidence on the positive responses of private consumption as well as real wage. They highlight how, historically, previous studies have found that these positive responses are only temporary but in their case are much more enduring even one year after the shocks are inflicted.

Caldara and Kamps follow the procedure of Blanchard and Perotti (2002) where they divide the impulse responses by the standard deviation of the fiscal shock in order to have relatively powerful shocks the size of one percent.

A very good example of a structural VAR approach, which is also followed in this paper, is definitely the work by Florian Hoeppner (2001). Hoeppner illustrates an analysis of fiscal policy shocks in Germany. His use of the structural VAR approach in a fiscal policy context is along with the work by Bernanke and Blinder (1992) that was mentioned above, the model framework used in this paper. Even though Hoeppner's work is designed to capture the short run effects of government spending and taxation shocks on the German economy, the structure of his work, along with the ideas behind his research allow for many parallel comparisons to other European countries. Countries, that struggle with lack of discretionary fiscal policy, mainly due to the establishment of the Stability and Growth Pact. Under the pact, EU states are heavily scrutinized for their spending and monitored on a consistent basis. This has been a huge issue in Greece over the years, and the anti-austerity measures of the recent past and present have reignited the controversy, and initiated a huge economic debate on whether countries should be fiscally independent or not.

To conclude on his findings, Hoeppner, uses data on German tax revenues and government spending which resembles Blanchard and Perotti (1999). His four variable VAR includes private disposable income and private consumption which is similar to private final consumption per capita data analyzed in this paper. GDP reacts negatively to tax shocks and positively to government expenditure. Private consumption reacts in a negative fashion to tax shocks, but increases when government expenditure is shocked.

As mentioned above, I will follow Hoeppner's empirical approach in this paper mainly by dividing the model into two VARs. There are challenges when using annual data but I hope that the shock effect on the impulse fiscal policy variables does not wear off after 12 months and that responses will be able to be captured.

Beetsma & Giuliodori (2010) take the research of fiscal policy shocks to the next level by researching the effect of fiscal policy on investment and trade balance, in a EU cross country comparison analysis. In the following sections of this paper I will examine similar effects on total exports of goods and services.

Hoppner (2001) , Blanchard and Perotti (1999 & 2002) as well as Beetsma & Giuliodori all get results that are very consistent to a theoretical Neo-Keynesian framework. A shock in government spending, will increase output per capita as well as consumption and investment (See Table 1)[4]. The effects are negative

[4] Beetsma & Giuliodori (2010) The Effects of Government Purchases Shocks: Review and Estimates for the EU. Economic Journal, Feb2011, Vol. 121 Issue 550, pF4-F32, 29p, 6 Charts, 4 Graphs. Chart; found on pF7

on the trade balance as well as on the public BOP (Balance of Payments). Beetsma et.al highlight that the stimulating effect is much weaker for open economies since trade openness allows exodus of capital.

Table 1

Predicted Effects of a Government Purchases Increase in a Closed Economy

	Output	Consumption	Real wage	Labour supply	Labour demand	Employment
Neo-classical	↑	↓	↓	↑	0	↑
Deep habits	↑	↑	↑	↑	↑	↑
NK – nominal rigidities only	↑	↓	↑	↑	↑	↑
NK – rule of thumb	↑	↑	↑	↑	↑	↑

Notes. This Table is based on Pappa (2006). 'NK' = New-Keynesian.

Table 1: Beetsma & Giuliodori (2010) The Effects of Government Purchases Shocks: Review and Estimates for the EU. Economic Journal, Feb2011, Vol. 121 Issue 550, pF4-F32, 29p, 6 Charts, 4 Graphs. Chart; found on pF7

3.1 The literature on Greece

As noted in previous sections empirical studies examining the effects of fiscal policy in Greece have been scarce. The lack data reliability has hampered the efforts of researchers and economists who have a serious interest in providing any sort of empirical advice. The recent troubles in Greece's economy have generated some interest in researching the value that could be added to the country's economic prospects by implementing an independent and discretionary fiscal policy. Data prior to the year 2000 are available but unfortunately have been revised multiple times while different organizations such as the IMF, the World Bank and OECD report data that seem to lack consistency. Greece's central statistical agency, also known as ELSTAT, has been influenced politically over the years with its Chief executive and board of directors being appointed by the elected governments and have traditionally been members of the ruling government parties. Greece has been governed by two major political parties from 1974 to 2015. Recent cabinet reshuffling revealed that both parties have been doctoring official government figures especially during the European Monetary Union convergence period between 1999-2002.

Important studies elaborating on Greece's fiscal policy include the work by Angelopoulos and Philippopoulos (2007) who examine the period between 1960 and 2000. They find that a more compact public sector would be more beneficial for Greece's finances. Increases to government consumption and public investment lead to growth. On the other hand taxing shocks do not seem to matter in terms of growth. This is definitely not a surprise considering Greece's history of lax taxation policies and years of tax evasion practices.

The period analyzed in this paper, post 1974, is considered a period of "liberal"-to say the least- fiscal policy. Fiscal liberalization became more prominent during the late 1970's and early 1980's. PASOK's (PanHellenic Socialist Movement) rise to power saw the initiation of multiple social benefit structures and the creation of a social, philanthropic government structure. Lockwood et al. find strong evidence linking politics and party connections to fiscal policy decisions.

Tagkalakis (2014) in his paper on discretionary fiscal policy in Greece finds the same Keynesian effects caused by shocks in government spending and net taxes. His response variables include output growth, private consumption and non residential investment. Increase in government spending has a profound positive impact on all the aforementioned variables but a negative impact on residential investment. Tagkalakis is also focusing on the trade balance by noticing how tax hikes improve the trade balance mainly through the reduction of imports. In this paper, I will show the direct impact on exports.

Tagkalakis estimates what he calls a quasi-VAR in order to extract fiscal shocks which he later uses to estimates the effect on private consumption.

4. The Model and empirical analysis

In the following section there will be an outline of the VAR analysis of fiscal policy in Greece using a combination of VAR models. The initial, basic VAR includes five variables: Government spending as a percentage of output (GDP), total tax revenue, GDP per capita, unemployment and private consumption expenditure per member of the population. In the next section, I will analyze the form of the variables and what is the mindset behind any possible transformation.

The paper continues by extending the analysis into a second VAR which ultimately wishes to capture the effects of fiscal policy shocks on trade which is essentially important in getting Greece out of a recessionary state and ultimately lead the country-once again -into the path to growth. In this second, four variable VAR, the response variables are exports of goods and services (denominated into current Euro prices and gone through a logarithm transformation) and GDP per capita. The impulse variables remain the same in Government Spending and total tax revenue.

4.1 The VAR

The very general structural model below can be representative of both VAR's analyzed in this paper. NP represents a vector of Non policy variables. NP in the first VAR includes the logarithm of GDP per capita, the logarithm of private consumption expenditure and unemployment. We allow for a log transformation for the first two variables in order to simplify the variables which are in billions of Euros but most importantly to capture potential trends. Unemployment is already a percentage figure so there is

no need for a transformation. FP are the fiscal policy variables which are Government spending as a percentage of GDP and total tax revenues. Further down this section we will explain the type of transformation these variables incur and why.

$$(1) \quad \{ NP_t=\beta_{NP0} + \beta_{NP1} NP_{t-1} +..+\beta_{NPk} NP_{t-k} +\alpha_{NP1} FP_{t-1} +...+\alpha_{NPk} FP_{t-k} +u_{NPt}\}$$

$$\{ FP_t = \beta_{FP0} + \beta_{FP1} FP_{t-1} +...+ \beta_{FPk} FP_{t-k} + \alpha_{FP1} NP_{t-1} +....+ \alpha_{FPk} NP_{t-k} + u_{FPt} \}$$

The subsequent second four variable VAR, in its general structural form is similar to the one above. It is designed to capture the unexpected shocks of fiscal policy variables on a different vector of response variables that includes exports of goods and services. Exports, which are denominated in current Euro prices, will be taken in logarithmic form.

In the first five variable VAR the two aforementioned vectors include:

$NP_t=\{ GDPpc_t , U_t , Cpc_t \}$ and $FP_t=\{ Total\_Tax\ Revenue_t , GpctGDP \}$.

The above structural form model can be reduced into a basic VAR specification which in reduced form will look like the equation below:

$$Y_t= A_0+ A\ (L,y)\ Y_{t-1} + U_t \qquad (2)$$

where $Y_t=[GDPpc_t , U_t , Cpc_t , Total\_Tax\ Revenue_t , GpctGDP_t]$ is a five-dimensional vector. The tax and government spending figures are already in percentage form (as a percentage of GDP) so there is no need for a logarithm conversion. The same implies to the annual national unemployment figures which are also in percentages. As mentioned above, GDP per capita and private consumption per capita are in logarithmic forms.

In the second, four variable VAR the two aforementioned vectors include:

$NP_t=\{ Ex_t , GDPpc_t \}$ and $FP_t=\{ Total\_Tax\ Revenue_t , GpctGDP \}$.

The above structural form model can be reduced into the same basic VAR specification presented with equation (1):

where $Y_t=[Ex_t , GDPpc_t, Total\_Tax\ Revenue_t , GpctGDP_t]$ is a four-dimensional vector. The figure Ex_t stands for exports of goods and services at current prices. The export variable is taken into its logarithmic form.

A (L,y) represents a one year distributed lag polynomial that- as will be described below- provides the opportunity to interpret each variable and its evolution based on its own lags and the lags of the other variables included in the regression. In this first 5 variable VAR the use of annual data is evident as the

results capture clearly the theoretical Neo-Keynesian model only in the short and perhaps medium term. Taking annual data reduces the frequency of observations as it reduces the examined observation pool. The importance of taking higher frequency data is highlighted by the fact that unexpected shocks on spending and taxation can many times have a significant effect on macroeconomic variables within the year or quarter by quarter. A shock in the first quarter of fiscal figures can have an effect on GDP in the next two quarters, for example. By taking annual data, that effect is difficult to capture as the economy is adjusting to the shock after a year or two, so the impulse responses appear a bit "flat". Fortunately for this research, the selection of Greece as the country of research, provides for a sample of a country that is extremely inelastic in terms of reaction to reforms and economic convergence. A_0 also includes a matrix of reduced form parameters.

$Ut=[\ gdp_t\ ,u_t\ ,c_t\ ,t_t\ ,g_t]$ is the vector of reduced form residuals. These residuals are normally distributed and are most likely a form of "white noise". The constant covariance matrix will resemble $E(U_tU'_t)=\Sigma_u$ as seen in Luetkepohl (2001) [5]. There will be non zero correlation between these error terms. Because of this endogeneity issue with the structural VAR model, the reduced form model presented above imposes zero restrictions on parameters to allow for identification.

4.2 Time series data properties and Structural Identification

Before running the VAR and presenting any sort of results, it is imperative that as an initial step we provide an analysis of the stationarity of the data. This is very common with time series data and it couldn't have been any different in this research analysis especially with the existence of annual data. In Table 2 we notice how the overall test statistic is low and smaller in absolute value than the statistics for 10% critical value. Basically the existence of unit root jeopardizes the quality and significance of the data series. From the total of 6 variables in this data set, two are considered to be following an upward trend; GDP per capita and Private Consumption expenditure per member of the population of Greece in current prices. Consumption and output have a traditional upward trend as both increase as the economy grows. The upward trend of tax collection is interrupted numerous times. The tax revenue and exports of goods and services variables are calculated as ones without any sort of constant and after a Augmented Dickey Fuller test they are not found to have unit root issues. On the contrary a unit root is detected while testing for such for consumption and GDP per capita. Therefore first difference operators seem mandatory. At last, government spending as a percentage of GDP is not a trend variable and therefore is tested as a

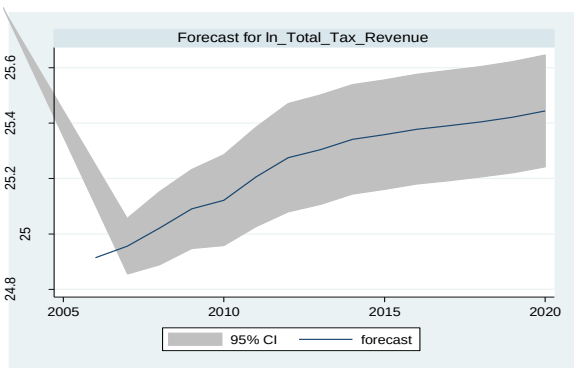
[5] Hubrich, Kirstin, Helmut Lütkepohl, and Pentti Saikkonen. "A review of systems cointegration tests." *Econometric Reviews* 20.3 (2001): 247-318.

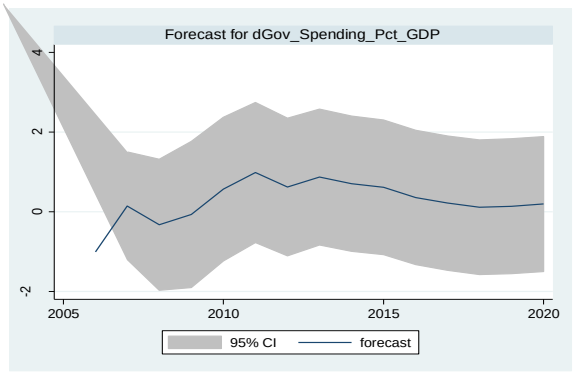
variable without a constant. Detection of unit root leads to also taking a first difference operator. The Augmented Dickey Fuller tests are summarized in Table 2.

Variable	*ADF Test*	*Variable First Difference*	*ADF Test FD*	*Upward trend?*
GpctGDP(Gov Spending % of GDP)	*0.477*	*d.GpctGDP*	*-8.495*	*No*
GDPpc	*3.654*	*d.GDPpc*	*-3.606*	*Yes*
Private Consumption Exp	*3.411*	*d.PrivtConsExp*	*-2.448*	*Yes*

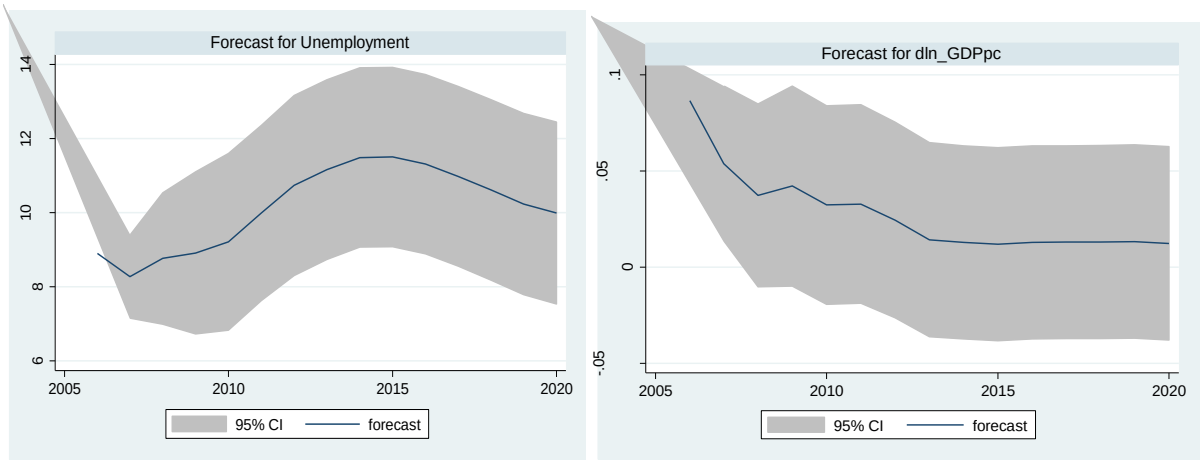
Table 2: The table refers to annual data. ADF refers to the Augmented Dickey- Fuller test. By definition the null hypothesis implies the existence of a Unit Root. Only significant lags are part of the ADF regressions that are summarized above.

The paper follows certain steps before implementing the VAR in order to analyze the data series as much as possible, and potentially let the data tell a story. The purpose of the two VARs is to get those valuable impulse response functions that will illustrate a picture of what the country's macroeconomic situation can look like, in the medium and long run, after its fiscal policy variables have experienced those "unexpected" shocks. The analysis below is a dynamic forecast that predicts what the situation will look like in 5 years' time. These are simple predictions clearly based on the recent time series trend. The forecast is conducted by suppressing the effect of the country's performance before the year 2007. I exclude financial accomplishments that belong to previous decades, as well as the financial and economic "miracle" of the early 2000's. At this point it is crucial to mention the fact that the recent fiscal consolidation measures have resulted in a fiscal surplus for the first time in decades.





Graphs 5.1 & 5.2 : Tax revenue and government spending in Greece in an ex-poste out of sample forecast. This is a dynamic forecast exactly 5 years into the future. Both figures show an all-around stability. There is probably a pessimistic view on tax revenue considering the aspirations of the Greek government officials and European Institutions to improve tax efficiency in the country. Government spending seems to stabilize and slowly decrease as we approach the last year of the dynamic forecast.



Graph 5.3& 5.4: According to the dynamic forecast model unemployment seems to have reached it's peak and will be slowly decreasing. Unfortunately for Greek taxpayers the future looks gloomy in terms of GDP per capita. The country does not seem to be returning to growth anytime soon with the economy appearing to have reached a level of long term stagnation.

It is therefore rational, based on the recent trends of economic improvement and fiscal consolidation, that the forecasted figures are promising. This has been the plan from the European institutions and the IMF; to push the country back into growth, through a strict fiscal discipline plan. The figures shown above, in Graph 5, illustrate a forecast based strictly on financial performance numbers without taking under consideration, the recent acceptance by Greece of a Memorandum of Understanding (MoU), which forces the country into rapid economic reforms, through fiscal discipline that will make Greece the recipient of IMF aid and ECB Outright Monetary Transactions.

Before analyzing the VAR, the paper will have to focus on properly identifying structural shocks mainly from analyzing a reduced form version of the model (see equation 2). The reduced form is the primitive (structural) form of the VAR (see system of equations 1) where one coefficient must be set to 0. Imposing zero restrictions on parameters will allow identification. Proceeding with a structural system of equations such as the one in Equation 1, will not alleviate the inherited issue of endogeneity amongst variables which is a well-known property of a VAR. The error terms in that system of equations between fiscal policy variables and non-policy variables are definitely correlated to some degree.

A shock to the error term in u_{NPt} will contemporaneously be transmitted to NP_t in the fiscal policy equation FP_t. Therefore the focus is to eliminate this structural error correlation and obtain orthogonal innovations for each variable. Blanchard and Perroti (2002) adopt an error decomposition model which is based in constructing elasticities[6] in order to identify the speed of effect of the tax shock. While this is

[6] Giorno, Claude, et al. "Estimating potential output, output gaps and structural budget balances." (1995). The method to calculate elasticities to GDP is taken from the above work of Giorno et al. Blanchard and Perotti are able to use these elasticity rates to illustrate the rate of change of macroeconomic variables to GDP changes and vice versa.

possible with quarterly data it is not ideal for annual data and even more difficult in a country like Greece. The size of tax evasion and tax avoidance in the country creates a tax environment the elasticities of which are difficult to capture. A recent paper by a Bank of Greece economist (Tagkalakis 2013) supports the view above by analyzing that the variability of indirect tax elasticity relative to GDP in Greece has shown a dramatic increase over the years. These high elasticities have made it almost impossible to perform accurate and reliable forecasting which might have serious budgetary implications such as severe revenue shortfalls. A very frequent occurrence after a country misses its budgetary targets is to implement more tax changes in response those shortfalls. In order to partially address the issue of error correlation and endogeneity this paper will follow with a Vector error correction model immediately after the fitting of the two VARs. This will help interpreting the VAR as well as indicate the portion of the forecast error variance that is attributed to exogenous shocks to other variables.

4.3 A Five Variable VAR: The effect of fiscal policy on domestic growth

The main VAR in this paper includes the two basic fiscal policy variables which are taxes and government spending. Government spending is presented as a percentage of Greece's GDP. As with most GDP variables, Government spending given in this form includes the presence of a Unit Root. Therefore any time series regression including this VAR would produce non valid estimates. The use of a first difference operator is essential for the continuation of this research study. The other fiscal policy variable examined and shocked as an impulse variable is the total tax revenues from Greece in current Euro values dating from the year 1974 to 2013.Total tax revenues are added to the VAR in logarithm form for more robust and compact results. The response variables in this five variable VAR will include a figure for total Unemployment, GDP per capita and private consumption per capita also in log form. GDP per capita as well as consumption are expressed with a first difference operator to account for the existence of a unit root. Impulse responses generated can be found in the compact table 3 below.

Five Variable VAR (1974-2013)

VARIABLES	(1) Unemployment	(2) Privt Cons	(3) GDPpc	(4) Gov_Spending_Pct_GDP	(5) Total_Tax_Revenue
L.Unemployment	1.0853***	0.0031**	0.0030	-0.0502	0.0030
	(0.0806)	(0.0012)	(0.0019)	(0.0643)	(0.0043)
L.Privt Cons	-1.5501	0.7425***	0.8447***	-11.5572	0.1892
	(9.8683)	(0.1524)	(0.2271)	(7.8764)	(0.5209)
L.GDPpc	-17.3174*	0.2455*	0.1027	11.9423	0.6778
	(9.1248)	(0.1409)	(0.2100)	(7.2829)	(0.4816)
L.Gov_Spending_Pct_GDP	-0.3727**	0.0057**	0.0079*	-0.3076**	0.0263***
	(0.1863)	(0.0029)	(0.0043)	(0.1487)	(0.0098)
L.Total_Tax_Revenue	-0.7441***	-0.0094***	-0.0099**	0.0287	0.9798***
	(0.2092)	(0.0032)	(0.0048)	(0.1670)	(0.0110)
Constant	19.4565***	0.1899**	0.1989*	-0.1017	0.4712*
	(5.0403)	(0.0778)	(0.1160)	(4.0229)	(0.2660)
Observations	38	38	38	38	38

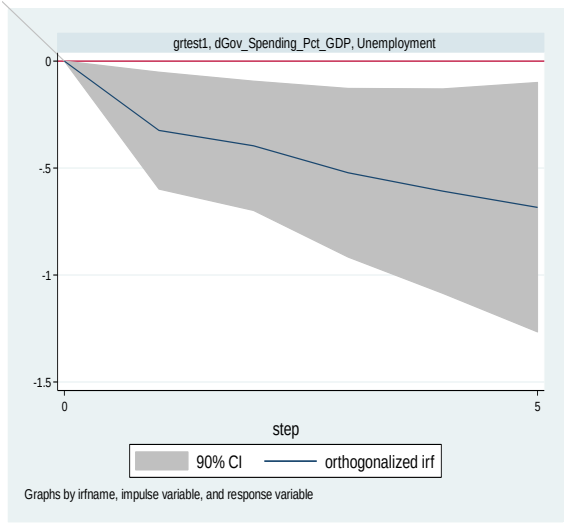
Table 3: The results of the table above are coefficients of the level of correlation between all variables and their lags. The optimal number of lags that minimizes the majority of the system's Information Criteria is one single lag. Private consumption per capita, GDP per capita and total tax revenue are all in log levels and deflated. Consumption per capita, GDP per capita and government spending are also expressed with a First Difference operator. Data are on a annual basis. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

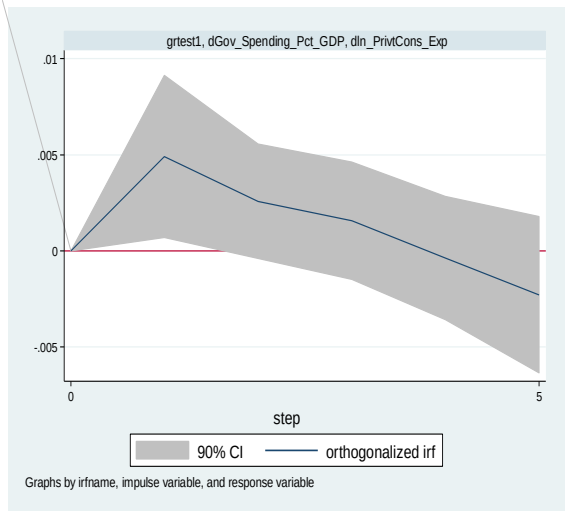
The neo-Keynesian macroeconomic effects of a potential increase in government spending and taxation on variables such as GDP per capita, unemployment and private consumption per capita are evident on Table 3. An increase with regards to the level of taxation or government spending that took place on a previous time period has significant impact on current macroeconomic variables. A one unit increase in government spending will reduce unemployment by .37, increase private consumption by .0057 and increase GDP per capita by .0079. Therefore government spending has a small but very significant effect on both consumption and output per capita and has the potential to reduce unemployment.

At this point it is important to generate impulse responses in order to specifically identify what is the exact effect of a potential fiscal policy shock. The impulse responses presented in this paper are a result of a one standard deviation shock to the impulse variable. In terms of the variables used in this paper, this standard deviation corresponds to one point increase in the government as a percentage of GDP variable and one percent increase on tax revenue respectively. The effects of the generated shocks will be examined on a five year horizon which constitutes a medium to long term period. Again, the fact that the paper works with annual data limits the frequency of the research and any significant effects that are generated within those one year periods cannot be recorded.

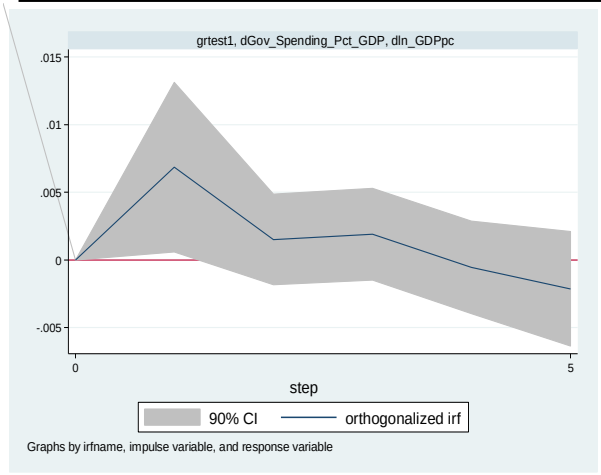
The existence of a long term relationship between fiscal policy variables and response macroeconomic variables (Non policy variables) will be analyzed later on in this paper by using a Vector Error Correction Model for cointegration. The lack of stationarity on a number of the original variables in this paper makes the model a great candidate for such an option.

The impulse responses in Graph 6 illustrate the effect of a shock in government spending to Greece's economy. The effect seems to have a significant long term effect on unemployment. A one percent increase in government expenditure has a long lasting effect on reducing the unemployment rate. The decline is sharper in the first year. After the initial shock, in the longer term from year two to year five,





Graphs 6.1 & 6.2 (above): The effect of a one standard deviation increase in government spending on unemployment and private consumption expenditure per capita respectively. While the effect on unemployment seems to have a longer term effect, the effect on consumption dies down approximately two years after the shock.



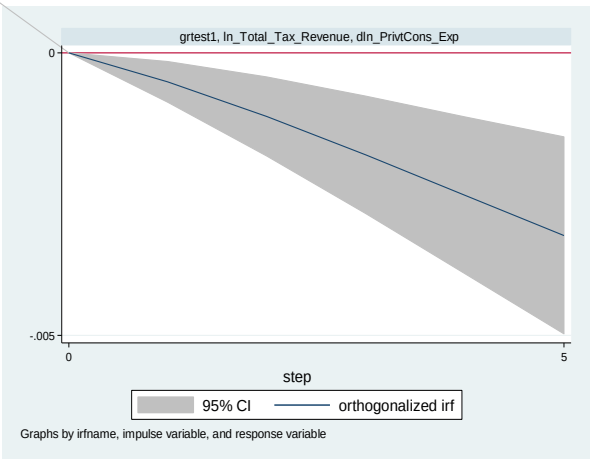
Graph 6.3 (left) : A one percentage point increase in government spending has a significant impact on GDP per capita. The increase in government purchases will increase output on the medium term. Approximately two to three years after the shock the levels of GDP per capita return to pre shock level. At that point the statistical significance is limited. The VECM model in the following sections of this paper will provide help in identifying any significant long term effects.

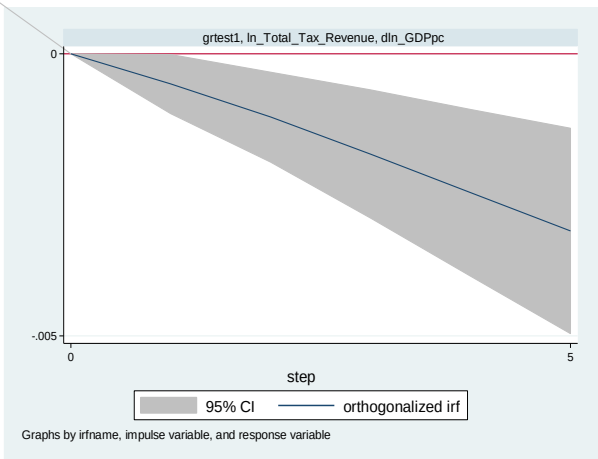
the rate continues to gradually fall. The overall effect on the unemployment rate in five years appears to be a reduction of one and a half percent. The reduction of the unemployment after a shock in government

spending is something that has been widely anticipated in this paper. The Greek government is a traditional long term employer in the country. Being on the government payroll does not imply working for certain sectors of central government alone. The Greek state owns hundreds of public utility companies including the Public Power Corporation (PPC) which is the largest single employer in the country. Increase in spending in many cases means increase in direct hiring of full time (permanent) state employees or -in many cases- short to medium term contractors. Contractors are much easier to hire than full time employees. The Greek state has seen the hiring of such employees as a short term solution to many of its economic woes over the years. The majority of these contractors are guaranteed renewal of their contracts for another 6 months to a year. The strong ties between ruling political parties and central government turn these contracts into full time positions through major legal loopholes and severe bureaucracy. Therefore, government spending is historically associated with improving or controlling the rate of unemployment in Greece. The curtailing of Government spending over the last 5 years has created a huge humanitarian disaster in the country as government has seized to hire while the government was forced to lay off thousands of employees in many cases unlawfully and unconstitutionally. Proposals to "organically" reduce public payroll by not filling positions vacated through retirement were universally rejected by Greece's borrowers and the Troika as too "long term".

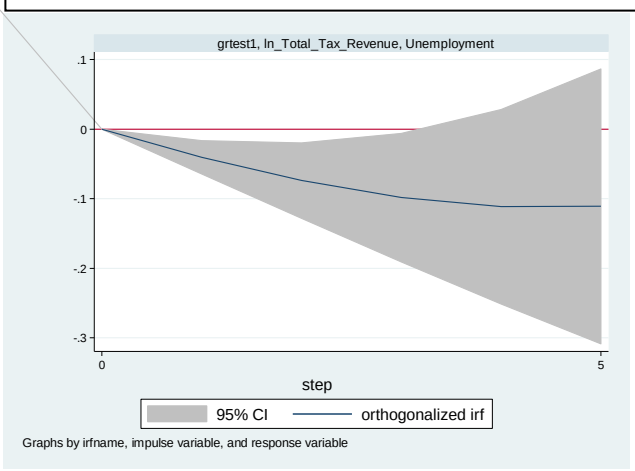
The government spending shock does not seem to have the anticipated long term effect on GDP per capita and private consumption expenditure per capita. The first two years of the shock reveal an increase in output and therefore consumption. Those first two years are in perfect alignment with the Keynesian neo classical literature that sees an increase in output after the government intervenes with a major spending splurge. In the case of Greece the reaction on growth and consumption is short term. After the two year period growth and consumption return to pre-shock levels but at that point in time the results appear to be statistically insignificant. This return to baseline values for both consumption and GDP per capita can to degree be attributed to Greek economy's automatic stabilizers such as expansive welfare and social benefits spending. In addition to the above, the average Greek's alarmingly elevated debt to income ratios, make the extra spending power generated by Government efforts more of a debt relief program than genuine consumption. At this point it would be beneficial to mention that government spending shocks are usually anticipated mainly because of the budgetary nature of fiscal policy which is quite opposite from monetary policy. The economy is prepared to react to budgetary increases in spending as many of the economy's automatic stabilizers act in order to dampen any sort of significant effects. If there is a longer term relationship between growth, consumption and government spending that will be determined in the Vector Error Correction Model for cointegration.

The impulse responses in Graph 7 paint a picture of a potential tax revenue shock in the Greek economy. This is a very interesting analysis mainly because of the history of taxation in Greece. Tax authorities have been ineffective over the years and extremely lenient to tax evaders. Therefore a surprising increase in tax revenue is not a common occurrence and if accomplished it will come at a heavy price for both the formal and informal economy in Greece.





Graphs 7.1 & 7.2 (above): The effect of a one percent increase in tax revenue on private consumption per capita and GDP per capita respectively. An unexpected increase in tax revenue, has a deteriorating effect on consumption and growth which also appears to last deep into the 5 year horizon. Results are significant at the 95% level.



Graph 7.3 (left) : A one percentage point increase in tax revenues has a very unexpected effect on unemployment. Contrary to Keynesian neo classical claims that tax cuts and not hikes decrease the unemployment rate, this paper finds that unemployment is curtailed in the short term and stabilizes in a level below the baseline value. This justifies the claim of this paper that the Greek government is the most important employer. Extra revenue leads to immediate hiring. The increase in tax revenues will prompt the Greek government to make more jobs available preferably temp to permanent roles. Results are significant at the 95% level.

The impact of a tax revenue shock on both private consumption and output per capita appears to have a devastating effect. This is in agreement with the neo classical literature and very much expected. The results above are significant at the 95% level and show that the effect of the shock is a long term one that persists even towards the end of the fifth year. Based on the history of taxation in Greece, it has to be said that a one standard deviation increase or one percent increase of tax revenue from year to year , is something that is very unusual for the country and its tax authorities. Such an increase implies that tax

authorities are increasing their grip on tax evasion and tax avoidance which is a big deal in Greece. The surprise tax increase contracts the economy and stalls growth.

The effect of the tax revenue shock is surprising with regards to unemployment. One would expect a typical westernized economy to show signs of an unemployment increase, at least one period after the shock. That would be due to the fact that private corporations and wealthy individuals pay more taxes which subsequently hurt the economy in terms of investment and creation of new jobs. This is not the case with Greece. The central governments along with the public utility branches comprise an enormous chunk of the Greek economy. An increase in tax revenue will signal budgetary changes for the next period. These changes usually come in the form of government job creation which over bloats the economy. The government in Greece is so multi-branched that it has become a huge business partner for private ventures. As mentioned before, the economy's stabilizers kick in and that extra revenue is allocated towards the creation of jobs which reverses the increasing effect on unemployment on the private sector. In graph 7.3 it is evident how unemployment decreases by one percentage point from the shock to year four and finally stabilizes between year four and year five.

4.4 A Four Variable VAR: The effect of fiscal policy on domestic growth and exporting activity

In this section there will be a partial repeat of the VAR that was conducted above. Included in the VAR, will be Exports of goods and services at current prices and GDP per capita which will be analyzed as the response variables. Once again the paper examines the effects of fiscal policy shocks. Therefore government spending as a percentage of GDP and total tax revenues will continue to be the impulse variables. The results from calculating this VAR are presented in table 4 .

An increase in government spending has a slightly negative but also statistically insignificant impact on exports of goods and services (-0.013 or .013%). A government increase in spending will have a significant positive effect on GDP per capita as we also observed with the previous VAR. A one standard deviation increase in spending by central the government will increase output per capita .01%. The interesting results on this VAR come from the government tax hikes. A 1% increase in total tax revenue has a profound positive and statistically significant effect on the level of exports of goods and services (0.251). Conventional wisdom dictates that this is possible because an increase in taxes will reduce demand for imports which will subsequently improve the trade balance and the net exports ratio. In the case of this paper the only variable included in the VAR is the monetary value of all exports of goods and services. Hence there is no control for the trade balance or import demand. On the other hand it is a fact that less disposable income will lower not only import demand but general domestic demand. As a

consequence big Greek exporters in the agricultural product and food product industries in particular will seek to improve their exporting activities by creating quality products that will be competitive abroad. Also a more efficient tax system that improves tax collection will subsequently create more opportunities in the public sector and better wage structure in the long term. That will give private sector employers an incentive to better their wages in order to stay competitive and will also incentivize employees to work efficiently and create better products which will improve exports (Tagkalakis 2014)[7].

.

Four Variable VAR(1974-2013)

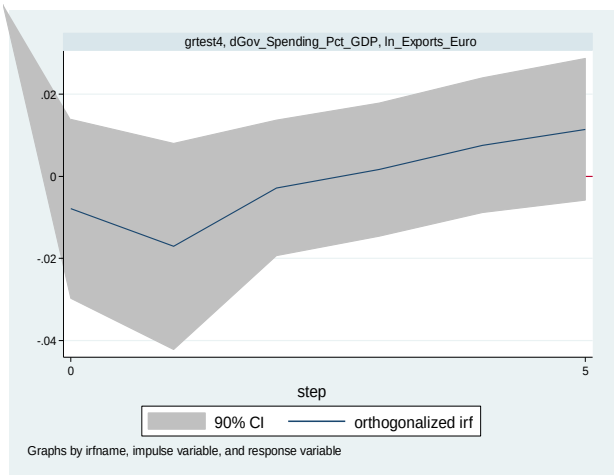
	(1)	(2)	(3)	(4)
VARIABLES	GDPpc	Exports	Gov_Spending_Pct_GDP	Total_Tax_Revenue
L.GDPpc	0.7584***	-0.0482	4.9081	0.7998***
	(0.1142)	(0.3101)	(3.4199)	(0.2253)
L.Exports	-0.0097	0.6987***	1.3112	0.0218
	(0.0355)	(0.0964)	(1.0629)	(0.0700)
L.Gov_Spending_Pct_GDP	0.0092*	-0.0132	-0.3283**	0.0256***
	(0.0049)	(0.0134)	(0.1478)	(0.0097)
L.Total_Tax_Revenue	-0.0026	0.2511***	-1.1582	0.9619***
	(0.0329)	(0.0893)	(0.9850)	(0.0649)
Constant	0.3027**	1.1825***	-3.4378	0.4223
	(0.1431)	(0.3884)	(4.2840)	(0.2823)
Observations	38	38	38	38

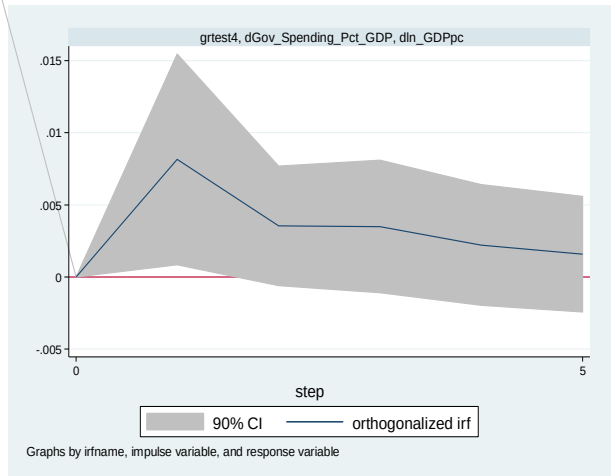
Table 4: The results above are coefficients of the level of correlation between all variables and their lags. The optimal number of lags that minimizes the majority of the system's Information Criteria is one single lag. GDP per capita, Exports of goods and services and total tax revenue are all in log levels and deflated. GDP per capita and Government Spending are also expressed with a First Difference operator.Data are on a annual basis. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

In the graphs that follow it is evident that the impulse response functions are in alignment with the Keynesian dogma. A shock in government spending has a significant effect on output per capita in the first two years after the shock. A GDP per capita increase significantly after the government spending increase goes into effect. An increase in spending can come into the form of a base wage increase for the average government or SOE (State Owned Enterprise) employee. Also spending can translate into creation of new jobs as well as funding of new public infrastructure projects. The reality for Greece is that this spending rarely has a long term impact. As the results indicate, the effect fades almost 2 years after the spending shock and output per capita enters a negative territory, before lack of significance jeopardizes our forecast for the long run. The vast existence of red tape in all government organizations

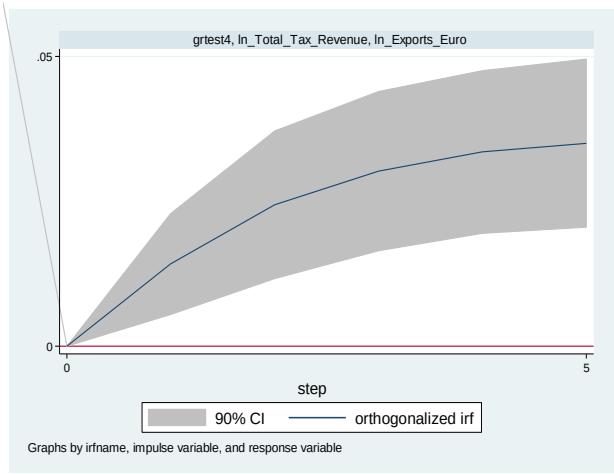
[7] Discretionary Fiscal Policy and Economic activity in Greece, Athanasios Tagkalakis 2014. The author cites that net exports could increase through improvement of the wages in the public sector. Exporting firms are motivated to improve employment conditions to keep up with the public sector and therefore improve their own conditions. Subsequently productivity improves which leads to quality exports.

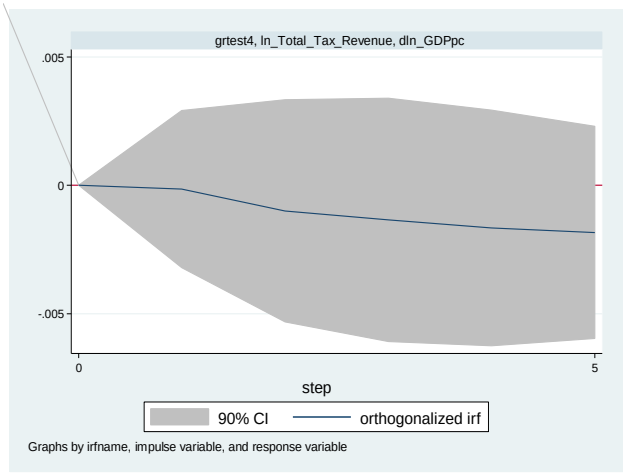
make it difficult and convoluting to efficiently funnel spending subsidies into the hands of the right people. The reality in the country is, that these inefficiencies are part of the economy. Therefore long term effect is not to be expected. Bureaucracy and corruption operate as economic destabilizers in this case.





Graphs 8.1 & 8.2 (above): The effect of a government spending shock on the level of exports of goods and services and GDP per capita. Results are vastly insignificant for the relationship between exports and government spending while there is significance in the first two years after the spending shock on GDPpc. Results are significant at the 90% level.





Graphs 8.3 & 8.4 (above): An increase in tax collection has a significant impact towards increasing exporting activity. Increasing taxes reduces output per capita even though the results are not significant in a four variable VAR.

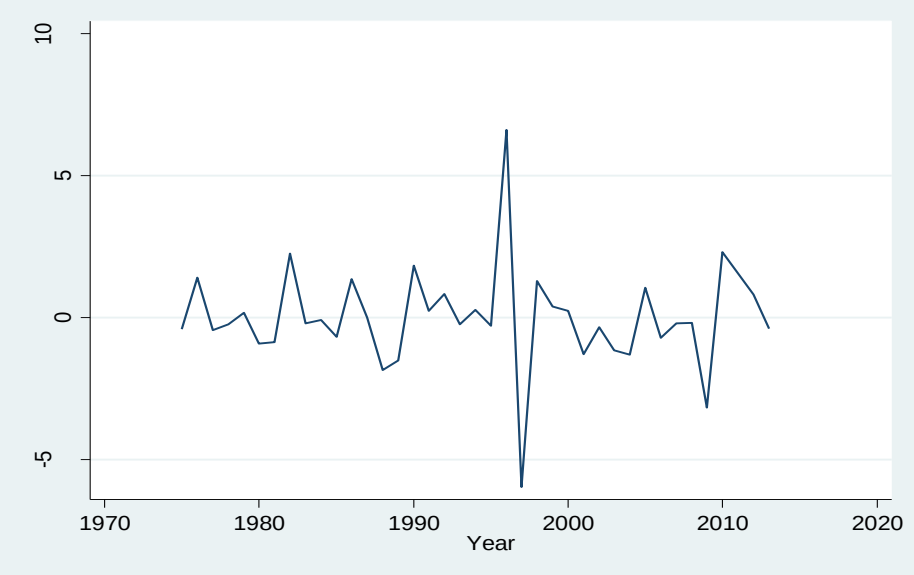
There is a long term increasing trend for exports of goods and services after spending has been shocked. Although this is a trend, that the literature on Greece strongly supports, the results on this particular relationship are insignificant.

On the other hand a positive tax revenue shock brings very significant and longer term results on exports of goods and services. The increase in exports is gradual and seems to stabilize almost 4 years after the initial shock. Finally a shock in taxation delivers a negative response from GDP per capita which is insignificant at the 90% level.

The effects of government spending shocks appear to have temporary and relatively insignificant effects on the examined macroeconomic variables for the Greek economy. Over the last 5 years or so, since the country has been under official supervision from its lenders and European counterparts, superhuman efforts have been allocated towards servicing the country's huge national debt. Recent budget surpluses, which are unprecedented for a country in deep recession, not only for Greek standards but in a more European scale, have been directed towards servicing Greece's debt. Therefore, any sort of extra cash that would help the country turn its recession slump into growth have been severely undermined by its debt burden. As a conclusion government spending cannot have a long term effect on growth but can only provide a short spark which usually lasts up to 24 months. On the other hand, revenues as a result of more efficient taxation can have more long term impact on Greece's macroeconomic prospects. These long term effects of both government spending and taxation will be examined below by using a Vector Error Correction Model which provides a more detailed examination of the data properties and the time series model is examined for potential cointegration and long term trends. With the VECM it can be determined if the orthogonalized shocks to Government Spending and Taxation have a permanent effect or not on the response variables.

5.1 VECM-Five Variable Model

A standard approach such as OLS requires that all of the analyzed variables are covariance stationary. When variables are not covariance stationary the use of the first difference operator for the variables in question is absolutely imperative. Cointegration analysis or the use of a Vector Error Correction Model operates on the framework that many of the variables in the regression are not covariance stationary. Graphs 13.1 & 13.2 in the appendix show the series of tests conducted in order to determine the right number of cointegrating relationships for this five variable VAR which includes Unemployment, Private Consumption per capita and GDP per capita. The model indicates one cointegrating relationship and uses 4 lags. A graphical representation of the one and only cointegrating equation of this model is presented below in graph 9. The late mid to late 1990's show a shock in Greece's economic indicators fueled mainly through the negotiating processes and challenges of entering a single currency mechanism. The late 2000's shock is of course associated with the major debt crisis that gradually led to the country losing almost a third of its GDP. This is what causes the downward spikes in the equation . The paper continues the VECM analysis as if the below equation (ce1 in table 5) is stationary.



Graph 9: Illustrating the cointegrating equation over time; the large shocks of the late 1990's and of the late 2000's show that certain events put a significant brake on Greece's economic growth.

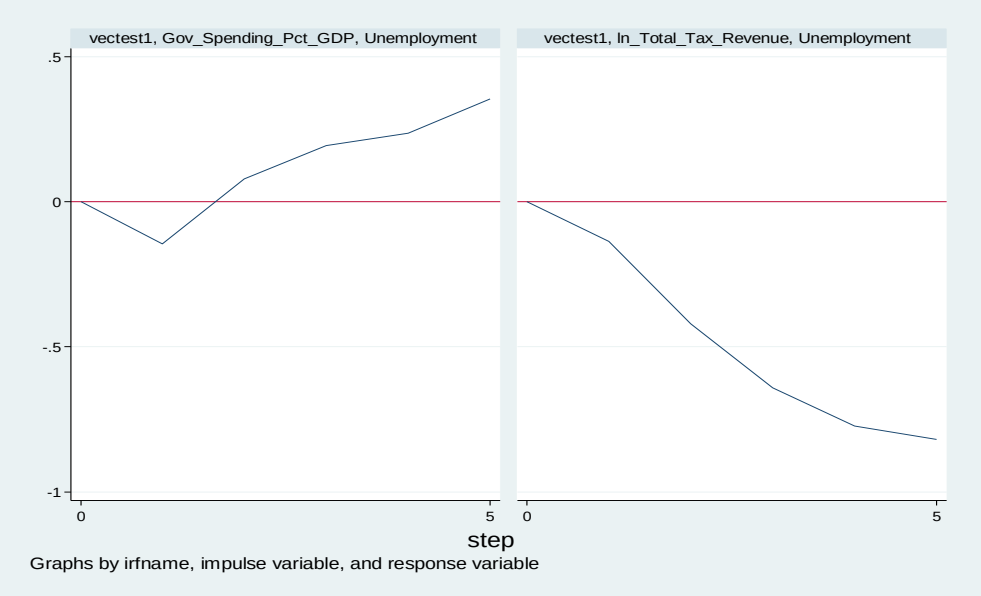
After specifying the model it seems natural that the next step would be to analyze and interpret Impulse Response Functions for this VECM model. The unique characteristic of the VECM impulse response functions is that they do not always die down over time as we will see below. In a stationary VAR each variable contains a time invariant mean and time-invariant variance. Therefore the effect of the shock on fiscal policy variables such as Government Spending and Total Tax revenue will eventually phase out simply because the variable reverts to its mean. Therefore in the case above the variables that comprise this VECM are not mean reverting and the specification tests performed in graphs 13.1 & 13.2 of the appendix show that many of these shocks will not die out over time. Graphs 10.1-10.3 all show that when government spending and tax revenue have an unexpected upward shock the effects on unemployment, private consumption and output are all permanent. Therefore there is a long term relationship between the impulse and the response variables. On the 5 year horizon which we have chosen to examine it is difficult to identify any sort of transitory effect. GDP per capita appeared to show stability after the government spending increase for about three years with signs of decay around the latter stages. GDP per capita also shows signs of dying down three to four years after tax revenue has increased.

Five Variable VECM

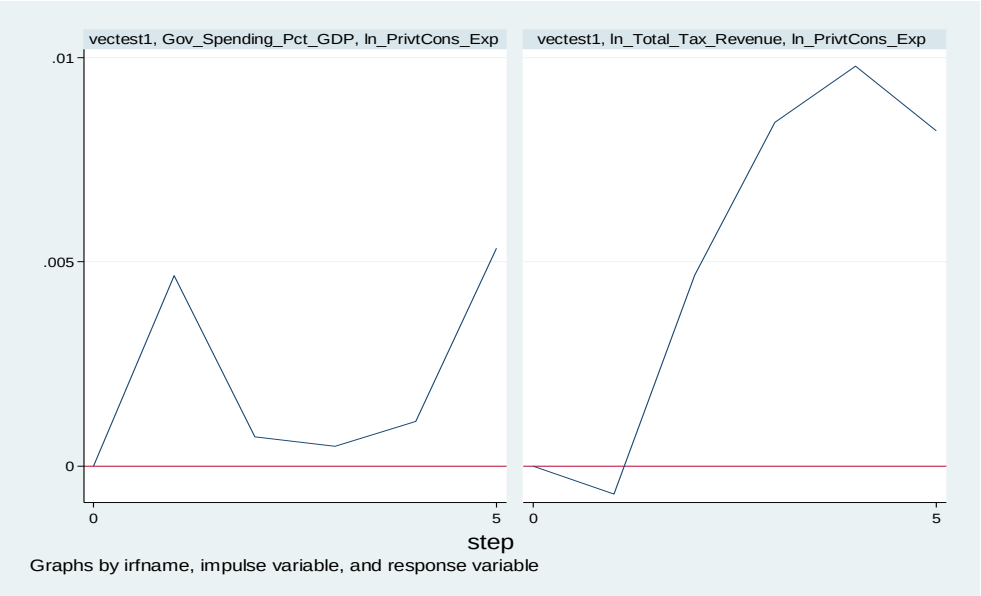
VARIABLES	(1) D_Unemployment	(2) D_PrivtCons_Exp	(3) D_GDPpc	(4) D_Total_Tax_Revenue	(5) D_Gov_Spending
L._ce1	-0.0601	0.0013	0.0011	-0.0089***	-0.0945**
	(0.0467)	(0.0008)	(0.0013)	(0.0019)	(0.0432)
LD.Unemployment	0.7364***	-0.0032	-0.0130*	-0.0103	-0.1940
	(0.2418)	(0.0043)	(0.0068)	(0.0099)	(0.2238)
L2D.Unemployment	0.1059	0.0015	0.0134	0.0408***	0.6845**
	(0.3386)	(0.0060)	(0.0095)	(0.0139)	(0.3134)
L3D.Unemployment	-0.0532	0.0030	0.0060	0.0496***	0.0118
	(0.3683)	(0.0066)	(0.0103)	(0.0151)	(0.3409)
LD.PrivtCons_Exp	10.9290	1.1533***	1.1853***	1.2231*	-8.2046
	(16.2326)	(0.2900)	(0.4548)	(0.6648)	(15.0254)
L2D.PrivtCons_Exp	-9.6033	-0.3016	0.4459	0.2310	6.5586
	(20.4324)	(0.3650)	(0.5724)	(0.8367)	(18.9129)
L3D.PrivtCons_Exp	13.7005	0.1945	0.0058	-1.2303*	-33.6640**
	(15.9608)	(0.2851)	(0.4471)	(0.6536)	(14.7738)
LD.GDPpc	-13.6595	0.2146	-0.1645	0.2018	10.1309
	(12.2830)	(0.2194)	(0.3441)	(0.5030)	(11.3695)
L2D.GDPpc	-1.3584	-0.1904	-0.5464	0.3279	7.6223
	(12.0703)	(0.2156)	(0.3381)	(0.4943)	(11.1727)
L3D.GDPpc	-0.0832	0.1090	-0.0406	0.8197	7.4352
	(12.4733)	(0.2228)	(0.3494)	(0.5108)	(11.5457)
LD.Total_Tax_Revenue	-2.1048	-0.0384	0.0545	-0.2380	1.7669
	(3.9999)	(0.0715)	(0.1121)	(0.1638)	(3.7024)
L2D.Total_Tax_Revenu	-2.0778	-0.0138	0.0009	-0.5493***	1.4782
	(3.9692)	(0.0709)	(0.1112)	(0.1625)	(3.6740)
L3D.Total_Tax_Revenu	-1.2981	-0.0330	0.0380	-0.1683	0.8155
	(3.4200)	(0.0611)	(0.0958)	(0.1401)	(3.1657)
LD.Gov_Spending	0.0281	0.0011	0.0025	0.0332***	-0.0929
	(0.2374)	(0.0042)	(0.0067)	(0.0097)	(0.2197)
L2D.Gov_Spending	0.5242*	-0.0143***	-0.0091	0.0248**	0.3234
	(0.2675)	(0.0048)	(0.0075)	(0.0110)	(0.2476)
L3D.Gov_Spending	0.4837	-0.0008	0.0043	0.0451***	0.0847
	(0.2951)	(0.0053)	(0.0083)	(0.0121)	(0.2731)
Constant	0.0490	-0.0004	-0.0020	-0.0448**	-0.0270
	(0.5088)	(0.0091)	(0.0143)	(0.0208)	(0.4710)
Observations	36	36	36	36	36

Table 5: The coefficients for L._ce1 correspond to the speed of adjustment of the respective cointegrating relationship to each variable. The optimal number of lags that minimize the final prediction error (FPE) and Akaike's information criterion(AIC), is four, which also indicates one cointegrating relationship.Consumption, Tax revenue and GDP per capita are all in log form. Standard errors in parentheses.

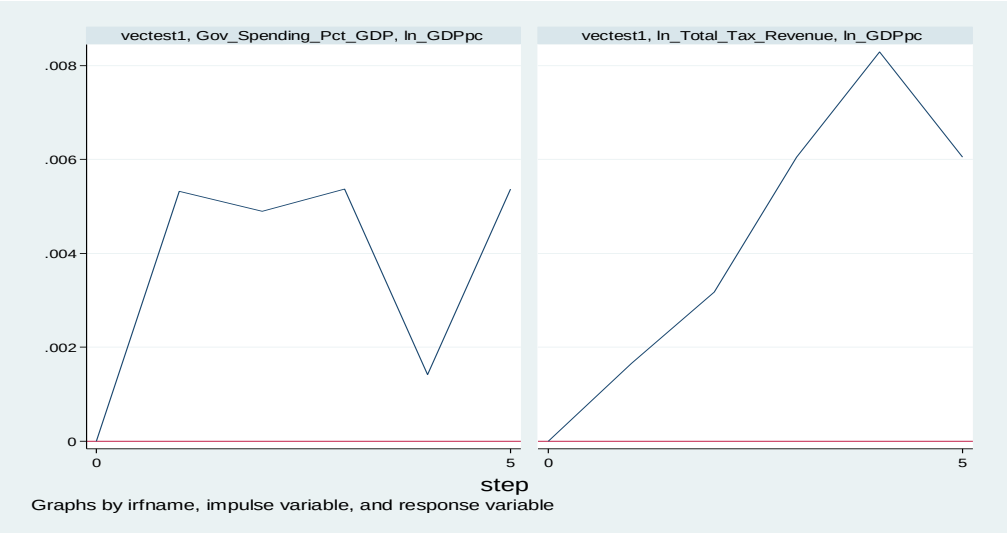
*** p<0.01, ** p<0.05, * p<0.1



Graph 10.1: The effect of government spending on unemployment appears to die down in the shorter term and it's probably the only semi-transitory effect with regards to the response variables. After the third year unemployment seems to revert to old levels since the effect of short term hiring dies out. Tax revenue has a more permanent effect on unemployment.



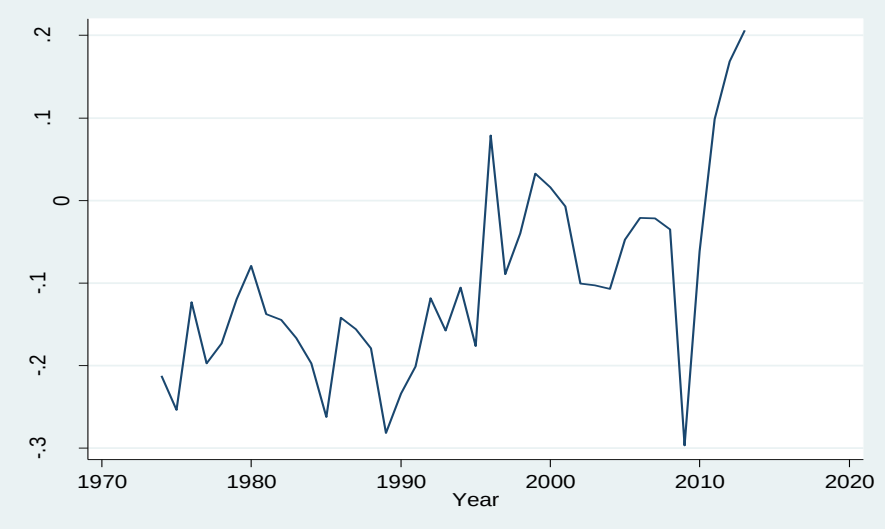
10.2: The effect of the shocks on consumption appears to have a more permanent effect. That permanent effect shapes up a year after the shock.



10.3: The effect of the shocks on GDP per capita appear to also have a permanent effect. That permanent effect shapes up early on but there are signs of the effect dying out after the fourth year. The effect of government spending on GDP provides a 3 year stability to later on show signs of decay.

5.2 VECM-Four Variable Model

The four variable VECM is specified differently, as the designated, optimal number of lags in this case is just two. There is still one cointegration equation while the model appears to be well specified according to the fitting tests which can be found in the appendix. Once again the paper shows an analysis of the cointegration equation over time. With exports of goods and services in the equation, graph 11 shows some significant shocks over this 40 year period. The exporting activity of the Greek economy has always been a very sensitive issue. Exports were a priority in the 70's and 80's when Greek industry was prevalent and thriving. Being part of the European Community and later of the European Union allowed Greece access to cheap ECB loans which were funneled through local banks to the Greek consumers at very low interest rates. The 90's and 2000's saw the average Greek consumer demanding more imported goods which therefore decreased net exports. The recent financial crisis and tax hikes, brought that exporting mentality back to the Greek manufacturers who saw an opportunity to improve their products and start exporting once again, since the local economy was stagnant. The graph clearly shows a dip around 2010 but an immediate rebound following steep tax hikes and an export boom.



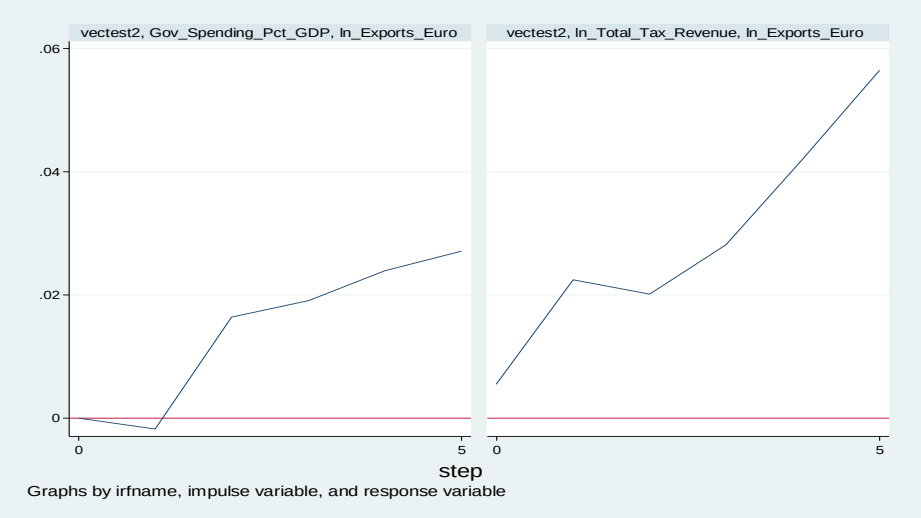
Graph 11: Illustrating the cointegrating equation over time; the financial and export boom of the 1990's is clearly shown in this graph. The downward spiral of the 2010 recession is also evident. Exporting activity and tax collection improvement explains the latest spike.

Four Variable VECM

VARIABLES	(1) D_Total_Tax_Revenue	(2) D_Exports_Euro	(3) D_GDPpc	(4) D_Gov_Spending
L._ce1	-0.3370**	-0.2012	-0.0077	7.6025***
	(0.1647)	(0.2691)	(0.0944)	(2.1497)
LD.ln_Total_Tax_Revenue	-0.1207	0.3883	0.0165	-3.8694*
	(0.1782)	(0.2912)	(0.1021)	(2.3259)
LD.ln_Exports_Euro	0.1806	0.2067	0.0182	0.4827
	(0.1200)	(0.1960)	(0.0688)	(1.5660)
LD.ln_GDPpc	0.7760**	0.0487	0.9159***	12.4424***
	(0.3456)	(0.5645)	(0.1981)	(4.5097)
LD.Gov_Spending_Pct_GDP	0.0199*	-0.0150	0.0109*	-0.1247
	(0.0107)	(0.0175)	(0.0061)	(0.1396)
Constant	-0.0080	0.0255	-0.0037	0.0003
	(0.0196)	(0.0320)	(0.0112)	(0.2556)
Observations	38	38	38	38

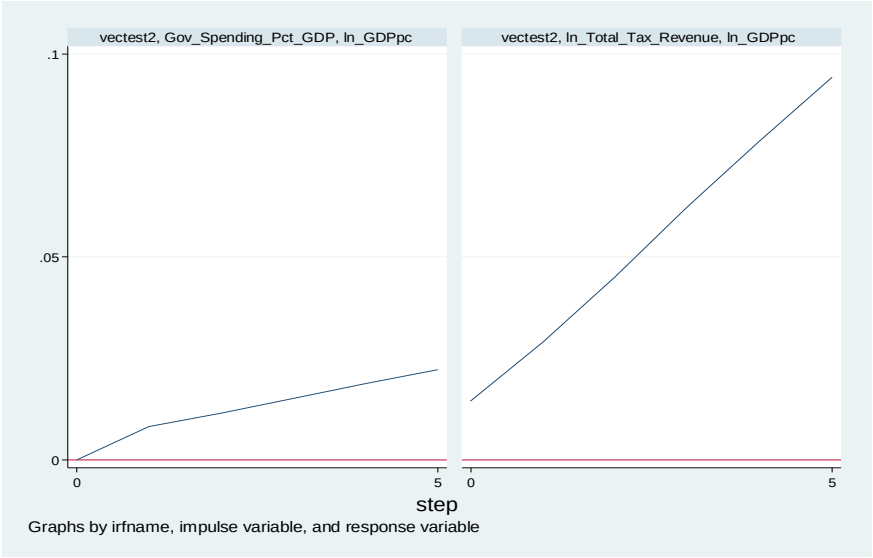
Table 6: Coefficient L._ce1 corresponds to the speed of adjustment of the respective cointegrating relationship to each variable. The optimal number of lags that minimizes the Hannan and Quinn information criterion (HQIC) and Akaike information criterion(AIC), is two, which also points to one cointegrating relationship. Consumption, Tax revenue, GDP per capita are all in log form.Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Shocking government spending and taxation appears to have permanent effects on exports of goods and services. The effect of shocking tax revenue is definitely more profound and more permanent. An increase in tax revenue appears to have a healthier long term impact on the Greek economy. That sort of effect cannot be delivered by increasing government spending.



Graph 11.1: Shocking spending and taxation has a solid, permanent, increasing effect on exports of goods and services

The impact is similar on GDP per capita with the only difference being that government spending does not appear to have that dominant effect on output per capita. As we saw in the previous VECM, government spending has a significant but short term effect on output. The effect appears to be permanent but shows signs of dying down towards the end of the five year period. The results were very similar while examining the two VAR's in the previous part of this paper. The size of the Greek public sector, the level of bureaucracy and red tape have reached a point where an extra Euro spent on government functions, will most likely, go into a bottomless barrel. The return on government capital and the capital produced by additional units of government labor, are minimal to none.



Graph 11.2:Shocking spending and taxation has a permanent effect on GDP per capita. The effect of the shock in spending appears to die down. Overall an increase in tax revenue has a longer term effect.

6. Concluding Remarks

This paper examines the effectiveness of fiscal policy in Greece with regards to fundamental macroeconomic variables during the post military government era .The choice of a Vector Auto Regressive model for this analysis might not seem like the best option at first sight, given the annual frequency of the data set. It turns out to be ideal, given the increased level of endogeneity amongst all variables. The existence of multiple endogenous variables, require a model that is able to capture that simultaneous effect that all variables have on one another. The analysis focuses on both government spending and total tax revenues. Using a VAR can help determine what is the exact effect of an unexpected government spending increase on variables such as consumption per capita, GDP per capita and on the unemployment composite rate . The same process is repeated for tax collections. It is necessary to highlight that during that one standard deviation increase (approximately 1% with both fiscal policy variables), all other unaffected variables in the VAR remain constant. A similar process is repeated using a four variable VAR that includes exports of goods and services. Despite the low frequency annual data, the paper discovers increased significance in the medium to longer term periods, especially when a shock is delivered via increased tax revenue.

Fiscal policy changes have Keynesian type effects on the Greek economy. Taxation shocks seem to deliver longer term effects while government spending has a very short term impact on Greece's macro economy. The results presented in this paper show that an increase in government spending can only deliver significant long term effects on the country's unemployment level. If central government delivers a solid round of spending towards the economy's core, that is most likely allocated towards creating jobs. The level of the government's involvement in a number of major SOE's and utilities, directly correlates spending with job openings in the public sector. Surprisingly an increase in government consumption and spending only have a temporary effect on consumption and GDP per capita. The significance of the results presented in table 3 only last for approximately 2 years. During that first year Greeks seem to improve their economic situation, and therefore spend more. The temporary effect of this shock does not allow the average citizen to continue to spend. The effect dies down two years after the shock. The excess number of government debt obligations along with the massive amounts of private bank debt that has been accumulated over the financial boom years, do not allow the government spending shock to have real, positive effect. In a paper by Artavanis, Morse and Tsoutsoura (2012) for the Fama-Miller Center for Research in finance (University of Chicago) [8] the writers find that self employed Greeks spend

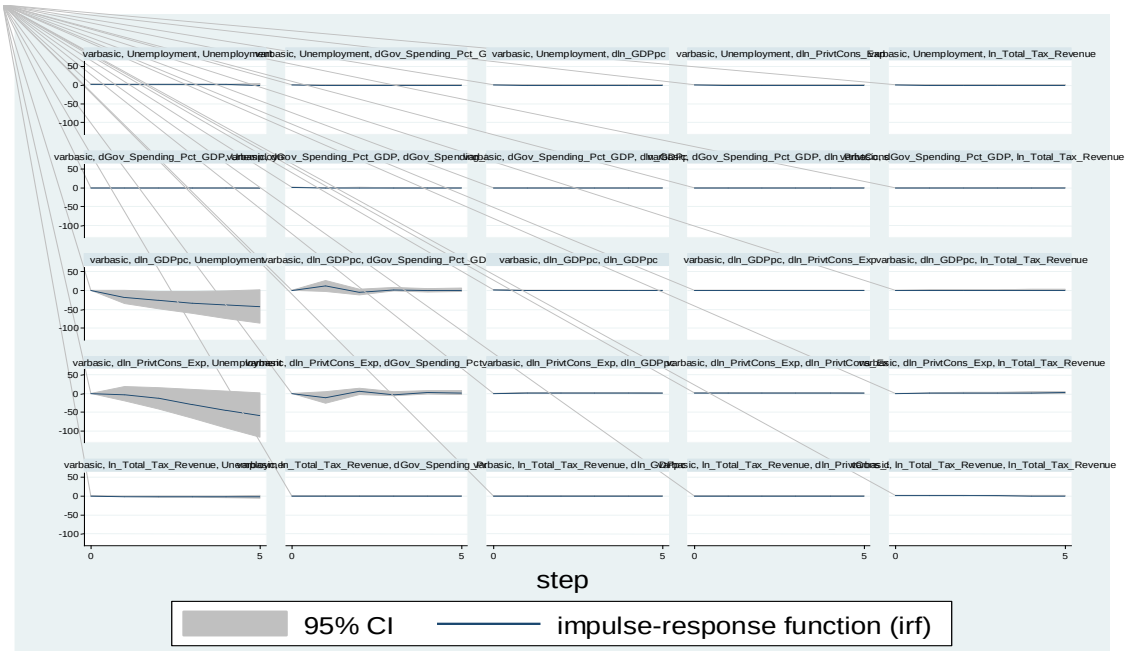
[8] Artavanis, Nikolaos T., Adair Morse, and Margarita Tsoutsoura. "Tax evasion across industries: soft credit evidence from Greece." *Chicago Booth Research Paper* 12-25 (2012). The authors show the importance of semi formal income in Greece by analyzing bank iformation for households from a major Greek Bank. Data indicates the existence of a informal economy is Greece where banks validate stated income and use metrics(Soft vs Hard Credit) to approximate the level of unreported income that corresponds to each banking customer. Discrepancies between loans outstanding (credit cards etc) and reported income indicate elevated levels of tax evasion and tax avoidance.

approximately 82% of their monthly reported income servicing debt. While this is an indication of increased unreported income in Greece, it also indicates the ease of which Greek banks lent to consumers, mainly based on stated income, and a huge culture that legalizes a shadow economy and semi-formal businesses. Banks, in the US and in the rest of the more developed nations in Europe, operate with strict lending policies and usually don't lend if debt- to- income ratios exceed 30%. Overleveraged households make the effect of a government spending shock insignificant in the long term.

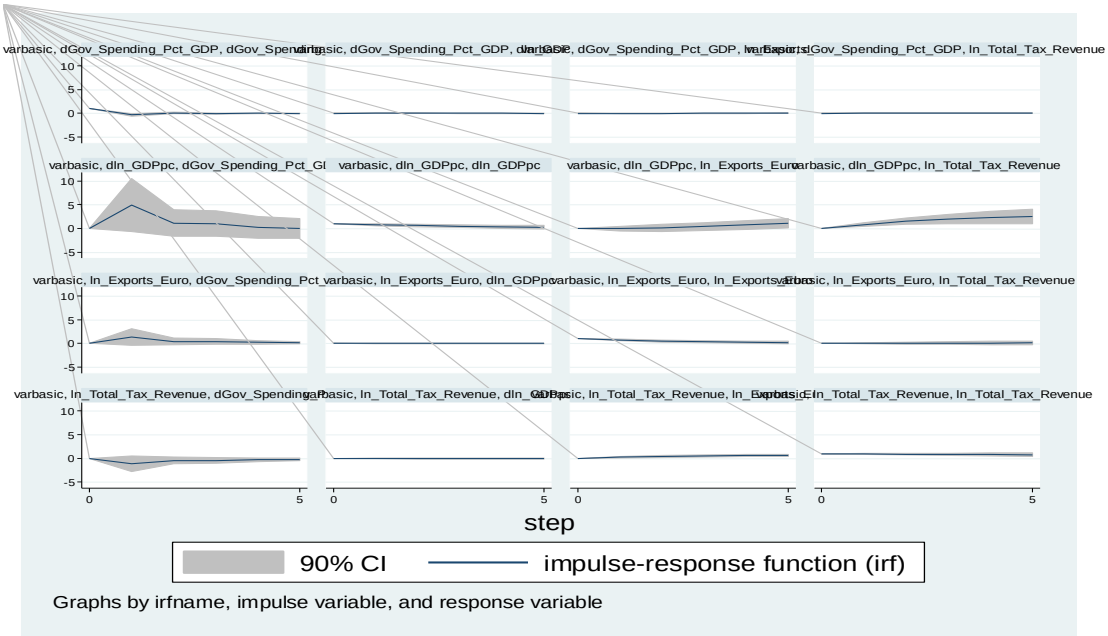
Taxation seems to be a more robust choice and delivers better results. An increasing shock in terms of tax revenue has typical Keynesian effects on GDP per capita and private consumption. Surprisingly unemployment also drops and stabilizes in a lower level in the long run. That is explained through the size of the Greek public sector. A surprisingly good tax year for the Greek state, is usually a first class opportunity to improve services, perform new hiring and occasionally increase wages. Improvement of services, facilities and cultural centers/sights attracts more tourism as well as shipping. Both sectors are the two pillars of the Greek economy. This sort of increase in tourism receipts will eventually improve Greece's exporting of services. Also as mentioned by Tagkalakis (2014), a good tax year will improve Greece's government mechanism, increase wages and make the private sector compete for talent by increasing its wage structure, provide better services and subsequently better products that can compete abroad. This unusual long term effect, is primarily witnessed in countries with a complex, multi-leveled and over -bloated government sector.

Unfortunately as analyzed by Artavanis et.al (2012) extensive tax evasion and tax avoidance practices are indirectly legalized by the country's bank sector. Huge lines of credit, as well as large outstanding loans to private businesses with insufficient reported income, indicate the fact that banks have normalized tax evasion by simply baptizing such business units as semi -formal, and therefore contributing to Greece's fiscal mess. Greece's government mechanism has one visible way out of this crisis and that would be to better it's tax policies and tax collection methods. That does not necessarily mean increase existing tax rates. Greece has already high rates. The point is to be more efficient in collecting. Reducing the rates, in order to create that initial psychological effect, might be a start. In addition to that, the possibility of providing incentives for non cash transactions might be another way to make people change habits. Either way, tax collection is massive, and efficient use of existing tax policies might, slowly but steadily, show a way out of the slump.

7. Appendix



Graph 12.1 :All possible impulse response functions in a five variable VAR.



Graph 12.2 :All possible impulse response functions in a four variable VAR including exporting activity of goods and services.

VECM-Five Variable Model-Tests for good fit

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_Unemployment	0.211	2	0.89983
D_ln_PrivtCons_Exp	1.818	2	0.40293
D_ln_GDPpc	7.660	2	0.02171
D_ln_Total_Tax_Revenue	9.342	2	0.00937
D_Gov_Spending_Pct_GDP	2.458	2	0.29266
ALL	21.488	10	0.01794

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
D_Unemployment	.05527	0.018	1	0.89230
D_ln_PrivtCons_Exp	-.39526	0.937	1	0.33296
D_ln_GDPpc	-.62624	2.353	1	0.12504
D_ln_Total_Tax_Revenue	.81686	4.004	1	0.04540
D_Gov_Spending_Pct_GDP	-.33092	0.657	1	0.41760
ALL		7.969	5	0.15794

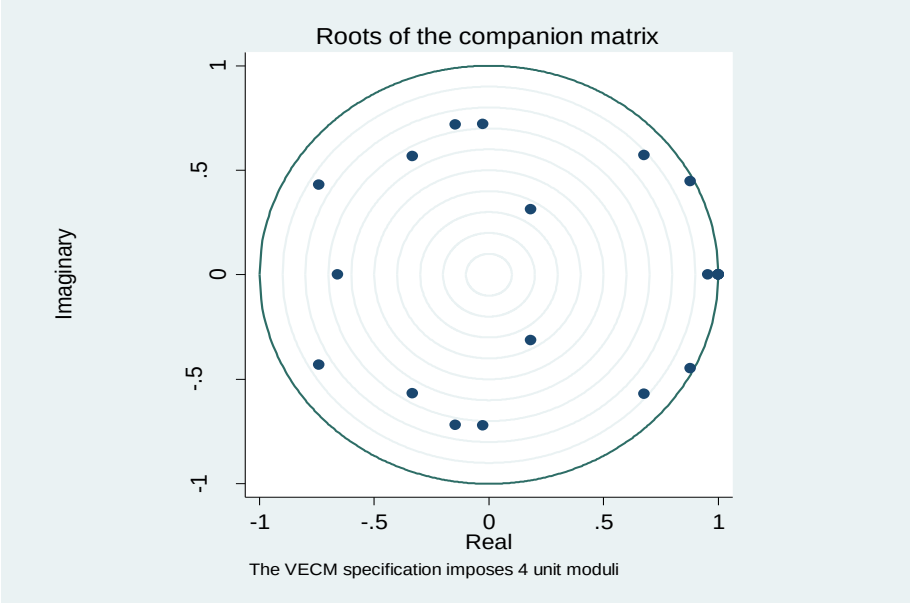
Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
D_Unemployment	2.6415	0.193	1	0.66062
D_ln_PrivtCons_Exp	3.7662	0.881	1	0.34803
D_ln_GDPpc	4.8809	5.307	1	0.02125
D_ln_Total_Tax_Revenue	4.8864	5.338	1	0.02087
D_Gov_Spending_Pct_GDP	4.0956	1.800	1	0.17966
ALL		13.518	5	0.01898

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	25.5519	25	0.43181
2	29.3082	25	0.25124

H0: no autocorrelation at lag order



Graph 13.1: The VECM is stationary since all of the eigenvalues of the companion matrix lie inside the unit circle. The eigenvalues are important but not essential in this analysis. The model is stationary if the above values lie in the circle which is clearly the case. In the VECM examined there are five variables and four lags so therefore 20 eigenvalues. Two pairs are close to the limit which indicates that some of the shocks last longer in time.

VECM-Four Variable Model-Tests for good fit

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_ln_Total_Tax_Revenue	0.556	2	0.75723
D_ln_Exports_Euro	1.873	2	0.39203
D_ln_GDPpc	7.135	2	0.02823
D_Gov_Spending_Pct_GDP	3.992	2	0.13588
ALL	13.556	8	0.09411

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
D_ln_Total_Tax_Revenue	.25389	0.408	1	0.52287
D_ln_Exports_Euro	-.282	0.504	1	0.47790
D_ln_GDPpc	.83347	4.400	1	0.03595
D_Gov_Spending_Pct_GDP	.73898	3.459	1	0.06292
ALL		8.770	4	0.06711

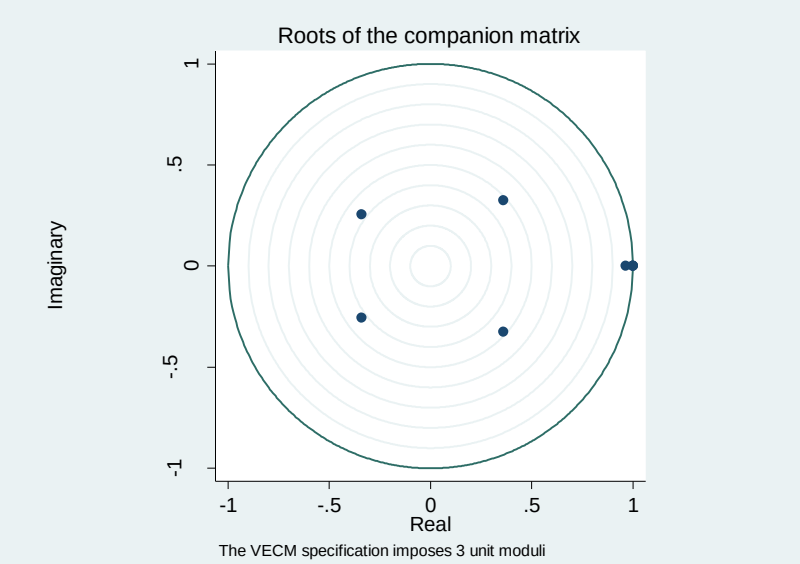
Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
D_ln_Total_Tax_Revenue	2.6943	0.148	1	0.70050
D_ln_Exports_Euro	3.9299	1.369	1	0.24195
D_ln_GDPpc	4.3143	2.735	1	0.09818
D_Gov_Spending_Pct_GDP	3.5804	0.533	1	0.46516
ALL		4.786	4	0.31002

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	14.9009	16	0.53191
2	8.7276	16	0.92421

H0: no autocorrelation at lag order



Graph 13.2: The VECM is stationary since all of the eigenvalues of the companion matrix lie inside the unit circle. The eigenvalues (figures) are important but not essential in this analysis. The model is stationary if the above values lie in the circle which is clearly the case. The analysis does not provide a large number of eigenvalues since the VECM is one variable and three lags shorter. In the VECM examined there are four variables and two lags so therefore 8 eigenvalues. One pair is close to the limit which indicates that some of the shocks last longer in time.

References

BLANCHARD, O; PEROTTI, R. An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output. *Quarterly Journal of Economics*. 117, 4, 1329-1368, Nov. 2002.

BEETSMA, R; GIULIODORI, M. The Effects of Government Purchases Shocks: Review and Estimates for the EU. *Economic Journal*. 121, 550, F4-32, Feb. 2011.

CALDARA, D; KAMPS, C. What are the effects of fiscal shocks? A VAR-based comparative analysis. 47 pages, 2008. European Central Bank, Working Paper Series: 877

BLANCHARD, O; PEROTTI, R. An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output. 1999. National Bureau of Economic Research, Inc, NBER Working Papers: 7269.

Höppner, Florian. "A VAR analysis of the effects of fiscal policy in Germany." *Institute for International Economics* (2001).

TAGKALAKIS, AO. Discretionary Fiscal Policy and Economic Activity in Greece. *Empirica*. 41, 4, 687-712, Nov. 2014.

ANGELOPOULOS, K; PHILIPPOPOULOS, A. The Growth Effects of Fiscal Policy in Greece 1960-2000. *Public Choice*. 131, 1-2, 157-175, Apr. 2007.

Artavanis, Nikolaos T., Adair Morse, and Margarita Tsoutsoura. "Tax evasion across industries: soft credit evidence from Greece." *Chicago Booth Research Paper* 12-25 (2012).

Bernanke, Ben S., and Alan S. Blinder. "The federal funds rate and the channels of monetary transmission." *The American Economic Review* (1992): 901-921.

Monokrousos, P. and Thomakos, D. (2012) Fiscal multipliers in deep economic recessions and the case for a 2-year extension in Greece's austerity programme, Economy & Markets: Eurobank Research, Volume VIII, Issue 4, October 2012.

Lockwood, Ben, Apostolis Philippopoulos, and Elias Tzavalis. "Fiscal policy and politics: theory and evidence from Greece 1960–1997." *Economic Modelling* 18.2 (2001): 253-268.

Data Sources

Total Tax revenue *(1974-2013)/ Annual Data/Greece : Organisation of Economic Cooperation and Development. Source: OECD.stat*

Gross domestic product at current market prices per head of population -1000 EUR *(1974-2013)/ Annual Data/ Greece: Annual Macro-Economic Database (AMECO), European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN).*

Exports of goods and services at current prices (National accounts)- Billion EURO-GRD *(1974-2013)/ Annual Data/ Greece: Annual Macro-Economic Database (AMECO), European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN).*

Unemployment (1974-2013)/ *Annual Data/Greece : Annual Macro-Economic Database (AMECO), European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN).Data cross referenced for accuracy with data obtained by The World Bank, World Development Indicators. Source: data.worldbank.org*

Government spending as percent of GDP *(1974-2013)/ Annual Data/Greece : The World Bank, World Development Indicators in conjunction with data from the IMF Data library. Sources:data.worldbank.org & elibrary-data.imf.org*

Private final consumption expenditure at current prices per head of population -1000 EURO-GRD *(1974-2013)/ Annual Data/ Greece: Annual Macro-Economic Database (AMECO), European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN).*